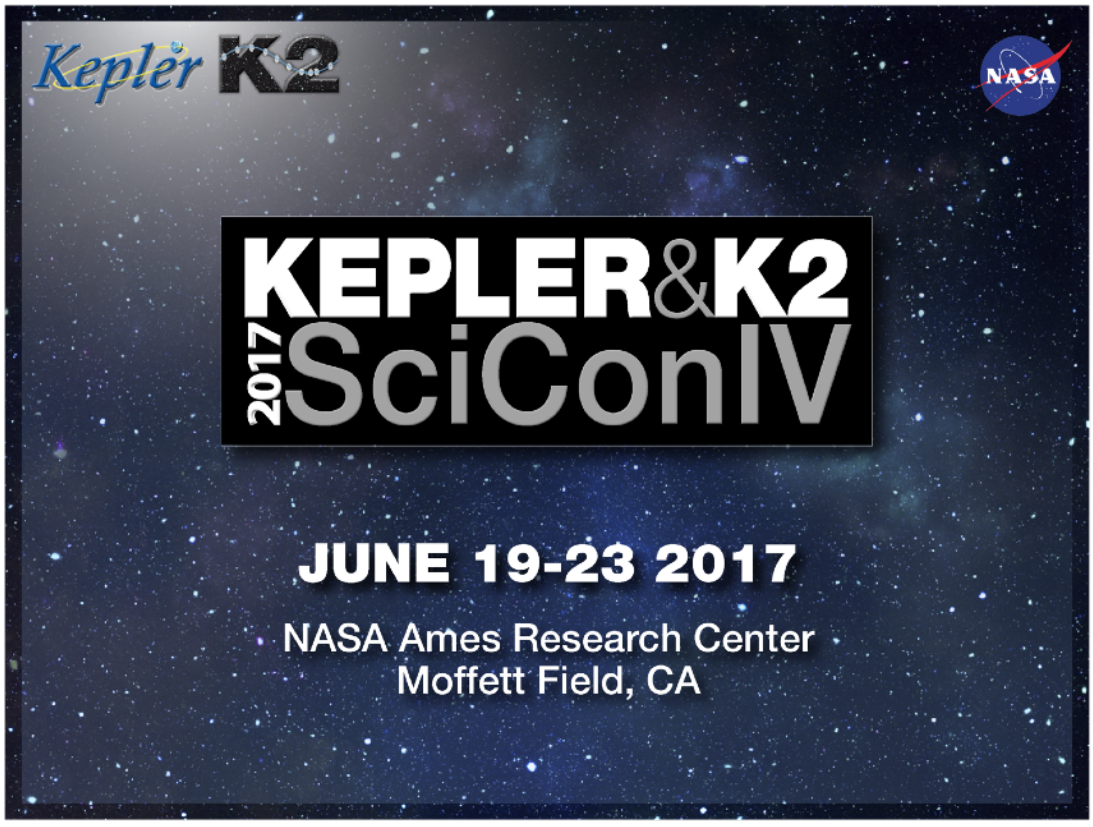
Kepler/K2 Science Conference IV Program

Version 3, June 13 2017



Monday, June 19

Session 1 *Kepler & K2 Updates (Chair: Jeff Coughlin)*

8:00-9:00 Registration & Press Conference (live-streamed to conference auditorium)
9:00-9:15 Welcome to Ames & Logistics ((Mark Messersmith, Steve Zornetzer, and Bill Borucki)
9:15-9:30 Jessie Dotson: K2 Project Status & Future Opportunities
9:30-10:00 Susan Thompson (invited): Kepler's Final Exoplanet Catalog

10:00-10:30 Coffee Break

Session 2 *Benchmark Systems from Kepler/K2 (Chair: David Charbonneau)*

10:30-11:00 Jason Rowe (invited): Benchmark Exoplanet Systems Discovered by Kepler/K2
11:00-11:15 Rodrigo Luger: K2 unveils a seven-planet resonant chain in TRAPPIST-1
11:15-11:30 Songhu Wang: Improved Masses for the Potentially Habitable TRAPPIST-1 Planets
11:30-11:45 Courtney Dressing: Characterizing K2 Planetary Systems Orbiting Cool Dwarfs
11:45-12:00 Andrew Vanderburg: HARPS-N Observations of K2 Planet Candidates and Planet Masses in the WASP-47 System

12:00-13:30 Lunch Break

Session 3 *Asteroseismology of Solar-Like Oscillators (Chair: Sarbani Basu)*

13:30-14:00 Dennis Stello (invited): The asteroseismic revolution of red giant stars: from stellar interiors to the structure of the Milky Way
14:00-14:15 Matteo Cantiello: Asteroseismic Signatures of Evolving Internal Stellar Magnetic Fields
14:15-14:30 Enrico Corsaro: Spin alignment of stars in old open clusters
14:30-14:45 Jamie Tayar: Core and Surface Rotation Rates of Evolved Intermediate Mass Stars
14:45-15:00 Kevin Schlaufman: Joint Spectroscopic and Asteroseismic Analysis of Very Metal-poor Stars in the Kepler Field

15:00-15:30 Coffee Break

Session 4 *Exoplanets & Stars (Chair: Dawn Gelino)*

15:30-15:45 Erik Petigura: The California Kepler Survey: High-Resolution Spectroscopy of 1305 Stars Hosting Transiting Planets
15:45-16:00 Rob Wittenmyer: Revised radius estimates for K2 planet candidates from AAT/HERMES
16:00-16:15 Tim Bedding: Surface Gravities for 15,000 Kepler Stars measured from Stellar Granulation

16:15-16:30 Emily Sandford: Know the Planet, Know the Star: Precise Stellar Parameters with Kepler
16:30-16:45 Rachel Matson: Stellar companions of K2 Exoplanet Candidate Host Stars
16:45-17:00 Lea Hirsch: Assessing the Effect of Stellar Companions to Kepler Objects of Interest

17:00-18:30 Poster Session I

Tuesday, June 20

Session 1 Extragalactic & Solar System Science (Chair: Geert Barentsen)

8:30-9:00 Armin Rest (invited): High-cadence Light Curves of Transients from the Kepler Telescope
9:00-9:15 Brad Tucker: The Kepler Supernova Cosmology Experiment - C16 and C17
9:15-9:30 Erin Ryan: K2's Keys to the Solar System: Lightcurves of Trojan and Hilda Asteroids
9:30-9:45 András Pal: A review of the results related to Solar System studies
9:45-10:00 Miguel de Val-Borro: K2 photometry of comet 67P/Churyumov-Gerasimenko

10:00-10:45 Coffee Break

Session 2 Microlensing (Chair: Rachel Street)

10:45-11:15 Calen Henderson (invited): K2's Campaign 9: The First Automated Microlensing Survey from the Ground and from Space
11:15-11:30 Wei Zhu: K2C9 Early Science Results and Synergy with Spitzer Microlensing
11:30-11:45 Radek Poleski: K2 observations of microlensing superstamp in Campaign 9 and selected targets in Campaign 11
11:45-12:00 Matthew Penny: Forward Model Photometry of K2 Crowded Field Data

12:00-13:30 Lunch Break

Session 3 Exoplanet Formation & Evolution (Chair: Stephen Kane)

13:30-14:00 Ruth Murray Clay (invited): Planet formation and evolution: Implications for planetary compositions
14:00-14:15 Aaron Rizzuto: The Exoplanet Migration Timescale from K2 Young Clusters
14:15-14:30 John Brewer: Beyond Metallicity: Chemical Tracers of Planet Formation
14:30-14:45 Samuel Grunblatt: Re-Inflated Planets Orbit Evolved Stars: Toward Solving a 17-Year-Old Puzzle in Exoplanet Science
14:45-15:00 Vincent van Eylen: Planets around evolved stars: formation or evolution?

15:00-15:30 Coffee Break

Session 4 Galactic Archeology (Chair: Katia Cunha)

15:30-16:00 Jennifer Johnson (invited): Peering into the past: Galactic Archaeology with Kepler and K2
16:00-16:15 Joel Zinn: Mind the GAP: A 360 degree view of the Galaxy with the K2 Galactic Archaeology Program
16:15-16:30 Victor Silva Aguirre: Age dissection of the Milky Way disk using asteroseismology
16:30-16:45 Marc Pinsonneault: Asteroseismology and Spectroscopy for a Large Sample of Kepler Dwarfs and Subgiants
16:45-17:00 Ruth Angus: The ages of K2 dwarfs

19:00-20:30 Public Talk: An Evening with the Storytellers (Nadia Drake, Dennis Overbye, Mike Lemonick); Building 3

Wednesday, June 21

Session 1 Asteroseismology of Classical Pulsators (Chair: Steven Kawaler)

8:30-9:00 Conny Aerts (invited): Asteroseismology of Hot Stars
9:00-9:15 Timothy van Reeth: The interior rotation of intermediate-mass stars
9:15-9:30 Timothy White: Beyond the K2 bright limit: variability in the brightest stars in the ecliptic
9:30-9:45 László Molnár: The K2 RR Lyrae and Cepheid Survey: hunting for pulsating stars, near and far
9:45-10:00 JJ Hermes: Evidence from K2 for rapid rotation in the descendant of an intermediate-mass star

10:00-10:30 Coffee Break

Session 2 Exoplanet Occurrence Rates (Chair: Christian Clanton)

10:30-11:00 Chris Burke (invited): Terrestrial Planet Occurrence Rates From Kepler: Past, Current, and Future
11:00-11:15 Danley Hsu: Characterizing Kepler Planet Occurrence Rates Using Approximate Bayesian Computation
11:15-11:30 Ian Crossfield: Crowd-sourced Planet Occurrence: Citizen Science with K2
11:30-11:45 Steve Bryson: Science Yield from the Kepler Certified False Positive Table
11:45-12:00 Adam Kraus: The Ruinous Impact of Close Binary Companions on Planetary Systems

12:00-13:30 Lunch Break

Session 3 Breakout Sessions Part I

13:30-15:00 Kepler Occurrence Rate Hack (Natalie Batalha)
13:30-15:00 Speed-Networking with TESS (Tom Barclay)
13:30-15:00 Gaussian Processes (Daniel Foreman-Mackey)
15:00-15:30 Coffee Break

Session 4 Breakout Sessions Part II

15:30-17:00 Kepler Occurrence Rate Hack (Natalie Batalha)
15:30-17:00 NASA Exoplanet Exploration Program Update (Karl Stapelfeldt)
15:30-17:00 EVEREST Tutorial and Hack Session (Rodrigo Luger)

Thursday, June 22

Session 1 Exoplanet Compositions (Chair: Andrew Howard)

8:30-9:00 Angie Wolfgang (invited): The Mass-Radius "Relation" and the Diversity of Exoplanet Compositions
9:00-9:15 Eric Lopez: Predictions for the Transition Between Rocky Super-Earths and Gaseous Sub-Neptunes
9:15-9:30 BJ Fulton: The California-Kepler Survey. III. A Gap in the Radius Distribution of Small Planets
9:30-9:45 Tsevi Mazeh: The Planetary Mass-Radius Relation and its Dependence on Orbital Period as Measured by Transit Timing Variations and Radial Velocities
9:45-10:00 Luca Malavolta: Kepler-9 and Kepler-19: two pivotal systems that reconcile RV and TTV mass determinations

10:00-10:30 Coffee Break

Session 2 Rotation, Activity & Clusters (Chair: John Stauffer)

10:30-11:00 Luisa Rebull (invited): Stellar Rotation in Clusters with K2
11:00-11:15 Rebecca Esselstein: Determining the Rotation Periods of M67 and Their Implications on Stellar Evolution from K2 Data
11:15-11:30 Jason Curtis: The K2 Survey of Ruprecht 147
11:30-11:45 James Davenport: Stellar flare rate evolution revealed by Kepler
11:45-12:00 Hiroyuki Maehara: Starspot activity and superflares on solar-type stars

12:00-13:30 Lunch Break

Session 3 Rotation, Activity & Clusters (Chair: Ann Marie Cody)

13:30-14:00 Jennifer van Saders (invited): Kepler's Insights into Angular Momentum Evolution
14:00-14:15 Gibor Basri: Direct Signatures of Differential Rotation on Active Kepler Stars
14:15-14:30 Michael Gully-Santiago: Physical properties of starspots
14:30-14:45 Ben Montet: Observing Stellar Activity Cycles with Kepler

14:45-15:00 David Ciardi: Variable Variability: Understanding How Stars Vary from 4 years of Kepler Data

15:00-15:30 Coffee Break

Session 4 Dynamics, Architectures & Binaries (Chair: Eric Ford)

15:30-15:45 Gongjie Li: Uncovering Circumbinary Planetary Architectural Properties from Selection Biases

15:45-16:00 Dan Fabrycky: Differing Tidal Dissipation in exo-Earths, Super-Earths, and Sub-Neptunes from Resonant Chains of Planets

16:00-16:15 Daniel Jontof-Hutter: Outer Architecture of Kepler-11: Constraints from Coplanarity

16:15-16:30 Jerome Orosz: Kepler Triple Systems and Tidal Apsidal Structure Constants for Low Mass Stars

16:30-16:45 Avi Shporer: Radial velocity monitoring of Kepler heartbeat stars

16:45-17:00 Jim Fuller: Resonance Locking of Tidally Excited Pulsations in the Heartbeat Star KIC8164262

17:00-18:30 Poster Session II

Friday, June 23

Session 1 Exoplanet Compositions + Dynamics, Architectures & Binaries (cont'd) (Chair: Elisa Quintana)

8:30-8:45 Evan Sinukoff: Small Planet Masses and Compositions from K2

8:45-9:00 William Cochran: Small planets from K2: Rocky or Gaseous?

9:00-9:15 James Owen: Evaporation Of Close-in Planets: The “Evaporation Valley”

9:15-9:30 Lauren Weiss: The California Kepler Survey V: Stellar and Planetary Properties of Kepler's Multiplanet Systems

9:30-9:45 Sarah Millholland: Supervised Learning Detection of Sixty Non-Transiting Hot Jupiter Candidates

9:45-10:00 Bill Welsh: Non-Transiting Circumbinary Planets: Kepler's Hidden Gift

10:00-10:30 Coffee Break

Session 2 Rotation, Activity & Clusters (cont'd) + Other topics (Chair: Knicole Colon)

10:30-10:45 Raphaëlle Haywood: Addressing stellar activity at every step in the HARPS-N RV follow-up of Kepler and K2 systems

10:45-11:00 Fabienne Bastien: Space-Based Light Curves as Predictors of Good Radial Velocity Planet Search Targets

11:00-11:15 Christina Hedges: Hunting for Dippers with Supervised Machine Learning

11:15-11:30 Alexej Goldin: Astrometry with Kepler: prospects and lessons learned

11:30-11:45 Flavien Kiefer: KIC8462852: boosting up the exocomet fragments model

11:45-12:00 Poster competition winners

12:00-13:30 *Lunch*

Session 3 *Future & Outlook (Chair: Natalie Batalha)*

13:30-14:00 Eric Mamajek (invited): Kepler/K2 in the Context of Future Exoplanet Missions

14:00-14:15 George Ricker: Unlocking the Secrets of Nearby Exoplanets with the Transiting Exoplanet Survey Satellite

14:15-14:30 Jessie Christiansen: TESSting the Waters: Coordinating the characterisation of HD 3167 as a learning experience for TESS follow-up

14:30-15:00 Dave Latham (invited): Kepler & K2 Highlights and Future Outlook

15:00 *End of Conference*

	Monday June 19	Tuesday June 20	Wednesday June 21	Thursday June 22	Friday June 23
Session 1 (8.30 am-10.00am)	*Kepler & K2 Updates (Chair: Jeff Coughlin)*	*Extragalactic & Solar System Science (Chair: Geert Barentsen)*	*Asteroseismology of Classical Pulsators (Chair: Steven Kawaler)*	*Exoplanet Compositions (Chair: Andrew Howard)*	*Exoplanet Compositions + Dynamics, Architectures & Binaries (cont'd) (Chair: Elisa Quintana)*
8:30-8:45	8am-9am: Registration & Press Conference (live-streamed to conference auditorium)	Armin Rest (invited): High-cadence Light Curves of Transients from the Kepler Telescope	Conny Aerts (invited): Asteroseismology of Hot Stars	Angie Wolfgang (invited): The Mass-Radius "Relation" and the Diversity of Exoplanet Compositions	Evan Sinukoff: Small Planet Masses and Compositions from K2
8:45-9:00					William Cochran: Small planets from K2: Rocky or Gaseous?
9:00-9:15	Welcome to Ames & Logistics (Mark Messersmith, Steve Zornetzer, and Bill Borucki)	Brad Tucker: The Kepler Supernova Cosmology Experiment - C16 and C17	Timothy van Reeth: The interior rotation of intermediate-mass stars	Eric Lopez: Predictions for the Transition Between Rocky Super-Earths and Gaseous Sub-Neptunes	James Owen: Evaporation Of Close-in Planets: The "Evaporation Valley"
9:15-9:30	Jessie Dotson: K2 Project Status & Future Opportunities	Erin Ryan: K2's Keys to the Solar System: Lightcurves of Trojan and Hilda Asteroids	Tim White: Beyond the K2 bright limit: variability in the brightest stars in the ecliptic	BJ Fulton: The California-Kepler Survey. III. A Gap in the Radius Distribution of Small Planets	Lauren Weiss: The California Kepler Survey V: Stellar and Planetary Properties of Kepler's Multiplanet Systems
9:30-9:45	Susan Thompson (invited): Kepler's Final Exoplanet Catalog	Andras Pal: A review of the results related to Solar System studies	László Molnár: The K2 RR Lyrae and Cepheid Survey: hunting for pulsating stars, near and far	Tsevi Mazeh: The Planetary Mass-Radius Relation and its Dependence on Orbital Period as Measured by Transit Timing Variations and Radial Velocities	Sarah Millholland: Supervised Learning Detection of Sixty Non-Transiting Hot Jupiter Candidates
9:45-10:00		Miguel de Val-Borro: K2 photometry of comet 67P/Churyumov-Gerasimenko	JJ Hermes: Evidence from K2 for rapid rotation in the descendant of an intermediate-mass star	Luca Malavolta: Kepler-9 and Kepler-19: two pivotal systems that reconcile RV and TTV mass determinations	Bill Welsh: Non-Transiting Circumbinary Planets: Kepler's Hidden Gift
Break (10am-10.30am)		Break until 10:45am			
Session 2 (10.30 am-12pm)	*Benchmark Systems from Kepler/K2 (Chair: David Charbonneau)*	*Microlensing (Chair: Rachel Street)*	*Exoplanet Occurrence Rates (Chair: Christian Clanton)*	*Rotation, Activity & Clusters (Chair: John Stauffer)*	*Rotation, Activity & Clusters (cont'd) + Other topics (Chair: Knicole Colon)*
10:30-10:45	Jason Rowe (invited): Benchmark Exoplanet Systems Discovered by Kepler/K2		Chris Burke (invited): Terrestrial Planet Occurrence Rates From Kepler: Past, Current, and Future	Luisa Rebull (invited): Stellar Rotation in Clusters with K2	Raphaelle Haywood: Addressing stellar activity at every step in the HARPS-N RV follow-up of Kepler and K2 systems
10:45-11:00		Calen Henderson (invited): K2's Campaign 9: The First Automated Microlensing Survey from the Ground and from Space			Fabienne Bastien: Space-Based Light Curves as Predictors of Good Radial Velocity Planet Search Targets
11:00-11:15	Rodrigo Luger: K2 unveils a seven-planet resonant chain in TRAPPIST-1		Danley Hsu: Characterizing Kepler Planet Occurrence Rates Using Approximate Bayesian Computation	Rebecca Esselstein: Determining the Rotation Periods of M67 and Their Implications on Stellar Evolution from K2 Data	Christina Hedges: Hunting for Dippers with Supervised Machine Learning
11:15-11:30	Songhu Wang: Improved Masses for the Potentially Habitable TRAPPIST-1 Planets	Wei Zhu: K2C9 Early Science Results and Synergy with Spitzer Microlensing	Ian Crossfield: Crowd-sourced Planet Occurrence: Citizen Science with K2	Jason Curtis: The K2 Survey of Ruprecht 147	Alexej Goldin: Astrometry with Kepler: prospects and lessons learned
11:30-11:45	Courtney Dressing: Characterizing K2 Planetary Systems Orbiting Cool Dwarfs	Radek Poleski: K2 observations of microlensing superstamp in Campaign 9 and selected targets in Campaign 11	Steve Bryson: Science Yield from the Kepler Certified False Positive Table	James Davenport: Stellar flare rate evolution revealed by Kepler	Flavien Kiefer: KIC8462852: boosting up the exocomet fragments model
11:45-12:00	Andrew Vanderburg: HARPS-N Observations of K2 Planet Candidates and Planet Masses in the WASP-47 System	Matthew Penny: Forward Model Photometry of K2 Crowded Field Data	Adam Kraus: The Ruinous Impact of Close Binary Companions on Planetary Systems	Hiroyuki Maehara: Starspot activity and superflares on solar-type stars	Poster competition winners
Lunch (12pm-1.30 pm)					

Session 3 (1.30 pm-3pm)	*Asteroseismology of Solar-Like Oscillators (Chair: Sarbani Basu)*	*Exoplanet Formation & Evolution (Chair: Stephen Kane)*	*Breakout Sessions Part 1*	*Rotation, Activity & Clusters (Chair: Ann Marie Cody)*	*Future & Outlook (Chair: Natalie Batalha)*
1:30-1:45	Dennis Stello (invited): The asteroseismic revolution of red giant stars: from stellar interiors to the structure of the Milky Way	Ruth Murray Clay (invited): Planet formation and evolution: Implications for planetary compositions	Kepler Occurrence Rate Hack (Natalie Batalha) + Speed-Networking with TESS (Tom Barclay) + Gaussian Processes (Dan Foreman-Mackey)	Jennifer van Saders (invited): Kepler's Insights into Angular Momentum Evolution	Eric Mamajek (invited): Kepler/K2 in the Context of Future Exoplanet Missions
1:45-2:00					
2:00-2:15	Matteo Cantiello: Asteroseismic Signatures of Evolving Internal Stellar Magnetic Fields	Aaron Rizzuto: The Exoplanet Migration Timescale from K2 Young Clusters		Gibor Basri: Direct Signatures of Differential Rotation on Active Kepler Stars	Jessie Christiansen: TESSting the Waters: Coordinating the characterisation of HD 3167 as a learning experience for TESS follow-up
2:15-2:30	Enrico Corsaro: Spin alignment of stars in old open clusters	John Brewer: Beyond Metallicity: Chemical Tracers of Planet Formation		Michael Gully-Santiago: Physical properties of starspots	George Ricker: Unlocking the Secrets of Nearby Exoplanets with the Transiting Exoplanet Survey Satellite
2:30-2:45	Jamie Tayar: Core and Surface Rotation Rates of Evolved Intermediate Mass Stars	Samuel Grunblatt: Re-Inflated Planets Orbit Evolved Stars: Toward Solving a 17-Year-Old Puzzle in Exoplanet Science		Ben Montet: Observing Stellar Activity Cycles with Kepler	Dave Latham (invited): Kepler & K2 Highlights and Future Outlook
2:45-3:00	Kevin Schlaufman: Joint Spectroscopic and Asteroseismic Analysis of Very Metal-poor Stars in the Kepler Field	Vincent van Eylen: Planets around evolved stars: formation or evolution?		David Ciardi: Variable Variability: Understanding How Stars Vary from 4 years of Kepler Data	
Break (3pm-3.30 pm)					**End of Conference**
Session 4 (3.30 pm-5pm)	*Exoplanets & Stars (Chair: Dawn Gelino)*	*Galactic Archeology (Chair: Katia Cunha)*	*Breakout Sessions Part 2*	*Dynamics, Architectures & Binaries (Chair: Eric Ford)*	
3:30-3:45	Erik Petigura: The California Kepler Survey: High-Resolution Spectroscopy of 1305 Stars Hosting Transiting Planets	Jennifer Johnson (invited): Peering into the past: Galactic Archaeology with Kepler and K2	Kepler Occurrence Rate Hack (Natalie Batalha) + NASA Exoplanet Exploration Program (Karl Stapelfeldt) + EVEREST Tutorial & Hack Session (Rodrigo Luger)	Gongjie Li: Uncovering Circumbinary Planetary Architectural Properties from Selection Biases	
3:45-4:00	Rob Wittenmyer: Revised radius estimates for K2 planet candidates from AAT/HERMES			Dan Fabrycky: Differing Tidal Dissipation in exo-Earths, Super-Earths, and Sub-Neptunes from Resonant Chains of Planets	
4:00-4:15	Tim Bedding: Surface Gravities for 15,000 Kepler Stars measured from Stellar Granulation	Joel Zinn: Mind the GAP: A 360 degree view of the Galaxy with the K2 Galactic Archaeology Program		Daniel Jontof-Hutter: Outer Architecture of Kepler-11: Constraints from Coplanarity	
4:15-4:30	Emily Sandford: Know the Planet, Know the Star: Precise Stellar Parameters with Kepler	Victor Silva Aguirre: Age dissection of the Milky Way disk using asteroseismology		Jerome Orosz: Kepler Triple Systems and Tidal Apsidal Structure Constants for Low Mass Stars	
4:30-4:45	Rachel Matson: Stellar companions of K2 Exoplanet Candidate Host Stars	Marc Pinsonneault: Asteroseismology and Spectroscopy for a Large Sample of Kepler Dwarfs and Subgiants		Avi Shporer: Radial velocity monitoring of Kepler heartbeat stars	
4:45-5:00	Lea Hirsch: Assessing the Effect of Stellar Companions to Kepler Objects of Interest	Ruth Angus: The ages of K2 dwarfs		Jim Fuller: Resonance Locking of Tidally Excited Pulsations in the Heartbeat Star KIC8164262	
Evening Session (5pm-6.30pm)	Poster Session I			Poster Session II	
Evening Events		7pm-8.30pm: Public Talk: An Evening with the Storytellers (Nadia Drake, Dennis Overbye, Mike Lemonick); Building 3			

List of Posters

Name	Institution	Title	Poster Number
Akeson, Rachel	NexScI	Kepler and K2 data in the NASA Exoplanet Archive	1
Baranec, Christoph	University of Hawai`i	Robotic adaptive optics for visible and near-infrared characterization of stellar blends	2
Bayliss, Daniel	University of Geneva	Vetting HATSouth Exoplanet Candidates with K2	3
Bayliss, Daniel	University of Geneva	EPIC 201702477b - A High Density Transiting Brown Dwarf in a 41 day Orbit	4
Becker, Juliette	University of Michigan	Effects of Unseen Planetary Companions on Compact Exoplanetary Systems	5
Bell, Keaton	University of Texas at Austin	A New Outburst Phenomenon in Cool Pulsating White Dwarf Stars	6
Biersteker, John	Massachusetts Institute of Technology	Searching for Exoplanetary Oblateness Using Transit Depth Variations	7
Castanheira Endl, Barbara	Baylor University	Asteroseismology of white dwarfs observed by Kepler and K2	8
Chang, Han Yuan	Graduate Insititute of Astronomy, National Central University, Taiwan	Hyper-flares phenomena of M dwarfs	9
Chontos, Ashley	Institute for Astronomy, University of Hawaii	Asteroseismology of Kepler Exoplanet Hosts	10
Clarke, Riley	Western Washington University	Age-Activity Relationships in Kepler Wide Binaries	11
Cody, Ann Marie	NASA Ames Research Center	K2 Spies on the Lagoon	12
Colon, Knicole	NASA Goddard Space Flight Center	Preparing for JWST: Ground-Based Near-Infrared Studies of K2 Exoplanets	13
Coughlin, Jeffrey	SETI Institute	The Kepler Robovetter	14
Curtis, Jason	Columbia University	A Warm Brown Dwarf Transiting a Solar Twin in a Benchmark Cluster: Discovered with an iPhone 6 at Disneyland	15
Dai, Fei	MIT	Stellar Obliquity from Spot-crossings and Transit Mapping	16
Dalba, Paul	Boston University	Non-existent "phantom stars" and erroneous transit depth dilution	17
Davenport, James	Western Washington University	Rotating stars from Kepler observed with Gaia	18
Domagal-Goldman, Shawn	NASA Goddard Space Flight Center	Planet Classification, Beyond the Habitable Zone	19
Faigler, Simchon	Tel-Aviv University School of physics and astronomy	The dearth of short-period Neptunian exoplanets and its sharp edge: separating hot Jupiters and short-period super-Earths	20
Ford, Eric	Penn State University	The Occurrence Rate of Planetary Architectures	21
Fukui, Akihiko	Okayama Astrophysical Observatory, NAOJ	Multiband Photometry of K2 Transiting Planets with MuSCAT and MuSCAT2	22
Giampapa, Mark	National Solar Observatory	Rotation and Activity in the Suns of M67	23
Goldin, Alexey	Teza Technologies	Using astrometry and Independent Component Analysis to separate flux from unresolved targets in Kepler data	24
Gonzales, Erica	University of Notre Dame	Candidate Companions to K2 Stars From High-Resolution Follow-up Observations and the Effect on Planet Radii Due to Transit Dilution	25
Grziwa, Sascha	RIU-PF at the University of Cologne	The KESPRINT collaboration	26
Grziwa, Sascha	RIU-PF at the University of Cologne	Wavelet based filter methods for the advanced detection of transiting planets in K2 light curves.	27
Guo, Xueying	MIT	Ensemble Atmopheric Properties of Small Planets around M Dwarfs	28
Haas, Michael	NASA-Ames Research Center	Kepler's Product Menagerie	29
Hardegree-Ullman, Kevin	University of Toledo/IPAC	Spitzer Transit Follow-up of the HD 3167 System	30
Hardegree-Ullman, Kevin	University of Toledo	Planet Occurrence Rates Around Mid-Type M Dwarfs in the Kepler Field	31
Henderson, Cassandra	UCSC	A new statistical method for characterizing the atmospheres of extrasolar planets	32
Hoffman, Kelsey	SETI	Using Molecular Dynamics to Study the Material Properties of Exoplanet Interiors	33
Huber, Daniel	Institute for Astronomy, University of Hawaii	Asteroseismology and Gaia: Testing Scaling Relations Using 2200 Kepler Stars with TGAS Parallaxes	34
Ikuta, Kai	Kyoto University	Estimation of starspot properties on superflare stars with a new technique on the basis of Bayesian method	35
Isaak, Kate	ESA/ESTEC	CHEOPS: CHaracterising ExOPlanet Satellite	36
Jenkins, Jon	NASA Ames Research Center	Status of the TESS Science Processing Operations Center (SPOC)	37
Jenkins, Jon	NASA Ames Research Center	The Kepler Data Processing Handbook: A Field Guide to Prospecting for Habitable Worlds	38
Johnson, Marshall	The Ohio State University	Warm Jupiters and their Spin-Orbit Misalignments from Kepler, K2, and Doppler Tomography	39
Jontof-Hutter, Daniel	University of the Pacific	A targeted sample of low-mass exoplanet characterizations from transit timing.	40
Kaleida, Catherine	The Space Telescope Science Institute	The MAST Kepler and K2 Archive	41
Kane, Stephen	San Francisco State University	A Catalog of Kepler Habitable Zone Exoplanet Candidates	42
Kosiarek, Molly	UCSC	New Mass Measurements of K2-3 and GJ3470 from Radial Velocity Measurements	43
Kostov, Veselin	NASA GSFC	Tatooine's Future	44
Kruse, Ethan	University of Washington	K2 Planet Candidates Using Everest and QATS	45
Kuchar, Thomas	Boston College/Institute for Scientific Research	Dying Stars in the Kepler Field: A Progress Report	46

List of Posters

Name	Institution	Title	Poster Number
Lee, Chien-Hsiu	Subaru Telescope, NAOJ	Properties of eclipsing binaries from all-sky surveys	47
Livingston, John	University of Tokyo	Spitzer Confirmation of Planet Candidates from K2	48
Livingston, John	University of Tokyo	200 Candidates and Validated Planets from Year Two of K2	49
Luhn, Jacob	Penn State University	RVs with K2: Jitters, A New Planet, and Transit Probabilities for Subgiants	50
Masuda, Kento	Princeton University	Reassessment of the Null Result of the HST Search for Planets in 47 Tucanae	51
Mathur, Savita	Space Science Institute	Re-analysis of solar-like stars observed in short cadence by Kepler and effect of magnetism on acoustic modes	52
Matson, Rachel	NASA Ames/GSU	Radial Velocities of Kepler Eclipsing Binaries	53
Mayo, Andrew	Harvard College Observatory	197 Candidates and 102 New Validated Planets in C0-C10 of K2	54
Morello, Giuseppe	University College London	High-precision stellar limb-darkening in exoplanetary transits	55
Morris, Brett	University of Washington	The Active Latitudes of HAT-P-11	56
Murphy, Simon	University of Sydney	A planet in an 840-day orbit around a *Kepler* main-sequence A star	57
Nemec, James	Camosun College, Victoria, BC, CANADA	METAL ABUNDANCES FOR ~500 RR LYRAE STARS OBSERVED BY K2 (CAMPAIGNS 0-6)	58
Nemec, James	Camosun College, Victoria, CANADA	DOUBLE-MODE RR LYRAE STARS OBSERVED DURING K2 CAMPAIGNS 1-6	59
Nemec, James	Camosun College, Victoria, BC, CANADA	SX PHE STARS IN THE KEPLER FIELD	60
Notsu, Yuta	Kyoto University	Statistical properties of superflares on solar-type stars with Kepler data	61
Notsu, Yuta	Kyoto University	Spectroscopic observations of solar-type superflare stars found from Kepler	62
Ofir, Aviv	Weizmann Institute of Science	A spectral approach to transit timing variations	63
Olmedo Aguilar, José Manuel	Instituto Nacional de Astrofísica Optica y Electrónica	Near-UV Excesses and Variability of 660,000 Sources in the Kepler Field	64
Pál, András	Konkoly Observatory	TESS in the Solar System	65
Paudel, Rishi R.	University of Delaware	K2 Survey of Ultracool Dwarfs	66
Ragozzine, Darin	Brigham Young University	The Importance of Multi-Transiting Probability for Debiased Exoplanetary System Architectures	67
Ranc, Clément	USRA/NASA Goddard Space Flight Center	Simultaneous K2 Photometry and Light Curves Modeling for the Analysis of K2C9 Microlensing Observations	68
Rowden, Pamela	The Open University	Kepler as a calibrator for the false positive rate in future transiting exoplanet surveys	69
Rustamkulov, Zafar	University of California, Santa Cruz	A New Model for High-Resolution Exoplanet Transmission Spectroscopy	70
Schlieder, Joshua	NASA GSFC	On The Trail of Jovians Transiting Low-Mass Stars with K2	71
Scott, Nic	NASA ARC	Speckle imaging follow-up for Exoplanet Validation and characterization	72
Sheets, Holly	McGill University	A Statistical Characterization of Reflection and Refraction in the Atmospheres of sub-Saturn Kepler Planet Candidates	73
Shporer, Avi	Caltech	K2 Warm Jupiters with the LCO TECH Team	74
Socia, Quentin	San Diego State University	KIC 9832227: Testing the "Red Nova" Merger Prediction Using Vulcan Data	75
Somers, Garrett	Vanderbilt University	Testing models of M dwarf angular momentum evolution with K2 young cluster rotation rates	76
Stauffer, John	Spitzer Science Center, Caltech	The Role of Binarity in the Angular Momentum Evolution of M Dwarfs	77
Stefansson, Gudmundur	Penn State University	Extreme precision photometry from the ground with beam-shaping diffusers to follow-up Kepler, K2, and TESS targets	78
Stello, Dennis	UNSW	Asteroseismic masses of planet-hosting `retired A stars'	79
Thompson, Susan	SETI Institute/NASA Ames Research Center	Kepler DR25 Exoplanet Catalog Highlights	80
Thorngren, Daniel	UC Santa Cruz	Bayesian Inference of Hot Jupiter Radius Anomalies Points to Ohmic Dissipation	81
Trust, Otto	Mbarara University of Science and Technology	Age of rotating stars in NGC 6811 Open cluster	82
Tucker, Brad	Mt Stromlo Observatory, the Australian National University	GLUV - A High-Altitude Balloon-Borne UV Survey	83
Van Saders, Jennifer	Carnegie Observatories	A K2 Stellar Astrophysical Study of the Old Open Cluster M67	84
Vega, Laura	Vanderbilt University	Evidence for Possible Disk Obscuration in Kepler Observations of the Pulsating RV Tau Variable DF Cygni	85
Vrard, Mathieu	Instituto de Astrophísica e ciências do espaço (IA), Porto, Portugal	Amplitudes and lifetime of radial modes in red giant star spectra observed by Kepler	86
Wang, Songhu	Yale	Kepler-9 -- A New Look at a Classic Planetary System	87
Weiss, Lauren	Université de Montréal	The California Kepler Survey V: Stellar and Planetary Properties of Kepler's Multiplanet Systems	88
Werner, Michael	JPL	Spitzer Meets K2 - A Status Report	89
Windemuth, Diana	University of Washington	Searching for Tatooines	90
Ziegler, Carl	University of North Carolina at Chapel Hill	The Robo-AO KOI Survey: LGS-AO Imaging Of Every Kepler Planetary Candidate Host Star	91

Invited Talk Abstracts

Name	Institution	Title	Abstract
Aerts, Conny	Institute of Astronomy, KULeuven	Asteroseismology of Hot Stars	In this talk, we provide an overview of Kepler's and K2's achievements in the area of seismology of hot stars. In contrast to cool stars, hot stars show a huge diversity of variability and pulsational behaviour. One of the major achievements of Kepler is that it opened the window of gravity-mode pulsations. We show how such modes allow to determine the interior rotation frequency and the level of chemical mixing in the near-core regions of stars. We explain how that revolutionized our view on rotation and angular momentum inside stars, providing calibrations with unprecedented precision for evolutionary models of massive stars. We end by highlighting future prospects based on new dedicated space photometry coming up with the TESS and PLATO missions, in combination with astrometry from Gaia.
Burke, Christopher	SETI Institute / NASA Ames	Terrestrial Planet Occurrence Rates From Kepler: Past, Current, and Future	I review past and current results in measuring terrestrial planet occurrence rates using the planet candidates discovered by the Kepler mission. The final Kepler pipeline search results and the automated planet candidate assessments which are critical for an accurate measurement of habitable zone planet population statistics are publicly available. I discuss how to go from the biased set of Kepler planet candidate discoveries to measuring the underlying planet population. The Kepler data points to a sharp contrast between the planets hosted by G and M dwarfs with potential implications for understanding the planet formation process and providing guidance for planning future NASA missions to directly image Earth analogs.
Henderson, Calen	Caltech/IPAC	K2's Campaign 9: The First Automated Microlensing Survey from the Ground and from Space	K2's Campaign 9 (K2C9) conducted the first automated microlensing survey from the ground and from space, covering 3.7 square degrees and spanning 71 days from April 22nd through July 2nd of 2016. The spatial baseline between K2 and the Earth during C9, which ranged from ~0.1 to ~0.8 AU, will provide satellite parallax measurements for ~200 microlensing events, ultimately facilitating mass and distance determinations for the lensing systems. The events detected during K2C9 will allow us to address several demographic questions, including the frequency of cold exoplanets, the Galactic distribution of planets, and the abundance of free-floating exoplanets. I will give an overview of the parameters of K2C9, including the vast array of ground-based resources that simultaneously observed the survey superstamp, and will motivate the scientific drivers. I will also discuss the challenges of performing crowded-field photometry in the Galactic bulge with Kepler's 4" pixels as well as the efforts underway to make this problem tractable.
Johnson, Jennifer	Ohio State University	Peering into the past: Galactic Archaeology with Kepler and K2	Analysis of asteroseismic, rotational, and granulation signatures in Kepler and K2 data has provided an important new tool for understanding the history of the Milky Way Galaxy. In this overview of Galactic archeology investigations underway with Kepler and K2 data, I will discuss measurements of the star formation history across space and time and the chronology of the formation of the thin disk, thick disk, and inner halo. I will also discuss correlations between ages and chemistry and the search for the reservoirs of populations that are radially mixed into the solar neighborhood. With such results, studies of exo-solar systems, variable stars, and stellar properties can be understood in a well-defined Milky Way environment.
Latham, David	Harvard-Smithsonian Center for Astrophysics	Kepler & K2 Highlights and Future Outlook	I plan to focus on the scientific highlights from Kepler and K2, starting with a summary of the new results from this meeting that impressed me, and then moving on to my recollections of how I viewed key results as they unfolded during the missions. The most challenging part of my assignment is to look to the future and speculate on what we may learn next, building on the foundation inherited from Kepler and K2.
Mamajek, Eric	JPL/Caltech	Kepler/K2 in the Context of Future Exoplanet Missions	The Kepler space telescope has discovered thousands of candidate exoplanets orbiting close-in to their stars in its main mission and extended K2 program. Kepler has vividly demonstrated the ubiquity of exoplanets orbiting most stars, diversity in planetary systems architectures, and the commonality of planets smaller than Neptune, which appear to branch into sub-Neptune and super-Earth populations. I'll discuss the importance of Kepler results, especially constraints on the frequency of Earth-size planets in habitable zones, to NASA and the Exoplanet Exploration Program in the context of the arc of future missions to discover and characterize exo-Earths.
Murray Clay, Ruth	UCSC	Planet formation and evolution: Implications for planetary compositions	Disk initial conditions combined with formation processes determine the bulk composition of a planet. I will discuss new work showing that the masses of observed protoplanetary disks may be larger than previously thought and suggest that the features of high-mass disks, combined with the efficacy of pebble accretion in turbulent gas, may explain the observed distribution of giant planets. Within this context, I will suggest a possible source for the observed correlation between planet mass and metallicity among giants, discuss implications for planetary system architectures, and provide predictions for correlations between the compositions of low-mass planets discovered by Kepler/K2 and the likely presence and properties of giant planets orbiting the same stars on more distant orbits.

Invited Talk Abstracts

Name	Institution	Title	Abstract
Rebull, Luisa	Caltech-IPAC/IRSA, NITARP, and SSC	Stellar Rotation in Clusters with K2	K2 has provided a phenomenal opportunity to study properties of stars in clusters, particularly young low-mass stars, far beyond the expectations of the original Kepler mission. The high-precision photometry provided by K2 allows us to probe stellar variability to lower masses and lower amplitudes than has ever been done before. Younger stars are generally more rapidly rotating and have larger star spots than older stars of similar masses; there is often substantial variability as a result of star spots rotating into and out of view, . K2 has monitored stars from several clusters, most notably Upper Sco, the Pleiades, and Praesepe. The light curves have yielded thousands of rotation rates, and revealed far greater diversity in light curves than was anticipated. In this talk I will review the results of K2 observations of clusters, specifically distributions of rotation rates.
Rest, Armin	Space Telescope Science Institute	High-cadence Light Curves of Transients from the Kepler Telescope	Kepler's high photometric accuracy combined with the continuous 30 minute cadence offers crucial early rise time data on SNe and other transients that have been unobtainable with ground-based surveys. To date our Kepler Extra-Galactic Survey (KEGS) has found on the order of 20 SNe and transients, with the majority being SN Ia, but also core-collapse SNe and exotic transients. The 30-minute cadence of Kepler has revealed subtle features in the light-curves of these transients not detectable with any other survey, including signatures of shock break-out and interactions with the circumstellar material. I will discuss how this has provided us with crucial insight into the progenitor channels and physics of the explosions.
Rowe, Jason	Université de Montréal	Benchmark Exoplanet Systems Discovered by Kepler/K2	N/A
Stello, Dennis	UNSW	The asteroseismic revolution of red giant stars: from stellar interiors to the structure of the Milky Way	In less than a decade we have seen a string of breakthroughs in stellar astrophysics sparked by seismic data from space missions, particularly from Kepler. Very recent results suggest that this seismic revolution is still going strong. Currently funded follow up missions including K2, TESS, and PLATO show great prospects for using asteroseismology to not only probe the interior of stars, but also to probe the structure and evolution of the Galaxy. I will give a broad overview of the field including recent breakthroughs and look at future prospects for the decade to come.
Thompson, Susan	SETI Institute/NASA Ames Research Center	Kepler's Final Exoplanet Catalog	We present Kepler's Q1--Q17 DR25 planet candidate catalog. This catalog was created by searching the DR25 light curves for transits, and vetting those detections (TCEs) with our fully automated Robovetter. The Robovetter applies thresholds and simple logic to metrics which examine whether each TCE is a planet candidate or a false positive, i.e. more consistent with noise, an eclipsing binary, or contamination. All potentially transit-like objects are included in the catalog and are given a full transit fit with Markov chain Monte Carlo error bars. Also, new to this catalog is a disposition score which calculates the Robovetter's confidence in the disposition. With this score users can make a simple cut to easily find the best, most reliable exoplanet candidates in the DR25 catalog when looking for interesting targets to follow-up or selecting candidates for occurrence rate calculations. Kepler's ultimate goal is to provide the community with a catalog that can be used to measure how common temperate, terrestrial exoplanets are around FGK dwarf stars. With this in mind, this catalog was designed to prioritize the ability to measure the completeness and reliability of our vetting procedures. To do so, we applied the same Robovetter logic to simulated transits (from pixel-level transit injections) and simulated false alarms (from inverted and scrambled data) to estimate the fraction of planet candidates we missed and the number of false positives we included. For the long-period, low signal-to-noise planet candidates our measurements of reliability indicate that about half are caused by true astrophysical sources while the other half are likely caused by instrumental and stellar noise. While we cannot pinpoint which are the actual planets from the Kepler data alone, this catalog can still be used to measure how common terrestrial, temperate exoplanets are, as long as the completeness and reliability of the catalog are appropriately included.
van Saders, Jennifer	Carnegie Observatories	Kepler's Insights into Angular Momentum Evolution	Rotation is a universal property of stars, and one that varies strongly as a function of stellar type, evolutionary state and stellar history. It is also deeply entangled in numerous open questions: how do stars lose angular momentum, and how does that vary as a function of stellar type? How is angular momentum redistributed in the interior, and how does that affect stellar evolution? What is the impact of rotation on inferred stellar parameters, and how can we use rotation to make inferences about stellar properties? The data from Kepler and K2 is the single most powerful dataset for answering these questions. It provides the means to measure surface rotation periods of tens of thousands of stars: from low-mass M dwarfs, to quiet solar analogs, to open clusters spanning a variety of ages. It enables asteroseismology, which can probe the interior rotation profiles of stars across the HR diagram from solar-like main sequence stars, to massive stars and giants. In many cases, these Kepler data represent our first look into un-probed corners of parameter space, and such views have revealed unexpected behavior. I will discuss the wealth of constraints that Kepler data bring to the study of angular momentum evolution, the open questions, and the path forward for future missions.

Invited Talk Abstracts

Name	Institution	Title	Abstract
Wolfgang, Angie	The Pennsylvania State University	The Mass-Radius "Relation" and the Diversity of Exoplanet Compositions	With the Kepler mission close-out imminent, K2 in full swing, and the launch of TESS on the near horizon, the field of exoplanet science is increasingly focused on characterizing the thousands of planets that we already have and will soon discover. One crucial goal driving this characterization effort is to illuminate the diversity of exoplanet compositions: what is the "typical" exoplanet made of? How does this typical composition change with planet size or mass? What is the variation around this average composition-size trend? How does this trend change for planets at different orbital periods or for host stars with different masses or metallicities? And what does all this mean for how planets form? I will summarize the state of the field in answering these questions, focusing on the growing body of work on the relationship between exoplanet masses and radii. This mass-radius "relation" is an empirical description of the distribution of exoplanet compositions; while often referred to and quantified as a one-to-one function, I will show recent work by myself and others which demonstrate significant diversity in exoplanet compositions at a given size or mass. This astrophysical variation along with the diversity in mass measurement methods and observational surveys creates a field of research brimming with theoretical, observational, and statistical problems to be solved. I will overview these opportunities, preliminary efforts to address them, and the next steps that will be needed to understand and quantify the Galactic distribution of exoplanet compositions.

Contributed Talk Abstracts

Name	Institution	Title	Abstract
Angus, Ruth	Columbia University	The ages of K2 dwarfs	The K2 fields span a range of galactic coordinates and include thin and thick disc, bulge and halo stars in various proportions. If we can infer their ages, the stars in this dataset provide an excellent opportunity to learn about the formation history of the Milky Way. Many galactic archaeology studies focus on red giants as they are bright and their ages can be inferred from asteroseismology or spectral classification, yet most Milky way stars are dwarfs. Main sequence stars are usually omitted because their ages are difficult to infer. We develop a new method for accurately dating main sequence stars which uses all the available age-relevant information: rotation periods from K2 light curves; photometric colours; spectroscopic properties and dynamical parameters from Gaia wherever available, and combine this information into one overall model for age. Using this method we are able to generate an age map of the main sequence K2 sky with exciting prospects for galactic archaeology.
Basri, Gibor	UC Berkeley	Direct Signatures of Differential Rotation on Active Kepler Stars	One of the most obvious characteristics of Kepler photometry from a huge number of targets is the variations due to starspots. The most interesting signals (from stars more active than the Sun ever gets) show consistency over many more rotations than the Sun does. Amazingly, we still do not have a good handle on whether the patterns are due primarily to spot evolution or to changes caused by differential rotation (unlike the Sun, these stars apparently usually have spots at many latitudes together). As a consequence we do not currently have good estimates for either spot lifetimes or surface shear on these stars. We discuss an effort to distinguish them and start to learn these answers. We use MCMC modeling techniques and a thoughtful conversion of Kepler differential photometry to light deficit curves, which includes a methodology to deal with the fact that there is no "un-spotted" signal from these stars (this renders covering factors ambiguous). We show that in many cases a very simple differential rotation model can explain complex patterns of evolution in the light curve.
Bastien, Fabienne	Pennsylvania State University	Space-Based Light Curves as Predictors of Good Radial Velocity Planet Search Targets	As Kepler and K2 have collectively found thousands of exoplanet candidates, their discoveries have strained ground-based radial velocity (RV) follow-up resources, which are unable to simultaneously keep up with the pace of transit discoveries by measuring masses for all of the candidates and maintain vigorous RV searches for planets that do not transit their parent star. The burden to the RV community is expected to worsen with the upcoming TESS mission, even as new RV instruments are slated to come online in the coming years. Observations that can enable the RV community to prioritize targets on the basis of their stellar RV variability in advance and, ideally, independently of the RV instruments themselves, can therefore permit us to reserve our RV resources for the stars most likely to yield the highest payoff. We show that the light curves from space-based transit surveys may not only be used as predictors of good RV search targets for the stars predominantly targeted by the exoplanet community but also for stars usually avoided by both RV and transit surveys due to their high intrinsic levels of stellar variability. We also present recommendations to the RV planet search community on how to improve prospects for finding Earth analogs from the recent workshop at the Aspen Center for Physics, “Approaching the Stellar Astrophysical Limits of Exoplanet Detection: Getting to 10cm/s.”
Bedding, Tim	University of Sydney	Surface Gravities for 15,000 Kepler Stars measured from Stellar Granulation	The surface gravity of a star is one of its most fundamental parameters. Asteroseismology with Kepler provides accurate surface gravities for the brighter main-sequence and subgiant stars, but only if their oscillations are observed at short cadence. For those tens of thousands of stars which only have long-cadence data, it may still be possible to infer log g by measuring the low-frequency photometric fluctuations from granulation. This method was used by Bastien et al. (2013, 2014, 2016), who derived log g for nearly 28,000 stars with a typical precision of about 0.1 dex. Somewhat controversially, they found that stellar radii of exoplanet hosts stars are, on average, 20%-30% larger than previous measurements had suggested. To build on this work, we have developed a method to estimate log g by measuring the granulation background in the Fourier power spectrum. We calibrated the method using stars for which asteroseismology has been possible with short-cadence data, demonstrating a precision in log g of about 0.05 dex. We also derived a correction for white noise as a function of Kepler magnitude by measuring white noise directly from observations. We then applied the method to the same sample of long-cadence stars as Bastien et al. (2016). We found that about half the stars are too faint for the granulation background to be reliably detected above the white noise. For the remainder, we have derived values of log g (and uncertainties) for about 15,000 stars (Pande, Bedding & Huber, in prep.). We confirm that previous measurements of log g were overestimated, but not by as much as reported by Bastien et al. (2014). Our results provide the most accurate log g available for these 15,000 stars, and the method can also be applied to data from K2 and TESS.

Contributed Talk Abstracts

Name	Institution	Title	Abstract
Brewer, John	Yale University	Beyond Metallicity: Chemical Tracers of Planet Formation	The gas and solid compositions in the protoplanetary disk evolve over time, but stellar abundances will reflect the primordial chemical composition of the disk. Using this knowledge of the initial conditions in systems with known planets, we can place constraints on the range of outcomes for planet interiors and rule out certain migration mechanisms. Composition will be an important tool in narrowing the search for Earth 2.0, determining which of the many Earth-sized planets are truly Earth-like. Our recently published catalog of accurate stellar parameters and precise abundances of 15 elements for more than 1600 stars contains almost 300 planet hosts. We have now updated it to include more than 1200 planet hosts from Kepler and K2, providing an unprecedented resource to explore the influences and outcomes of chemistry on planet formation. I will discuss the catalog and new results on chemical differences in system architectures.
Bryson, Steve	NASA Ames Research Center	Science Yield from the Kepler Certified False Positive Table	Science Yield from the Kepler Certified False Positive Table Steve Bryson, Natalie Batalha, Knicole Colon, Jeff Coughlin, Michael Haas, Chris Henze, David Latham, Tim Morton, Pam Rowden, Jason Rowe, Michael Abdul-Masih, Doug Caldwell The Kepler Certified False Positive Table at the Exoplanet Archive is the product of the Kepler False Positive Working Group (FPWG). The FPWG manually examines Kepler objects of interest (KOIs) to determine with high-confidence whether a KOI is a false positives or planet candidate. All available information including ground observations and published literature is used. A KOI is considered a “certified” false positive if there is compelling evidence that the KOI is not caused by a planetary transit on a star in the target star system. The resulting certified false positive table includes details on why a KOI is determined to be a false positive. We describe several scientifically interesting results that can be extracted from the Kepler certified false positive table. There is a strong dependence on sky position of the density of background binary systems, which can be used to calibrate or constrain background false positive probabilities and statistical binary population models. An overpopulation of background binaries close to target stars can be used to infer unresolved stellar multiplicity. We will briefly discuss the challenges of identifying background planetary transits. The statistics of both astrophysical false positives and instrumental false alarms can be used to calibrate automated KOI vetting systems. We’ll present a few examples of interesting individual systems. These results are examples of how the Kepler certified false positive table can enhance exoplanet science. Certifying false positives is an ongoing effort: as of Spring 2017, 3,107 KOIs have been examined, resulting in 2,612 certified false positives. The Kepler Certified False Positive Table is available at the NASA Exoplanet Archive, http://exoplanetarchive.ipac.caltech.edu.
Cantiello, Matteo	Center for Computational Astrophysics, Flatiron Institute	Asteroseismic Signatures of Evolving Internal Stellar Magnetic Fields	Magnetic fields play a role in almost all stages of stellar evolution. Stars that have convective cores might produce internal magnetic fields, and these could survive into later stages of stellar evolution, but information has been limited by our inability to measure the fields below the stellar surface. I will discuss how we can use asteroseismology to study the occurrence of strong magnetic fields in the cores of low- and intermediate-mass stars across different evolutionary phases.
Christiansen, Jessie	Caltech/IPAC-NExScI	TESSting the Waters: Coordinating the characterisation of HD 3167 as a learning experience for TESS follow-up	HD 3167 is a nearby, bright (K=7) K0 star observed by the NASA K2 mission, which was found to host two small, short-period transit planets amenable to mass measurement. Here we present the results of a high-cadence multi-site, multi-instrument precision radial velocity campaign to characterize the HD 3167 system. The masses of the two transiting planets are measured as 5.02+/-0.38 Me for HD 3167 b, a hot super-Earth with a likely rocky composition, and 9.8+/-1.3 Me for HD 3167 c, a warm sub-Neptune with a likely substantial volatile complement. Radial velocity measurements also reveal a third, non-transiting planet, HD 3167 d, with an orbital period of 8.509 d (between planets b and c, indicating misalignment and possibly an interesting dynamical history) and a minimum mass of 6.90+/-0.71 Me. HD 3167 is typical of the systems that will be discovered by the NASA TESS mission: bright, compact multi-planet systems comprising low-mass planets. These systems are challenging radial velocity targets, and obtaining precise, timely mass measurements can require combining radial velocity data from multiple instruments at multiple sites. We describe the advantages and challenges in combining data sets in this way, and how this model could succeed in the era of TESS.
Ciardi, David	IPAC-NExScI/ Caltech	Variable Variability: Understanding How Stars Vary from 4 years of Kepler Data	We present an analysis of the variability of 113,000 stars that were observed nearly continuously for 4.5 years (17 quarters) by the Kepler spacecraft. We will provide an overview of the fraction of stars that are variable as a function of spectral type and the fraction of time that the stars are variable. We explore these regimes OF stellar variability on a variety of timescaleS (0.25 day, 0.5 days, 1 day, 5 days, 10 days, 20 days, 50 days, and 100 days) and discuss the implications of our findings, and how they relate to the photometric detection and characterization of exoplanets.

Contributed Talk Abstracts

Name	Institution	Title	Abstract
Cochran, William	McDOnald Observatory, University of Texas at Austin	Small planets from K2: Rocky or Gaseous?	Authors: W. Cochran and the KESPRINT Collaboration Despite great progress in searching for super-Earth- and Neptune-size planets, we still do not have a good understanding of their composition and internal structure. These are key ingredients needed to investigate the formation of these objects and shed light on the transition between gaseous and rocky planets. Nasa's Kepler spacecraft has found many such small worlds, but the faintness of the host stars is a big obstacle for any further study. The K2 mission is currently providing us with a bonanza of small planets transiting stars amenable to radial velocity follow-up observations. In this talk I will present the results of the KESPRINT collaboration, with particular emphasis on the list of K2 small planets whose radii and masses have been accurately measured by our team. The sample includes ultra-short period bare cores, as well as planets with thick atmospheric envelopes.
Corsaro, Enrico	INAF - Osservatorio Astrofisico di Catania	Spin alignment of stars in old open clusters	Stars originate by the gravitational collapse of a turbulent molecular cloud of a diffuse medium, and are often observed to form clusters. Stellar clusters therefore play an important role in our understanding of star formation and of the dynamical processes at play. However, investigating the star formation is difficult because its physics is highly complex to be properly modeled, and because star forming regions are obscured by dust, which severely limits observations to infrared and radio bands only. As a consequence hierarchical-step approaches to decompose the problem into different stages are required, as well as reliable assumptions on the initial conditions in the clouds. In this talk I will report for the first time the use of asteroseismology, namely the study of stellar oscillations, to put strong constraints on the early formation stages of open clusters, up to more than 8 billion years old. I will describe the analysis performed on a sample of 50 red giant stars in the old open clusters NGC 6791 and NGC 6819 observed for more than four years by NASA Kepler, for which nearly 4000 oscillation modes have been fully characterized. I will therefore present the important discovery made about the rotation history of these clusters and how 3D hydrodynamical simulations for stellar cluster formation can be used to constrain the physical processes of turbulence and rotation that are in action during the proto-cluster formation. This research has been published in Nature Astronomy at http://www.nature.com/articles/s41550-017-0064. The results and implications of this work constitute a unique scientific breakthrough accomplished by means of the extraordinary data quality provided by the NASA Kepler mission. This work will be relevant also for different fields in astrophysics, including planetary formation and galaxy formation, structure, and evolution.
Crossfield, Ian	UC Santa Cruz	Crowd-sourced Planet Occurrence: Citizen Science with K2	The original Kepler mission provided a bonanza of information regarding the statistical distribution of planet occurrence rates around main-sequence stars. However, Kepler surveyed only a narrow patch of sky with a particular set of characteristic stellar parameters -- in particular, a lower mean metallicity than the solar neighborhood and with a target list focusing heavily on FGK stars. I will describe our work using K2, which surveys 10-20x more sky area and a far larger fraction of late-type stars, to extend Kepler's groundbreaking occurrence work. We do this using the unique Zooniverse citizen-science portal, which allows a rapid, homogeneous assessment of real and simulated planet candidate signals --- thereby producing both candidate lists and measuring survey completeness. I will present our preliminary results and describe how we leverage the unique advantages and challenges of precision astrophysics using citizen science, and how we intend to build on our K2 efforts in preparation for measuring planet occurrence with TESS.
Curtis, Jason	Columbia University	The K2 Survey of Ruprecht 147	Ruprecht 147 is the oldest nearby star cluster (3 Gyr, 300 pc) and sat just beyond the edge of the proposed field for K2 Campaign 7. I called for a pointing adjustment to accommodate the cluster, and in response to my advocacy the field was shifted to encompass the majority of R147 without disturbing the spacecraft pointing accuracy. “The K2 Survey of Ruprecht 147” (GO 7035) includes a transit search, an asteroseismology program, and an effort to extend middle-age gyrochronology to lower-mass stars. Within one hour of the data release, I identified a Jupiter-sized object transiting an overactive solar twin using an iPhone 6 while at Disneyland. Our team determined that this object is a 35 Jupiter-mass brown dwarf in an eccentric 5.3-day orbit, which we suggest is causing the star to spin up, thereby enhancing its magnetic dynamo as the orbit circularizes. We announced our discovery at Cool Stars 19, and completed follow-up observations with Spitzer, which we are presently analyzing. We also identified 6 eclipsing binary members, including one at the main sequence turnoff. We measured precise masses in two systems so far, and we will continue monitoring the remaining EBs. Our asteroseismology program is one of a kind. Red giants have been targeted in many clusters with Kepler/K2, and R147 is no different with 9 such objects. Our program, led by Victor Silva Aguirre, is unique because we also study 35 dwarfs near the main sequence turnoff including 6 blue stragglers. Considering our asteroseismic sample and EBs together, our survey will enable stringent tests of stellar models and characterization techniques. Finally, we have measured rotation periods for FGK stars in R147, which extends the middle-age gyrochronology relation from ~0.8 Msun (NGC 6819, Meibom+2015; M67, Barnes+2016) down to 0.6 Msun. At this time, we report significant tension between empirical (Barnes+2016) and semi-physical (Matt+2015) spin-down models and measured K dwarf rotation at 3 Gyr.

Contributed Talk Abstracts

Name	Institution	Title	Abstract
Davenport, James	Western Washington University	Stellar flare rate evolution revealed by Kepler	I will present results from a search for stellar flares from every available Kepler light curve, using an iterative de-trending approach. A total of 4041 stars (1.9% of the Kepler sample) were found to have significant flare activity, with an average event energy of 10^35 erg. A decrease in flare rate with stellar rotation period is detected for the first time in field stars, and a tentative detection of flare activity saturation is made for rapidly rotating stars. Flares therefore are a useful age-dependent gauge of stellar magnetic activity. I will also present ongoing work in detecting stellar activity cycles via flares, and in studying breaks in the powerlaw energy distribution for "superflares".
de Val-Borro, Miguel	NASA GSFC	K2 photometry of comet 67P/ Churyumov-Gerasimenko	We present photometric observations of comet 67P/Churyumov-Gerasimenko, the target of ESA's Rosetta mission, obtained with K2 as it passed the Campaign 10 field. The K2 observations were conducted between 2016 Sep 7-19 shortly before the end of the Rosetta mission on Sep 30, when the spacecraft crash landed on the nucleus, as part of a world-wide campaign of observations of the comet in support of Rosetta. Due to the faintness of the comet, the comet was monitored with a mask 7-pixels wide that was centered on the nucleus position using the ephemeris retrieved from JPL/Horizons. The field of Campaign 10 included several bright targets in the apparent path of the comet. Therefore we performed a differential imaging technique subtracting each frame from a co-added master image to correct for background variations. The K2 photometry provides a measurement of the activity of the comet on large scale distances of ~20000 km from the nucleus, to which Rosetta is not sensitive, and extends the available remote observations of 67P to a time when Earth-based observations where no longer possible.
Dotson, Jessie	NASA Ames Research Center	K2 Project Status & Future Opportunities	K2 became fully operational in June 2014 after demonstrating that the Kepler spacecraft could be successfully operated with two reaction wheels. The mission has funding to continue operations until the spacecraft can no longer operate. While the exact timing of end of mission is unclear, we are planning for another 9 - 18 months of operations. We will present current mission status, plans for upcoming campaigns, and future proposal opportunities. In addition, upcoming changes to the Guest Observer proposal solicitation in response to the uncertainty in the date of end of mission will be presented.
Dressing, Courtney	California Institute of Technology	Characterizing K2 Planetary Systems Orbiting Cool Dwarfs	Due to the relatively short durations of K2 campaigns and the increased detectability of small planets orbiting small stars, roughly 40% of K2 targets are cool dwarfs. Accordingly, K2 has already observed significantly more low-mass stars than the original Kepler mission and continues to produce a fabulous data set for studying the properties and frequency of planetary systems orbiting small stars. One of the first steps in this analysis is to improve the characterization of putative K2 cool dwarfs and ensure that the sample is not contaminated by giants or hotter main sequence stars. We will present results from our ongoing multi-year project to refine the properties of K2 planetary systems orbiting cool dwarfs by acquiring medium-resolution NIR spectra with SpeX on the IRTF and TripleSpec on the Palomar 200". In our initial sample of 144 candidate low-mass host stars, we noted a high contamination rate from giants (16%) and reddened hotter dwarfs (34%). After employing empirically-based relations to determine the stellar temperatures, radii, masses, luminosities, and metallicities, we found that our new cool dwarf radius estimates were 10-40% larger than the previous estimates, indicating that the radii of the associated planet candidates were also underestimated. Combining our new stellar parameters with updated transit fits and using the VESPA tool to estimate false positive probabilities, we found that our sample contains 60 planets smaller than Neptune, including thirteen planets that are attractive targets for atmospheric characterization with Spitzer, HST, JWST, and the next generation of extremely large ground- and space-based telescopes. We will highlight the most exciting systems in our sample and discuss the prospects for future in-depth studies of K2 planets orbiting cool dwarfs.
Esselstein, Rebecca	University of Oxford	Determining the Rotation Periods of M67 and Their Implications on Stellar Evolution from K2 Data	In the summer of 2015, the Kepler spacecraft observed the well-known, roughly solar-age open cluster M67 during Campaign 5 (C05) of the K2 phase of its mission. This campaign offered the first opportunity in which rotation periods could be measured with sufficient precision to fill in the critical solar-age gap within gyrochronology, or the calibration of age, rotation period, and mass useful for determining the ages of field stars, while simultaneously providing a platform to test and refine stellar evolution models for older, main sequence stars. Though others have published rotation periods and gyro-ages for M67 (Barnes et al. 2016, Gonzalez 2016 I & II), we desired a more complete picture of the M67's rotation periods, including a bigger sample size and stars closer to the center of the cluster, in order to calibrate our own gyrochronology age and test magnetic braking models (van Saders et al. 2016). Utilizing the Kepler pipeline simple aperture photometry (SAP) light curves and creating our own 'superstamp' from the C05 target pixel files, we applied two different detrending techniques (Vanderburg & Johnson 2014, Vanderburg et al. 2016, Aigrain et al. 2016) and four rotation detection methods to the data, which we tested with a series of rigorous injection tests. In this talk, I will present the subsequent findings of the injection tests, as well as our determined rotation periods for the cluster and the implications both on gyrochronology and stellar evolution.

Contributed Talk Abstracts

Name	Institution	Title	Abstract
Fabrycky, Daniel	University of Chicago	Differing Tidal Dissipation in exo-Earths, Super-Earths, and Sub-Neptunes from Resonant Chains of Planets	During planet formation, while embedded in a gas disk, planets are expected to be pushed into mean-motion resonance with each other. The transit method has recently discovered a handful of systems of multiple planets in resonant chains. Over the history of the system, tidal dissipation acting in the planets tends to push them away from exact resonance. In chains of more than two planets, so-called 3-body resonances are maintained and their libration amplitudes damped. Here we quantify the amount of tidal dissipation needed to produce the system architectures observed in Kepler-223, Kepler-80, and TRAPPIST-1 (the latter had its resonant chain decisively completed, by means of measuring planet h's period, by K2). The Kepler-223 system consists of four sub-Neptune planets that have not spread away from resonance, whereas the Kepler-80 and TRAPPIST-1 systems have planet pairs spread out from two-body resonances but three-body resonances trapped with small amplitudes. We find the tidal dissipation coefficient in the super-Earths of Kepler-80 and the terrestrials of TRAPPIST-1 to be consistent with the solid-body tides in the Solar System's terrestrial planets, whereas the dissipation coefficent in the sub-Neptunes of Kepler-223 is at least 20 times higher, accounting for its lack of damping. To our knowledge, this is the first observationally-derived information about the interior structure of individual planets in the Earth to sub-Neptune regime, beyond mass and radius measurements.
Fuller, Jim	California Institute of Technology	Resonance Locking of Tidally Excited Pulsations in the Heartbeat Star KIC8164262	Heartbeat stars are eccentric binary stars in short period orbits whose light curves are shaped by tidal distortion, reflection, and Doppler beaming. Over 150 heartbeat stars have been identified in Kepler data thus far. Some heartbeat stars exhibit tidally excited oscillations and present new opportunities for understanding the physics of tidal dissipation within stars. We present light curve and radial velocity modeling of the extreme heartbeat star KIC 8164262, which has an orbital eccentricity of ~0.9 and a high-amplitude tidally excited pulsation at precisely 229 times the orbital frequency. We demonstrate this pulsation cannot be explained as a chance resonance between an orbital harmonic and a stellar oscillation mode. Instead, the oscillation is likely excited via resonance locking, and we show that the mode's frequency and amplitude are consistent with this hypothesis. Resonance locking allows the mode to maintain a large amplitude and create efficient tidal dissipation (we calculate an effective tidal quality factor of roughly Q ~ 2x10^4), such that tidal orbital decay/circularization proceeds on a stellar evolution time scale.
Fulton, Benjamin	Institute for Astronomy, University of Hawaii & Caltech	The California-Kepler Survey. III. A Gap in the Radius Distribution of Small Planets	The size of a planet is an observable property directly connected to the physics of its formation and evolution. We used precise radius measurements from the California-Kepler Survey (CKS) to study the size distribution of 2025 Kepler planets in fine detail. We detect a deficit in that distribution at 1.5-2.0 $R_\oplus$. This gap splits the population of close-in ($P < 100$ d) small planets into two size regimes: $R_p < 1.5\ R_\oplus$ and $R_p = 2.0\text{-}3.0\ R_\oplus$, with few planets in between. Planets in these two regimes have nearly the same intrinsic frequency based on occurrence measurements that account for planet detection efficiencies. The paucity of planets between 1.5 and 2.0 $R_\oplus$ supports the emerging picture that close-in planets smaller than Neptune are composed of rocky cores measuring 1.5 $R_\oplus$ or smaller with varying amounts of low-density gas that determine their total sizes.
Grunblatt, Samuel	University of Hawaii Institute for Astronomy	Re-Inflated Planets Orbit Evolved Stars: Toward Solving a 17-Year-Old Puzzle in Exoplanet Science	Determining the mechanism that causes inflation of highly irradiated gas giant planets has eluded us since the radius of an exoplanet was first measured 17 years ago. I will present the discovery and characterization of two inflated gas giant planets found with K2, K2-97b and EPIC228754001.01, which support the theory that planet inflation is caused by direct deposition of stellar irradiation into the planet interior. These planets orbit at moderate (~10 day) orbital distances around host stars which recently evolved into red giants. By precisely constraining the mass, radius, and evolutionary history of these systems with asteroseismology and Keck/HIRES radial velocity measurements, I show that these planets likely crossed the observed irradiation threshold for planet inflation during post-main sequence evolution. This suggests that the planets recently became re-inflated, as opposed to retaining their initial heat (and size) from formation. My mass measurements of these systems and other additional re-inflated planet candidates discovered by Kepler and K2 allow me to constrain the heating efficiency of the planetary inflation mechanism for the first time. Furthermore, these results suggest that TESS will vastly improve the opportunity to test planet inflation models by observing an order of magnitude more evolved stars than K2.

Contributed Talk Abstracts

Name	Institution	Title	Abstract
Gully-Santiago, Michael	BAERI / NASA Ames	Physical properties of starspots	Ages and masses of young (<10 Myr) stars are usually not a direct observable. Historically these values have been estimated from pre-main sequence stellar evolution models that predict mass and age given an observed effective temperature and luminosity and assumptions about radiative transfer in the stellar interiors. Apparent age spreads in coeval young star-forming regions provide evidence for confounding factors absent from our understanding of young stars. We investigate the role of non-standard physics in the fundamental properties of young stars by measuring the areal coverage fraction and temperature contrast of starspots towards the weak-lined T-Tauri star LkCa 4. The approach involves forward modeling high-bandwidth, high-spectral resolution near-infrared IGRINS spectra with a composite mixture model for starspots and ambient photosphere. This approach yields estimates for areal coverage fractions of 75-85% cool stars spots possessing temperatures of about 2750 K. The remainder 15-25% of the surface with 4100 K can be thought of either as ambient photosphere or as a hot spot covering 15-25% of the surface. These values measured through spectroscopic inference are consistent with the observed spectral energy distribution, photometric modulation amplitude, and TiO variability in multi-epoch optical spectroscopy. Longitudinally symmetric starspots (e.g. polar starspots) have likely evaded detection from most methods, suggesting a systematic underestimate of starspot properties. We explore a range of geometrical starspot configurations in a sample of K2 Cycle 2 lightcurves for 1658 candidate or confirmed young stellar objects towards OPH/SCO. Young stars are probably older than previous estimates based solely on pre-main sequence HR diagrams. Starspots also constitute at least some of the age spread tension in pre-main sequence HR diagrams.
Haywood, Raphaëlle	Harvard College Observatory	Addressing stellar activity at every step in the HARPS-N RV follow-up of Kepler and K2 systems	The TESS mission will soon discover hundreds of small planets, many of which will be ideal candidates to determine their compositions and characterise their atmospheres. However, these opportunities will not be realised unless we can determine the planets' most fundamental parameter: mass, as it is required to determine the atmosphere scale height. This is often precluded by the magnetic activity of the host stars, which induces significant variations in radial-velocity observations. The HARPS-N Science Team is deeply involved in the follow-up of Kepler and K2 candidate systems hosting small planets. Our experience in teasing out their orbital signatures has taught us that we must address stellar activity at every step: first, by selecting "magnetically manageable" host stars; second, by implementing observing strategies tailored to the host stars' activity patterns; finally, by using Gaussian process regression to account for the stars' activity-driven radial-velocity variations. I will focus on two recently observed systems, Kepler-21 and KOI-280. Taking the magnetic activity of the host stars into account is the only way we are going to be able to determine precise and accurate masses for small planets.
Hedges, Christina	Institute of Astronomy, Cambridge	Hunting for Dippers with Supervised Machine Learning	A new class of YSO has been defined known as "Dippers", where a large drop in flux is seen on time scales of a day. Dippers can reduce in flux by up to 50% on these short time scales. This variability is thought to be due to the circumstellar disk; warps at the inner edge periodically block stellar light. However, these dips are often aperiodic and change drastically in terms of depth, suggesting strong variability at the inner edge of the disk. In this talk I will discuss a machine learning algorithm built on K2 data to automatically search through K2 light curves and classify these objects. This work has drastically improved the number of known objects in the Upper Scorpius region from 25 targets to 95 objects. I will also discuss a similar class known as "Bursters" which cluster in all of the parameter spaces of dipper stars used by the machine learning algorithm. This suggests these objects are linked. In this talk I will discuss the method we have built to search for these stars and future opportunities with new and upcoming K2 campaigns.
Hermes, JJ	University of North Carolina at Chapel Hill	Evidence from K2 for rapid rotation in the descendant of an intermediate-mass star	All stars rotate, and we now have growing insight into both internal and external rotation at different epochs of stellar evolution: asteroseismology enabled by the original Kepler mission has afforded the measurement of both core and surface rotation rates in numerous 1-3 solar-mass stars, probing rotational evolution all the way from the main sequence up the red giant branch. However, we still have few constraints on internal angular momentum evolution in intermediate-mass stars greater than 3 solar masses. I will present observations and analysis from our growing sample of pulsating white dwarfs observed with K2, which constrain this question from the outer boundary condition. Using patterns in the oscillation frequencies of a white dwarf discovered by K2, we have now measured the fastest rotation rate (1.13 hr) of any pulsating white dwarf known to date. Follow-up spectroscopy tells us that this 0.88 solar mass white dwarf is more massive than any other white dwarf with a rotation rate determined via asteroseismology, and represents the remnant of a roughly 4.2 solar mass progenitor. The pulsations also give us evidence that this star is unlikely the byproduct of a stellar merger. By the end of K2, we hope to have a large set of white dwarf rotation rates to use to inform our understanding of angular momentum transport for evolved stars covering a wide range of progenitors, spanning the range of roughly 1.5-4.5 solar-mass stars on the main sequence.

Contributed Talk Abstracts

Name	Institution	Title	Abstract
Hirsch, Lea	UC Berkeley	Assessing the Effect of Stellar Companions to Kepler Objects of Interest	Unknown stellar companions to Kepler planet host stars dilute the transit signal, causing the planetary radii to be underestimated. We report on the analysis of 165 stellar companions detected with high-resolution imaging to be within 2" of 159 KOI host stars. The majority of the planets and planet candidates in these systems have nominal radii smaller than 6 Earth radii. Using multi-filter photometry on each companion, we assess the likelihood that the companion is bound and estimate its stellar properties, including stellar radius and flux. We then recalculate the planet radii in these systems, determining how much each planet's size is underestimated if it is assumed to 1) orbit the primary star, 2) orbit the companion star, or 3) be equally likely to orbit either star in the system. We demonstrate the overall effect of unknown stellar companions on our understanding of Kepler planet sizes, and project these results to K2 and future missions.
Hsu, Danley	Pennsylvania State University	Characterizing Kepler Planet Occurrence Rates Using Approximate Bayesian Computation	We present a new framework to characterize the occurrence rates of planet candidates identified by Kepler based on hierarchical Bayesian modeling, Approximate Bayesian Computing (ABC) and sequential importance sampling. We adopt a simple model for the planet occurrence rate based on a 2-D grid in planet radius and orbital period to facilitate interpretation and comparison with previous studies. Our methodology improves on previous occurrence rate studies by accurately accounting for the interaction of measurement uncertainties with detection efficiency and avoiding non-detection "correction" biases that are introduced when using the more common inverse detection efficiency method. We validate our algorithm by computing the true and estimated occurrence rates using simulated data sets, which allows us to characterize the algorithm efficiency and accuracy as a function of the number of target stars and the number of detected planets. Upon application to planet candidates orbiting FGK target stars in the Q1-Q16 KOI catalog, we confirm that occurrence rates estimated by ABC closely match those of the inverse detection efficiency method for large planets and short orbital period. However, we also demonstrate that using ABC to rigorously account for both detection efficiency and measurement uncertainties results in significantly increased planet occurrence rates for small planets at larger orbital periods compared to the inverse detection efficiency method. We apply our methodology to planet candidates from the DR25 KOI catalog, and quantify the sensitivity of the results to the assumed detection efficiency model. Our improved methodology significantly affects the measured shape of the planet size distribution, as well as the occurrence rate of small planets in the habitable zone of solar-type stars.
Jontof-Hutter, Daniel	University of the Pacific	Outer Architecture of Kepler-11: Constraints from Coplanarity	Kepler discovered over 90 multi-transiting systems of four or more planets in compact formation. Just a handful of these systems have radial velocity (RV) observations over a baseline of several years, and only a select few of these have constraints on their outer architectures; whether or not they have Jovian planets orbiting further out. Dynamical constraints on the presence or absence of outer perturbers at Kepler-11 can be derived from two lines of inquiry. Firstly, the lack of a detection of transit timing variations (TTVs) in the outer-most transiting planet, Kepler-11 g, makes a Jovian mass perturber very unlikely to be orbiting within 2 AU of the star. Secondly, the remarkably compact configuration of Kepler-11 ensures that the inner five planets are strongly secularly coupled, keeping their mutual inclinations very small and making their cotransiting geometry likely for any observer for which any of them are transiting. However, the large dynamical gap between Kepler-11 f and Kepler-11 g makes the cotransiting geometry of all six sensitive to the effects of a moderately inclined perturber. We determine at which distances, inclinations and mass a planet beyond Kepler-11 g can be ruled unlikely by these dynamical models and compare our results to the known constraints from RV.
Kiefer, Flavien	IAP	KIC8462852: boosting up the exocomet fragments model	KIC 8462852, the famous Boyajian’s star, is receiving a lot of attention from astronomers, because of its yet unexplained days long and un-periodic dips. We will report the first successful modelization of some of those dips by transiting exocomets fragments. Most importantly, we are able to predict the next transit epoch of comets. Future observations might then confirm our present model. If indeed confirmed, the comet scenario will robustly become the ruling explanation for the strange behavior of KIC8462852’s flux. After Beta Pictoris, HD172555, and 49 Ceti, the Boyajian’s star would be the fourth example of a stellar system harboring exocomets.

Contributed Talk Abstracts

Name	Institution	Title	Abstract
Kraus, Adam	UT-Austin	The Ruinous Impact of Close Binary Companions on Planetary Systems	The majority of solar-type stars are found in binary systems, and the dynamical influence of binary companions is expected to profoundly influence planetary systems. However, the difficulty of identifying planets in binary systems has left the magnitude of this effect uncertain; despite numerous theoretical hurdles to their formation and survival, at least some binary systems clearly host planets. We present high-resolution imaging of nearly 500 Kepler Objects of Interest (KOIs) obtained using adaptive-optics imaging and nonredundant aperture-mask interferometry on the Keck II telescope. We super-resolve some binary systems to projected separations of under 5 AU, showing that planets might form in these dynamically active environments. However, the full distribution of projected separations for our planet-host sample more broadly reveals a deep paucity of binary companions at solar-system scales, matching similar results for protoplanetary disk survival in star-forming regions. I will summarize the next results from this program, most notably multi-epoch imaging that allows us to proper-motion clean the sample (probing lower mass ratios and wider orbits) and measure orbital arcs or full orbits for our sample (quantifying the influence of binary properties like eccentricity on planet survival, the degree of alignment between the planetary and binary orbits, and how many of the remaining "close" binaries are wide binaries that are only seen close in projection).
Li, Gongjie	Harvard	Uncovering Circumbinary Planetary Architectural Properties from Selection Biases	Studying newly discovered circumbinary planetary systems improves our understanding of planetary system formation. Learning the architectural properties of these systems is essential for constraining the different formation mechanisms. We first revisit the stability limit of circumbinary planets. Next, we focus on eclipsing stellar binaries and obtain an analytical expression for the transit probability in a realistic setting, where a finite observation period and planetary orbital precession are included. Our understanding of the architectural properties of the currently observed transiting systems is then refined, based on Bayesian analysis and a series of tested hypotheses. We find that (1) it is not a selection bias that the innermost planets reside near the stability limit for eight of the nine observed systems, and this pile-up is consistent with a log uniform distribution of the planetary semimajor axis; (2) it is not a selection bias that the planetary and stellar orbits are nearly coplanar ($\lesssim 3°$), and this—along with previous studies—may imply an occurrence rate of circumbinary planets similar to that of single star systems; (3) the dominance of observed circumbinary systems with only one transiting planet may be caused by selection effects; (4) formation mechanisms involving Lidov-Kozai oscillations, which may produce misalignment and large separation between planets and stellar binaries, are consistent with the lack of transiting circumbinary planets around short-period stellar binaries, in agreement with previous studies. As a consequence of (4), eclipse timing variations may better suit the detection of planets in such configurations.
Lopez, Eric	NASA Goddard Space Flight Center	Predictions for the Transition Between Rocky Super-Earths and Gaseous Sub-Neptunes	One of the most significant advances by NASA's Kepler Mission was the discovery of an abundant new population of highly irradiated planets with sizes between that of the Earth and Neptune, unlike anything found in the Solar System. Subsequent analysis showed that at 1.5 Earth Radii there is a transition from a population of predominantly rocky super-Earths to non-rocky sub-Neptunes, which must have substantial volatile envelopes to explain their low densities. Determining the origin of these highly irradiated rocky planets will be critical to our understanding of low-mass planet formation and the frequency of potentially habitable Earth-like planets. These short-period rocky super-Earths could simply be the stripped cores of sub-Neptunes, which have lost their envelopes due to atmospheric photo-evaporation or other processes, or they might instead be a separate population of inherently rocky planets, which never had significant envelopes. We suggest an observational path forward to distinguish between these scenarios. Using models of atmospheric photo-evaporation we show that if most bare rocky planets are the evaporated cores of sub-Neptunes then the transition radius should decrease as surveys push to longer orbital periods. On the other hand, if most rocky planets formed after their disks dissipate then these planets will have formed without initial gaseous envelopes. In this case, we use N-body simulations of planet formation to show that the transition radius should increase with orbital period. Moreover, we show that distinguishing between these two scenarios should be possible in coming years with radial velocity follow-up of planets found by K2 and TESS. Finally, we will discuss the broader implications of this work for current efforts to measure eta-Earth, which may yield significant overestimates if most rocky planets form as evaporated cores.

Contributed Talk Abstracts

Name	Institution	Title	Abstract
Luger, Rodrigo	University of Washington	K2 unveils a seven-planet resonant chain in TRAPPIST-1	TRAPPIST-1 is the first transiting planet system found orbiting an ultra-cool dwarf and hosts the closest known terrestrial-size transiting planets in the habitable zone (Gillon et al. 2017). In total, at least seven small planets orbit TRAPPIST-1. Recently, the star was observed as part of Campaign 12 of the K2 mission. Given the faintness of the star in the Kepler band (Kp ~ 16-17) and strong instrumental noise due to the spacecraft's uncontrolled pointing variations, the raw photometric precision of the light curve is nearly an order of magnitude lower than that of the Spitzer dataset used in the discovery and initial characterization of the system. In this talk, we discuss how recent updates to the EVEREST K2 pipeline (Luger et al. 2017a) allowed us to obtain a factor of 3-4 improvement in the photometric precision of TRAPPIST-1. We present the results of our photometric analysis (Luger et al. 2017b) that recovered four transits of the outermost planet, TRAPPIST1-h, which had only been seen to transit once before. We constrain its orbital period to be 18.77d, placing TRAPPIST-1h in a three-body Laplace resonance with TRAPPIST-1f and g. We further show that all adjacent triplets of planets in TRAPPIST-1 are in fact linked by Laplace resonances, making the system a prime testbed for planet formation and migration studies. Finally, we discuss how transit timing variation measurements from the short cadence K2 light curve have helped further constrain the masses of all seven planets.
Maehara, Hiroyuki	National Astronomical Observatory of Japan, NINS	Starspot activity and superflares on solar-type stars	Recent space-based observations (e.g., Kepler mission) enable us to investigate the nature of “superflares” on solar-type stars (G-type main sequence stars). The bolometric energy released by superflares on solar-type stars ranges from 10^33 erg to 10^36 erg which is 10-10^4 times larger than that released by a typical X10-class solar flare. Most of the stars with superflares show large-amplitude photometric variations associated with the stellar rotation which suggest that the stars with superflares have large starspots. We analyze the correlation between starspots and superflares on solar-type stars using the data from the Kepler mission. Our analysis shows that the fraction of the stars showing superflares decreases as the rotation period increases and as the amplitude of photometric variations, which is thought to correlate with the area of starspots, decreases. Assuming simple relations between spot area and life time and between spot temperature and photospheric temperature, we compared the size distribution of large starspots with the area of >10^4 MSH (micro solar hemispheres; 1 MSH=3x10^16 cm^2) on slowly-rotating solar-type stars with that of sunspot groups. The size distribution of starspots on the solar-type stars shows the power-law distribution. We found that both the size distribution of starspots on solar-type stars and that of larger sunspots are roughly on the same power-law line. The size distribution of starspots from the Kepler data suggests that the average appearance frequency of the starspots with the area of >3x10^4 MSH on the solar-type stars with the rotation period similar to that of the Sun is once in a few hundred years. We also found that the frequency-energy distributions for flares originating from spots with different sizes are the same for solar-type stars with superflares and the Sun. These results suggest that the magnetic activity on solar-type stars with superflares and that on the Sun is caused by the same physical processes.
Makarov, Valeri (presented by Alexey Goldin)	USNO	Astrometry with Kepler: prospects and lessons learned	The photon statistics, the mode of operation, and the sensitivity of the Kepler instrument bears the enticing possibility of sub-microarcsecond differential astrometry. This potential has not been realized. Previous attempts to derive precise proper motions and parallaxes stumbled on a puzzling pattern of centroid motion at a level of 0.1 arcsecond. Using numerical simulations and the Variability-Induced Motion method on the entire collection of main mission data, we reveal the origins of these seemingly stochastic perturbations: 1) inadequate photometric flat-fielding at the pixel level; 2) blooming and saturation for brighter stars. The prospects of ultra-precise differential astrometry with Kepler are reviewed. We also discuss what needs to be done for the future NASA missions to avoid this limitation.
Malavolta, Luca	Dipartimento di Fisica e Astronomia, Università degli Studi di Padova	Kepler-9 and Kepler-19: two pivotal systems that reconcile RV and TTV mass determinations	The disagreement on the density of planets from Transit Time Variations (TTVs) and Radial Velocities (RVs) is a long-standing problem. To assert the reliability of mass measurements obtained with the two techniques, we gathered high-precision RVs of two pivotal exoplanetary system showing TTVs, using the high-resolution HARPS-N spectrograph on the Telescopio Nazionale Galileo in La Palma (Spain). Kepler-9 is the first system confirmed using TTVs. The density of the two Jupiter-size planets obtained in the discovery paper were nearly halved by a later analysis, moving them in the region of extremely low density planets. We confirm the lower density of the planets by combining 31 new RVs with TTV from all the Kepler quarters. Kepler-19b is a transiting planet showing TTVs due to one or more non-transiting planets. We perform a combined fit of 91 RVs with TTVs from all the Kepler quarters to characterize, at a 5-sigma level, its mass and those of two outer Neptune-mass planets detected in the RVs. The density of Kepler-19b is consistent with the density of other super-Earths and mini-Neptunes characterized by RVs only. We conclude by comparing our results with the latest mass determinations of Kepler and K2 targets obtained with both RV and TTV techniques.

Contributed Talk Abstracts

Name	Institution	Title	Abstract
Matson, Rachel	NASA Ames	Stellar companions of K2 Exoplanet Candidate Host Stars	The binarity of an exoplanet host star can have significant implications for our detection and knowledge of the planet. The presence of a stellar companion can trigger a false positive or mask the true size of a planet, and may affect the formation of planets in general. Determining the fraction of planet host stars observed with K2 that are also binaries will allow us to better determine planetary characteristics and establish a relationship between stellar binarity and the existence of exoplanets. Using high angular resolution speckle imaging observations from WIYN, Gemini North, and Gemini South we detect stellar companions within ~1 arcsec for a sample of K2 planet candidate host stars. We then compare the observed rate of companions to TRILEGAL star count simulations and known detection limits for speckle imaging to estimate the binary fraction of K2 planet host stars and compare it to results from the original Kepler field.
Mazeh, Tsevi	Tel Aviv University	The Planetary Mass-Radius Relation and its Dependence on Orbital Period as Measured by Transit Timing Variations and Radial Velocities	The two most common techniques for measuring planetary masses —the radial velocity and the transit timing variations methods, have been observed to yield systematically different masses for planets of similar radii. We consider in details the results of the two methods and show that when we take into account the different biases the two techniques produce the same mass-radius relation for the population of planets with radius and mass determined. However, to our great surprise we find a statistically significant difference between the short- and the long-period planets, obtained by both observing techniques for planets with radii smaller than 8 Earth radii. The mass-radius relationship parameterized as a power law has a steeper index, 1.46+/-0.06, at short periods (P<~10 d) than at long periods, 0.69+/-0.06. This reveals a profound difference, probably of composition and structure nature, between the population of the short- and the long-period small planets. We discuss how this surprising difference could have been formed.
Millholland, Sarah	Yale University	Supervised Learning Detection of Sixty Non-Transiting Hot Jupiter Candidates	The optical, full-phase photometric variations of a short-period planet pro- vide a unique view of the planet's atmospheric composition and dynamics. The number of planets with optical phase curve detections, however, is currently too small to study them as an aggregate population, prompting an extension of the search to non-transiting planets. Here we present an algorithm and perform a search for non-transiting, short-period giant planets in the Kepler prime field. The algorithm uses the phase curves themselves as evidence for the planets' existence. We employ a logistic regression model in a supervised learning context to recognize the salient time-dependent properties of synthetically generated planetary phase curves; we then search for detections of signals that match these properties. After demonstrating the algorithm's capabilities, we classify the full set of ~ 145, 000 FGK Kepler stars without confirmed planets or KOIs. On each one, we assign a probability of a phase curve of a non-transiting planet being present. We identify ~50 high-probability non-transiting hot Jupiter can- didates. We examine trends in the candidate planets' phase curves, revealing novel characteristics of hot Jupiter albedos and atmospheric inhomogeneities. These ~ 50 detections are strong candidates for follow-up radial velocity con- firmation and characterization.
Molnár, László	Konkoly Observatory (MTA CSFK), Budapest, Hungary	The K2 RR Lyrae and Cepheid Survey: hunting for pulsating stars, near and far	Space-based photometry revolutionized our understanding of the pulsations of RR Lyrae and Cepheid stars. The original Kepler mission provided us with many discoveries, including various low-amplitude additional modes or the detection of granulation in a Cepheid, but the sample size was rather limited. With K2, we aim to observe thousands of RR Lyrae stars and at least several dozen Cepheids in our survey to build up an extensive database of high-quality light curves. Here I present some of our initial results, including the first space-based photometry of modulated first-overtone and double-mode RR Lyrae stars, and the distribution of various additional modes with hypotheses on their possible origins. I also highlight our efforts to detect variables in peculiar locations such as globular clusters and Local Group galaxies. We successfully observed pulsating stars in the galaxies Leo IV and IC 1613 with Kepler. And the photometry of the globular cluster M80 suggests that a new subgroup of strongly modulated, short-period RR Lyrae stars, or maybe even a new class of variables, could be hiding in plain sight in some globular clusters.
Montet, Benjamin	University of Chicago	Observing Stellar Activity Cycles with Kepler	Kepler data are optimized for the detection of signals from transiting planets, which have short durations and sharp features. Many of the data collection, storage, and processing strategies either intentionally remove long-term changes in the brightnesses of the observed stars or induce instrumental effects which overwhelm these features. These long-term changes can be recovered in Kepler's Full Frame Images (FFIs), a set of images of the entire detector collected approximately monthly over the duration of the Kepler mission. I will present my team's work to use the FFIs to measure long-term stellar brightness variations: specifically, our observations of stellar activity cycles on a sample of Sun-like stars through detections of their flux modulations. Kepler's FFIs provide an opportunity to extend previous observations of stellar activity cycles through spectroscopy or asteroseismology to thousands of Sun-like stars. I will show how the amplitude, period, and structure of observed stellar activity cycles change as a function of stellar rotation period, as well as our efforts to recover the stellar dynamo transition between active and inactive stars.

Contributed Talk Abstracts

Name	Institution	Title	Abstract
Orosz, Jerome	San Diego State University	Kepler Triple Systems and Tidal Apsidal Structure Constants for Low Mass Stars	In a close binary system with an eccentric orbit, the line of apsides can precess if the potential of one or both stars deviate from spherical symmetry due to tides and rotation. The rate of this apsidal motion depends on the radii of the stars relative to the semimajor axis of the orbit, the eccentricity of the orbit, the mass ratio of the stars, and the apsidal-motion constant k of each star. The apsidal motion constant depends on the central condensation of the star and indicates how easy it is to deform it. For main sequence stars of the Sun's mass and larger k <~ 0.02, while for low-mass stars with deep convective envelopes k ~ 0.15. In favorable cases, the value of k for stars in well-studied binaries can be measured, and the empirical value of k, in turn, can give clues about the internal structure of the stars. To date, binaries where the k-constants have been measured contain stars more massive than the Sun. The aspsidal motion constant, and hence the internal mass distribution in low mass stars, has never before been measured. During its nominal four year mission, Kepler observed over 2000 eclipsing binaries. About 15 to 20 percent of these binaries show evidence for a tertiary companion through changes in the times of eclipse. This includes several systems where the third star eclipses one or both stars in the binary and/or is itself eclipsed by one or both of the other stars. If the tertiary component is relatively close to the binary, it can induce a relatively rapid precession of the orbit. Since the change in the eclipse times of the binary and the times of tertiary eclipse events depend very sensitively on the positions and masses of the stars, full photo-dynamical models of these triples can yield very accurate masses and radii for the stars involved. There are about a half a dozen triples that contain stars less massive than the Sun where a measurement of the k constant is feasible, including KOI-126, which was the first eclipsing triple system discovered by Kepler. In this contribution we will present the results of the photo-dynamical modeling of some of these systems.
Owen, James	Institute for Advanced Study	Evaporation Of Close-in Planets: The “Evaporation Valley”	Close-in exoplanets are thought to experience sufficient irradiation such that evaporation of the primordial atmospheres is one of the dominant evolutionary drivers. One of the key predictions of recent numerical exoplanet evaporation and thermal evolution models is the evaporation valley: a gap in the radius distribution between those planets that retain a H/He envelope with a mass fraction of ~1% and those which are completely stripped. I will present a basic physics argument as to the origin of this feature and demonstrate its robustness as well presenting a simple derivation of its properties. Finally, as such a feature has recently been claimed to have been detected in the transiting exoplanet population from Kepler I will discuss its implication for improving our understanding of the underlying photoevaporation model (e.g. energy-limited, recombination limited, etc.) and what it can tell us about planet formation.
Pál, András	Konkoly Observatory	TESS in the Solar System	The Transiting Exoplanet Survey Satellite (TESS), expected to be launched during the spring of 2018, will observe nearly the full sky providing time-series data in campaigns with a duration of ~27 days. In the primary mission of TESS, one out of the four of the cameras is going to observe field of 24x24 degrees, centered at the ecliptic latitude of 18 degree. Hence, while the ecliptic plane itself is not covered (incl. planets), the characteristics scale height of the main asteroid belt and Kuiper belt implies that a significant amount of small Solar System bodies will cross the field-of-view of this camera. In this presentation, we review the main analogues and differences between the Kepler/K2 mission and the TESS mission focusing on scientific implications related to our Solar System. Regarding to the comparison of the supposed amount information of TESS and K2, we can compute the cumulative étendue of the two optical setups. This comparison results in roughly comparable étendue, therefore one can predict roughly same amount of scientific output at the first glance. However, many principles of the data acquisition and optical setup are clearly different, including the level of confusion of background sources, full-frame integration and cadence, the field-of-view centroid with respect to the apparent position of the Sun as well as the campaign duration. As one can expect, TESS will yield time-series photometry and hence rotational properties for only brighter objects, but in terms of spatial and phase space coverage, this sample will be more homogeneous and complete. We also mention the relations between TESS and ground-based full-sky surveys with approximately the same plate scale and/or étendue - such as Fly's Eye or Evryscope.
Penny, Matthew	Ohio State University	Forward Model Photometry of K2 Crowded Field Data	K2 Campaign 9 observed the dense Galactic bulge region in order to perform a blind survey of for microlensing parallax. However, K2's undersampled PSF and pointing drifts present traditional crowded field photometry methods with difficulties. By forward modeling the Kepler data as a constant component (derived from multi-band ground-based imaging) and a series of varying point sources, we hope to derive photometry that already accounts for the dominant sources of systematics before any detrending. I will present a progress update on the development of such a forward modeling tool built around high dynamic range imaging of the K2 Campaign 9 superstamp from DECam.

Contributed Talk Abstracts

Name	Institution	Title	Abstract
Petigura, Erik	Caltech	The California Kepler Survey: High-Resolution Spectroscopy of 1305 Stars Hosting Transiting Planets	While Kepler has revealed over 4000 planets, key challenges to understanding their demographics are the often large uncertainties in host star properties. The California-Kepler Survey (CKS) is a large spectroscopic survey with the aim of bringing the properties of Kepler host stars into sharper focus. Using Keck/HIRES, we obtained high resolution (R=50,000), high SNR spectra of 1305 Kepler stars hosting over 2000 planet candidates. These spectra enable precise measurements of planet sizes, host star metallicity, and other quantities. I will give an overview of this survey and early results. The spectra are available to the community, enabling additional studies.
Pinsonneault, Marc	The Ohio State University, Dept. of Astronomy	Asteroseismology and Spectroscopy for a Large Sample of Kepler Dwarfs and Subgiants	The APOKASC team has obtained a large number of high-resolution H-band spectra of targets in the Kepler and K2 fields using the APOGEE spectrograph. Here we report on a large sample of 420 dwarfs and subgiants in the Kepler field with asteroseismic and spectroscopic data. These stars are important calibrators for exoplanet host star characterization. Previous samples were either smaller or lacked metallicity information. We compare our results using standard scaling relations to estimate masses and radii with grid modeling (using classical evolutionary tracks to constraint mass and radius as well as seismology) and studies that employ more sophisticated treatment of the asteroseismic data. We find reasonable overall agreement but we identify systematic differences between pure scaling relation estimates and grid modeling techniques, as well as significant offsets arising from random and systematic temperature errors. The path forward to more secure mass and radius measurements is reviewed, in particular in light of K2 and Kepler cluster studies and the upcoming Gaia and TESS releases.
Poleski, Radoslaw (Radek)	Ohio State University	K2 observations of microlensing superstamp in Campaign 9 and selected targets in Campaign 11	During K2 Campaign 9 most of the available pixels were devoted to a superstamp located in the part of Galactic Bulge with a very high stellar density. The position of superstamp was decided based on statistics of the previously observed microlensing events. The high stellar density gives not only many microlensing events but it also makes extraction of the accurate photometry a harder problem. The main goal of the K2 microlensing observations was to measure microlensing parallaxes for statistically significant number of microlensing events. The parallax measurements require concurrent ground-based observations of the same events and many telescopes were devoted to this task. Additional microlensing events were observed in K2 Campaign 11. I will present the current status of analysis of K2 microlensing data and discuss selected events of high importance. I will also present a catalog of more than 60,000 variable stars located in the K2 microlensing superstamp.
Ricker, George	MIT	Unlocking the Secrets of Nearby Exoplanets with the Transiting Exoplanet Survey Satellite	The Transiting Exoplanet Survey Satellite (TESS) will discover thousands of exoplanets in orbit around the brightest stars in the sky. In a two-year survey, TESS will monitor >200,000 bright stars in the solar neighborhood at a 2-minute cadence for planetary transits. This first-ever spaceborne all-sky transit survey will identify planets ranging from Earth-sized to gas giants, around a wide range of stellar types and orbital distances. TESS stars will typically be 30-100 times brighter than those surveyed by the Kepler satellite. Thus, TESS planets will be far easier to characterize with follow-up observations, enabling studies of masses, sizes, densities, orbits, and atmospheres of a large cohort of small planets, including a sample of rocky worlds in the habitable zones of their host stars. TESS will also provide full frame images (FFI) at a cadence of 30 minutes. These FFI will provide precise photometric information for every object within the 2300 deg2 instantaneous field of view of the TESS cameras. In total, more than 30 million stars and galaxies brighter than magnitude I=16 will be precisely photometered during the two-year prime mission. In principle, the lunar-resonant TESS orbit will provide opportunities for an extended mission lasting more than a decade, with data rates of ~100 Mbits/s. An extended survey by TESS of regions surrounding the North and South Ecliptic Poles will provide prime exoplanet targets for characterization with the James Webb Space Telescope (JWST), as well as other large ground-based and space-based telescopes of the future. A NASA Guest Investigator program is planned for TESS. The TESS legacy will be a catalog of the nearest and brightest main-sequence stars hosting transiting exoplanets, which should endure as the most favorable targets for detailed future investigations. TESS is currently on target for launch in March 2018 as a NASA Astrophysics Explorer mission.

Contributed Talk Abstracts

Name	Institution	Title	Abstract
Rizzuto, Aaron	UT Austin	The Exoplanet Migration Timescale from K2 Young Clusters	A significant fraction of known exoplanets orbit within 0.1 AU of their host star, with periods of <20 days. The discovery of these close-in planets has defied conventional models of planet formation and evolution based on our own solar system. It is widely accepted that these close-in planets did not form in such close proximity to their host stars, but rather that dynamical or interactive processes caused them to migrate inwards from larger orbital semimajor axes and periods. Migration models for close-in exoplanets($a < 0.1$ AU, $P < 20$ days) can be loosely divided into two categories: Disk-driven migration, and multi-body dynamical interactions. Disk migration, occurs over the lifetime of the protoplanetary disk (<5 Myr), while migration involving dynamical multi-body interactions operate on timescales of ~100's of Myr to ~1Gyr. K2 has measured planet formation timescales and migration pathways by sampling groups of stars at key pre-main-sequence ages: Over the past 10 campaigns, multiple groups of young stars have been observed by K2, ranging from the 10 Myr Upper Scorpius OB association, through the ~120 Myr Pleiades, the ~600-800 Myr Hyades and Praesepe moving groups, to the original Kepler Field. The frequency, orbital and compositional properties of the exoplanet population in these samples of different age, with careful treatment of detection completeness, will be sufficient to address the question of exoplanet migration as their host stars are settling onto the main sequence. We will present the initial results of a program to directly address the question of planet migration with a uniform injection-recovery tests on a new K2 detrending pipeline that is optimized for the particular case of young, rotationally variable stars to robustly measure the detectability of planets of differing size and orbit. Initial results point towards a migration timescale of 200-700 Myr, which is consistent with the slower planet-planet scattering or Kozai migration models.
Ryan, Erin	SETI Institute	K2's Keys to the Solar System: Lightcurves of Trojan and Hilda Asteroids	Our understanding of solar system formation is undergoing a renaissance as new planetary systems are found, often unlike our own. Many questions now ask how the giant planets & their satellite systems within our own Solar System formed and if there is clear evidence when and by how much the giant planets may have migrated to new orbital positions. Two of the keys to understanding these questions within the solar system are the Jupiter Trojan population which is co-orbital with Jupiter, and the Hilda asteroid population at ~3.95 AU. Both of these asteroid populations have orbits which are stable over the age of the Solar System, unlike many other present epoch small body populations. Planetary migration models such as the Nice Model, Jumping Jupiter & Grand Tack suggest that Trojans & Hildas may have originated from a source reservoir beyond Saturn, but clearly linking these populations to a source region and/or a notional giant planet migration is challenging due to a paucity of distinct mineralogical spectral features for these objects. With the K2 mission a new method of characterization of the Hildas and Trojans has been made available: lightcurve characterization. From lightcurve studies of asteroids physical characteristics such as shape, density, and binary fraction can be obtained and compare to results for other outer solar system small body populations. Three K2 GO programs covering Campaigns 6-13 led by Principal Investigator Ryan have obtained lightcurves for ~110 L4 Trojans and ~80 Hildas over durations of at least 10 days at a 30-min cadence. At K2SciCon we will present recently published results on L4 Trojans (Ryan et al., 2017, AJ, 153, 116) and a subsequent update including Campaign 11 data. We will present a comparison between the Trojan and Hilda populations to determine if these two populations originated from the same source region during a single migrational event, or if two distinct migrational events may have shaped our solar system.
Sandford, Emily	Columbia University	Know the Planet, Know the Star: Precise Stellar Parameters with Kepler	The Kepler space telescope has revolutionized exoplanetary science with unprecedentedly precise photometric measurements of the light curves of transiting planets. In addition to information about the planet and its orbit, encoded in each Kepler transiting planet light curve are certain properties of the host star, including the stellar density and the limb darkening profile. For planets with strong prior constraints on orbital eccentricity (including tidally circularized planets, planets with observed secondary eclipses, and planets in compact multi-planet systems), we may measure these stellar properties directly from the light curve. This method promises to aid greatly in the characterization of transiting planet host stars targeted by the upcoming NASA TESS mission and any long-period, singly-transiting planets discovered in the same systems. Using Bayesian inference, we fit a transit model, including a nonlinear limb darkening law, to a large sample of transiting planet hosts to measure their stellar properties. We present the results of our analysis, including posterior stellar density distributions for each stellar host, and show how the method yields superior precision to literature stellar properties in half of cases studied.

Contributed Talk Abstracts

Name	Institution	Title	Abstract
Schlaufman, Kevin	Johns Hopkins University	Joint Spectroscopic and Asteroseismic Analysis of Very Metal-poor Stars in the Kepler Field	Galactic archaeology is dedicated to exploring the origin of the most ancient stars in the Milky Way, their possible link to the first stars in the Universe, and their connection to the earliest stage of Milky Way formation. While it is often assumed that the most metal-poor stars are also the most ancient stars, this is not necessarily the case. Indeed, stars seeded with metals by a first-generation supernova can have [Fe/H] ~ -2.5. While progress in this effort has been held back because of the difficulty in determining ages for individual metal-poor field stars, Kepler asteroseismology provides an effective way to infer the ages of isolated field red giants. We have used the metal-poor star selection of Schlaufman & Casey (2014) to identify nine metal-poor red giants in the Kepler field with -3.0 < [Fe/H] < -2.0 and nu_max & Delta nu measured by asteroseismology. We have determined stellar parameters, detailed abundances, and ages for all nine stars from the combination of high signal-to-noise, high-resolution spectroscopy and asteroseismology. This combination of age and detailed abundance for a sample of very metal-poor field stars is unprecedented and allows for the first time the identification of the abundance signature of the most ancient stars.
Shporer, Avi	Caltech	Radial velocity monitoring of Kepler heartbeat stars	Heartbeat stars are an emerging class of eccentric binary stars with close periastron passages. The characteristic heartbeat signal evident in their light curves is produced by a combination of tidal distortion, reflection, and Doppler boosting near orbital periastron. Many heartbeat stars continue to oscillate after periastron and along the entire orbit, indicative of the tidal excitation of oscillation modes within one or both stars. These systems are among the most eccentric binaries known, and they constitute an exciting opportunity to observe tidal effects in action. We are conducting radial velocity monitoring of Kepler heartbeat stars using Keck/HIRES, initiated in Summer 2015, in order to measure the orbit and characterize the two stars. In Shporer et al. (2016) we have published the first results from that campaign including the orbits of 19 systems, doubling the number of heartbeat systems with a known orbit. We used those systems to show that the high eccentricity of the heartbeat systems allows us to characterize the upper envelope of the eccentricity-period relation, which is key to understanding orbital evolution and tidal circularization. For some of the systems we are able to test pseudo-synchronization rotation theory by comparing the expected rotation rate based on the system's eccentricity with directly measured stellar rotation through stellar activity. We are now moving to the extended phase of the project where while extending our sample using K2 data we are looking for tertiary companions to heartbeat binary stars with a measured orbit. To that end we are using long term RV monitoring, high angular resolution imaging, and spectroscopic analysis. Our overall goal is to understand the formation and evolution of heartbeat stars, and use them to study the processes of tidal dissipation and orbital migration. The physics learned from them will apply to many other astrophysical phenomena, such as high-eccentricity planet migration and eccentricity-induced mergers in triple systems.
Silva Aguirre, Victor	Stellar Astrophysics Centre, Aarhus University	Age dissection of the Milky Way disk using asteroseismology	Stellar ages allow us to unveil the formation and evolution of the Milky Way. Thanks to space-borne missions, we can use asteroseismology to measure ages for thousands of stars across the Galaxy. In this talk I present results obtained combining Kepler asteroseismic measurements with APOGEE spectroscopic and kinematic information. We identified the chemical and kinematic components of the populations in this region of the Galaxy based on an unbiased selection function, and dissect the age properties of the disk(s) to put firm constraints on its formation history and evolution. Our results can be compared to chemo-dynamical models of the Milky Way, and highlight the potential for studies that combine ground-based surveys with asteroseismology from CoRoT, Kepler, K2, and TESS.
Sinukoff, Evan	University of Hawaii, Institute for Astronomy	Small Planet Masses and Compositions from K2	We present results from the first year of the NASA Keck Key Project to measure the masses of small planets from the K2 Mission using Keck/HIRES. This project explores the compositional diversity of planets between the size of Earth and Neptune and identifies suitable targets for atmospheric study by JWST. So far, we have measured the masses and densities of more than 20 sub-Neptune-size planets, significantly expanding on the mass/radius measurements from Kepler. Our measurements help to map out the transition from rocky to gas-dominated planets with higher fidelity and probe the dependence of planet composition on planet radius, incident flux, host star properties, and system architecture, connecting bulk planet composition with planet formation and evolution.

Contributed Talk Abstracts

Name	Institution	Title	Abstract
Tayar, Jamie	Ohio State University	Core and Surface Rotation Rates of Evolved Intermediate Mass Stars	Intermediate mass stars (M ~ 2.0 - 3.0 Msun) provide important tests of the role of rotation in the structure and evolution of stars because they live in an important transitional regime. Like massive stars, they rotate rapidly on the main sequence and have convective cores. However, they evolve to become secondary red clump stars, where their structure and internal rotation can be measured with the tools of red giant asteroseismology developed for lower mass stars. Compared to prior studies, we have focused our efforts on measuring surface rotation rates and studying trends in representative samples. The slow rotation rates of these stars provides conclusive evidence for some combination of strong post-MS angular momentum loss and differential rotation with depth in convective envelopes. We compare the measured core and surface rotation rates, find that the contrast is smaller than in first ascent red giants, and examine the core-envelope coupling as a function of time. Finally, we discuss trends in both core and surface rotation with mass, metallicity, and surface gravity and their implications for internal angular momentum transport and loss models.
Tucker, Brad	Mt Stromlo Observatory, the Australian National University	The Kepler Supernova Cosmolog Experiment - C16 and C17	I will give an overview of the plans for Kepler Campaigns C16 and C17. Both of these fill be forward-facing campaigns, with a large focus on supernova observations and follow-up. I will discuss the facilities that will be monitoring these fields, the resources, and the opportunities for the larger community to benefit.
Van Eylen, Vincent	Leiden University	Planets around evolved stars: formation or evolution?	What happens to planets as their stars evolve and become giant stars, and later white dwarfs? In this talk, I discuss results of the search for planets orbiting subgiant and giant stars, as well as white dwarfs, as part of the KESPRINT collaboration. For subgiant and giant stars, observations show a lack of short-period planets. Two different explanations have been proposed: either such planets disappear as a consequence of strong tides, or planets have never formed around these stars, due to their mass which is higher than their observed main sequence counterparts. We can distinguish between these two scenarios by observing new planets orbiting evolved stars at the shortest orbital periods, which are the least likely to survive strong tidal forces. In addition, asteroseismology can help pinpoint the precise properties of these stars. Fortunately, K2 provides a major advancement on both of these issues, as it has observed thousands of subgiant and giant stars, which can be searched for planets and many of which are amenable to asteroseismology. I present results looking for short-period planets orbiting these stars using the k2phot pipeline. I highlight the discovery of K2-39b, the shortest-period planet orbiting an evolved star known to date, and detail how constraining its orbital decay distinguishes between the two aforementioned scenarios explaining the lack of short-period planets. Finally, I present results of the search for planets orbiting white dwarfs in K2 and show planet occurrence rates for these stars, which are compared with the occurrence rate of planets orbiting their main sequence counterparts.
Van Reeth, Timothy	Institute of Astronomy, KU Leuven	The interior rotation of intermediate-mass stars	Gamma Doradus stars are intermediate-mass stars with a convective core and a convective core that exhibit gravity-mode pulsations, which are sensitive to the properties of the near-core regions in the deep stellar interior. By analysing these pulsations, we can study the interior structure of these stars, and test stellar structure and evolution theory in this mass range, in particular concerning the rotational mixing and angular momentum transport mechanisms. Over the last decade, photometric observations with space missions such as Kepler have provided us with unprecedented opportunities in this field. Using the traditional approximation to treat the influence of stellar rotation on pulsations, we have developed methodology to derive the near-core rotation rate from observed gravity-mode pulsation periods and identify the pulsation mode geometry. This is an absolute requirement for detailed theoretical modeling of these stars. We successfully applied our technique to 40 targets in a sample of 50 gamma Doradus stars, allowing us to do ensemble modeling. The majority of the observed pulsations were found to be prograde dipole modes, which travel in the direction of the rotation, and the derived rotation rates cover a large range of possible values. In ten of the studied stars, our analysis resulted in the detection and identification of Rossby modes, purely inertial pulsations which travel in the direction opposite from rotation. This is the first time these modes have been found in gamma Doradus stars. This analysis forms the first step towards detailed seismic modeling of observed pulsation period spacing patterns in individual gamma Doradus stars.
Vanderburg, Andrew	Harvard-Smithsonian Center for Astrophysics	HARPS-N Observations of K2 Planet Candidates and Planet Masses in the WASP-47 System	The HARPS-N collaboration has been observing planet candidates from Kepler and K2 to learn about the masses and compositions of small planets. I will describe how we identify the best planet candidates for precise radial-velocity follow-up and will talk in detail about our observations of one of these systems, WASP-47, a star known to host a hot Jupiter, a distant Jovian companion, and, uniquely, two additional small transiting planets. When we combine new stellar parameters (from analysis of the HARPS-N spectra) with reanalyzed K2 transit photometry and our mass measurements, we can make strong constraints on the small planets' compositions. Finally, we constrain the orbital inclination of the outer Jovian planet through a dynamical analysis that requires the system to reproduce its observed parameters.

Contributed Talk Abstracts

Name	Institution	Title	Abstract
Wang, Songhu	Yale	Improved Masses for the Potentially Habitable TRAPPIST-1 Planets	The newly detected TRAPPIST-1 system, with seven roughly Earth-sized and roughly Earth-mass planets transiting a nearby ultra-cool dwarf, is one of the most important exoplanet discoveries to date. The short baseline of the available discovery observations, however, meant that the planetary masses (obtained through measurement of transit timing variations) of the planets of the system were only loosely constrained. The mass uncertainties in the discovery paper range from 30\% to 80\%, making it impossible to either interpret the potential planetary compositions, formation, and evolution or to infer possibilities for habitability. Recently obtained K2 photometry, however, increases the number of transit timing measurements for every known planet in the system. We present an analysis of this data which permits substantially improved determinations of the planetary masses. With possession of these results, the prospects for planetary habitability can now be better assessed, and the resonant dynamical relationship between the planets (which gives direct insights into their formation process) can be elucidated.
Weiss, Lauren	Université de Montréal	The California Kepler Survey V: Stellar and Planetary Properties of Kepler's Multiplanet Systems	As part of the California Kepler Survey (CKS), we present a catalog of precise stellar and planetary properties for 391 Kepler multi-planet systems containing 1008 transiting planets. Using this catalog, we conduct an unbiased comparison of the properties of systems with one versus multiple transiting planets. We also examine how stellar and planetary properties vary with planet multiplicity. We find (1) there is no difference in the masses of stars hosting one versus multiple transiting planets, (2) hot stars with low vsini have one transiting planet, not multiple transiting planets, (3) lone transiting planets have larger radii than planets in multi-planet systems, (4) planets of varying multiplicities exhibit a bimodal radius distribution around the Fulton gap at 1.8 Earth radii, as presented in Paper III in the CKS series, and (5) planets in multi-transiting systems are over-represented at 0.1 AU compared to lone transiting planets, which exhibit a broader distribution of orbital separations. In addition, we find that in systems of high multiplicity (4 or more planets), the planets tend to be similar in size and regularly spaced. Using empirical mass-radius relationships, we estimate the mutual Hill separations of planet pairs. We find that planet pairs are at least 10 mutual Hill radii apart, and that a spacing of 20 mutual Hill radii is typical.
Welsh, William	San Diego State University	Non-Transiting Circumbinary Planets: Kepler's Hidden Gift	Among the many treasures revealed by the Kepler Mission, the circumbinary planets are gems of exquisite brilliance. The rich phenomenology these systems exhibit is not only fascinating, it is astrophysically important: the Kepler transiting circumbinary planets are providing important clues to star and planet formation, and orbital evolution/migration. To date, all the published the Kepler circumbinary planets have been *transiting* planets, a vital criterion for the unambiguous discovery of this new class of planet. However, a very large population of non-transiting circumbinary planets must exist. In this talk, I will present the evidence for several such planets. Their detection is based on eclipse timing variations, a method whose precision (sigma_timing / orbital period) often exceeds one part in 100,000. Such precision allows us to measure extremely slight perturbations of the stellar orbits caused by the unseen planet, from which we can extract the orbital elements and mass of the planet. I will briefly discuss this technique, then highlight the discovery of KIC 8610483, a ~50 Mearth mass planet whose ETVs are consistent with it being on a fascinating very highly-inclined and rapidly precessing orbit.
White, Timothy	Stellar Astrophysics Centre, Aarhus University	Beyond the K2 bright limit: variability in the brightest stars in the ecliptic	The most powerful tests of stellar models come from the brightest stars in the sky, for which complementary techniques, such as astrometry, asteroseismology, spectroscopy and interferometry can be combined. The K2 Mission is providing a unique opportunity to obtain high-precision photometric time series of bright stars along the ecliptic. These stars, however, require a large number of pixels to capture the entirety of the stellar flux, and bandwidth restrictions limit the number and brightness of stars that can be observed. To overcome this, we have developed a new photometric technique to observe very bright stars from a limited number of unsaturated pixels in the wings of the PSF. We have applied this method to the brightest stars in the K2 fields, including the seven brightest stars in the Pleiades, red giants in the Hyades, and Spica, obtaining high-quality time series that reveal their variability. I will present asteroseismic results from these K2 observations that we are using, along with complementary measurements, to test stellar models, and will resolve the long-standing question as to whether the Pleaides member Maia is a so-called Maia variable.
Wittenmyer, Rob	University of Southern Queensland	Revised radius estimates for K2 planet candidates from AAT/HERMES	Accurate and precise radius estimates of transiting exoplanets are critical for understanding their compositions and formation mechanisms. To know the planet, we must know the host star in as much detail as possible. We present first results from the K2-HERMES project, which uses the HERMES multi-object spectrograph on the Anglo-Australian Telescope to obtain R~28,000 spectra of up to 400 stars in one exposure. This ongoing project aims to derive self-consistent spectroscopic parameters for about half of the stars targeted by K2. We derive complete stellar parameters, masses, and radii for all K2 candidate planet hosts, as well as revised planetary radii and mass estimates for a selection of published mass-radius relations. We discuss the emerging distributions of the K2 planet sample, and comment on the properties of planets and planet hosts as a function of location in the Galaxy.

Contributed Talk Abstracts

Name	Institution	Title	Abstract
Zhu, Wei	Ohio State University	Graduate Student	K2's campaign 9 (K2C9) is a dedicated microlensing campaign. During the 70-day observing window, simultaneous observations of nearly 200 microlensing events were achieved by K2 and from the ground. These can yield microlensing parallax measurements of more than 100 events, which are the crucial component in determining the microlens mass. In addition, there are approximately 20 events that were also observed by the Spitzer microlensing program. However, K2C9 data reduction is not trivial, because of large pixel size, the drifting pointing, and extreme dense microlensing field. In this talk, I will first present a method that can successfully extract microlensing signals out of the K2C9 data, the key of which is the derivation of a global astrometric solution. I will then present some early scientific results of K2C9, including the characterization of planetary events, binary events, and a few relatively short-timescale (~3 days) events that are likely caused by isolated brown dwarfs. Several interesting events that were observed by both K2 and Spitzer will also be discussed.
Zinn, Joel	Ohio State University	Mind the GAP: A 360 degree view of the Galaxy with the K2 Galactic Archaeology Program	The K2 Galactic Archaeology Program (K2GAP) has yielded asteroseismic parameters for thousands of red giants across the Galaxy. Combined with spectroscopic metallicities and temperatures from GALAH and APOGEE they will yield precise stellar ages that can probe the dynamical and chemical history of the Galaxy. We present the K2GAP Data Release 1 and Data Release 2 samples, and compare the results to synthetic stellar populations. The large number of stars covering the bulge, disc, and halo, the few per cent-level masses and radii, and the complementary spectroscopic abundances and metallicities, make this set of red giants more suited for galactic archaeology studies than existing open cluster or classical pulsator samples. In addition to the main sample with masses and radii from asteroseismic scaling relations, log(g)s for still thousands more K2 stars may be derived based on an extension of recent work on a surface gravity-stellar granulation scale. This new metric can yield surface gravities for stars without resolved asteroseismic oscillations. We present work on calibrating this "granulation" surface gravity scale, and place it---along with the asteroseismic and spectroscopic surface gravities---on a physical scale using open and globular clusters for log g < 1 for the first time. Red giant surface gravities using this granulation scale will extend the K2GAP main sample to reach the most luminous, distant halo stars that would otherwise be inscrutable using standard asteroseismic techniques with K2 or TESS data.

Breakout Session Abstracts

Name	Institution	Title	Abstract
Barclay, Thomas	NASA GSFC / UMBC	Speed-Networking with TESS: Discuss Science Objectives One-On-One with TESS Team Members	The Transiting Exoplanet Survey Satellite (TESS) will launch in 2018 with a primary mission goal of detecting exoplanets around nearby stars that are amenable to follow-up observations. TESS builds upon the legacy of Kepler and K2 by utilizing high-precision, long-baseline photometry from space. For TESS, a much larger field-of-view comes at the expense of lower photometric precision compared to Kepler/K2. Nevertheless, like Kepler/K2, the TESS mission will enable a wide diversity of astrophysical discoveries. The success of TESS relies on the participation of Kepler/K2 users who have established expertise that take full advantage of the large amounts of photometric data, and have been successful in yielding new discoveries and advancing their fields. The purpose of this workshop is to introduce the TESS mission and highlight opportunities to become involved. A particular focus will be given to the Full-Frame Image data, the Guest Investigator Program, and follow-up observing plans. We envisage short, introductory talks from TESS team members followed by a speed-dating style of interaction with TESS team members. The aim here will be to have short one-on-one discussions on how particular objectives can be accomplished.
Batalha, Natalie	NASA Ames Research Center	Kepler Occurrence Rate Hack	In the Spring of 2017, Kepler released its final (Data Release 25) planet candidate catalog together with the completeness and reliability products required to study exoplanet populations. Some of these products accompanied previous data releases, while others are completely new. Collectively, they represent the most comprehensive and versatile suite of measurements produced by the mission. They are also the most complex. The Kepler team will host a splinter session to familiarize the community with the data products and catalyze new science. The session will be designed as hands-on hacks in small groups with the experts responsible for generating the products.
Foreman-Mackey, Daniel	University of Washington	Gaussian Processes	In this hands-on tutorial, we will discuss the fundamental theory of Gaussian Process models and how they have been used for time series analysis of exoplanets and stellar variability. We will outline some of the limitations of these models, present software and methods used to mitigate these issues, and discuss the current state-of-the-art. Using what we learn, we will work in small groups to either implement a simple Gaussian Process code or use an existing software package, and fit your favorite dataset (Kepler light curves, for example). Participants are encouraged to bring a dataset and a lot of questions.
Luger, Rodrigo	University of Washington	EVEREST Tutorial and Hack Session	We propose to lead a hands-on tutorial of the EVEREST (EPIC Variability Extraction and Removal for Exoplanet Science Targets) software for detrending K2 light curves (Luger et al. 2016, 2017). During the first part of the breakout session, we will briefly review the mechanics of the detrending process and guide participants on how to install and use the Python code to access the EVEREST online catalog, and how to tailor the code to meet specific science goals. We will then review recent updates to the code that allow users to simultaneously detrend and search for exoplanet transits by performing a fast joint regression on the instrumental, stellar variability, and transit components of the light curve. During the second part, participants will break out into small groups and perform blind searches for transiting planets on simulated K2 datasets with EVEREST. Groups will use either the classical detrend-then-search method or the joint regression model, and we will compare recovery rates at the end. Prior experience with Python is recommended, but familiarity with the EVEREST code or transit search methods is not required.
Stapelfeldt, Karl	JPL / Caltech	NASA Exoplanet Exploration Program Update	Under the direction of the NASA Astrophysics Division, the Exoplanet Exploration Program (ExEP) implements NASA's search for habitable planets and life beyond our solar system. To achieve that ambitious goal requires delivering the science from current NASA missions; making new instrumental capabilities available to the community for follow-up and precursor observations in support of NASA exoplanet missions; developing new technologies and mission concepts for exoplanet direct imaging; and bringing the excitement of exoplanet research to the scientific community and the general public. This splinter session will review recent activities in the NASA-NSF exoplanet research collaboration, progress in the characterization of exozodiacal light, the status of ongoing studies of future exoplanet flagship missions, and recent technology milestones. It will conclude with an open discussion what more ExEP could or should be doing to advance the field toward the goal of imaging habitable planets orbiting nearby stars.

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Akeson, Rachel	NexScI	Kepler and K2 data in the NASA Exoplanet Archive	The NASA Exoplanet Archive supports research and mission planning by the exoplanet community by operating a service providing confirmed and candidate planets, numerous project and contributed data sets and integrated analysis tools. For Kepler, the Exoplanet Archive hosts the end products of the pipeline, including the TCE and DV (data validation) reports, as well as subsequent products, including the KOI activity tables, completeness and reliability products, and a list of confirmed planets from the literature. For K2, the archive includes an interactive table of the campaign target lists and the list of confirmed K2 planets. The Archive also provides the infrastructure for ExoFOP, a website designed to optimize resources and facilitate collaboration in follow-up studies of exoplanet candidates, which includes dedicated areas for both Kepler and K2 where users can directly upload notes, data or parameters.	1
Baranec, Christoph	University of Hawai`i	Robotic adaptive optics for visible and near-infrared characterization of stellar blends	Robo-AO, an automated laser adaptive optics system, observes up to 250 pointings in a single night. It images at the diffraction-limit in visible and near-infrared wavelengths (~0.1"-0.25"). The system now operates at the Kitt Peak National Observatory 2.1-m telescope where we implemented two new data reduction pipelines: one enhances the sensitivity to faint 'companions' to 5 and 7 magnitudes at 0.5" and 1.0" respectively, and another significantly improves the image quality for targets that are too faint to be used as their own tip-tilt guide star (typically V>16). Using Robo-AO, we previously imaged all of the Kepler Objects of Interest for potential blends, and now observe high-priority K2 objects on request. Recently we also started a program to determine companion amplitude dilutions to all Kepler Asteroseismic 'standard stars' as well as determine if close stellar companions suppress oscillation modes in some stars. At the conclusion of our time at Kitt Peak, we plan to move Robo-AO to NASA's 3-m IRTF as a visiting instrument that will also be publicly accessible. There, we will use Robo-AO to image all of the accessible transit host stars identified by future missions such as TESS and PLATO.	2
Bayliss, Daniel	University of Geneva	Vetting HATSouth Exoplanet Candidates with K2	K2 is most often responsible for discovering transiting planet candidates, which are later vetted using ground-based facilities. In this project the roles are reversed. We report on the results of a campaign to monitor 25 HATSouth transiting planet candidates with K2 during Campaign 7. We discovered a transiting hot Jupiter with a mass of 2.79 M_J and a radius of 1.26 R_J in a 4.175d period orbit. We also refine the properties of three previously discovered HATSouth transiting planets (HATS-9b, HATS-11b, and HATS-12b). In addition we also report on a further three systems that remain as Jupiter-radius transiting exoplanet candidates. These candidates do not have determined masses, however pass all of our other vetting observations. We also report on the 18 candidates which we are now able to classify as eclipsing binary or blended eclipsing binary systems based on a combination of the HATSouth data, the K2 data, and follow-up ground-based photometry and spectroscopy. These range in periods from 0.7days to 16.7days, and down to 1.5mmag in eclipse depths. Our results show the power of combining ground-based imaging and spectroscopy with higher precision space-based photometry, and serve as an illustration as to what will be possible when combining ground-based observations with TESS data.	3
Bayliss, Daniel	University of Geneva	EPIC 201702477b - A High Density Transiting Brown Dwarf in a 41 day Orbit	We present the discovery of EPIC 201702477b, a transiting brown dwarf in a long period (41 day) and eccentric (e = 0.23) orbit. This system was initially reported as a planetary candidate based on two transit events seen in K2 Campaign 1 photometry. We confirmed the transit and refined the ephemeris with two subsequent ground-based detections of the transit using the LCO 1 m telescope network. We rule out any transit timing variations above the level of 30s. Using high precision radial velocity measurements from HARPS and SOPHIE we identify the transiting companion as a brown dwarf with a mass, radius, and bulk density of 66.9M_J, 0.757 R_J, and 191g cm^–3 respectively. EPIC 201702477b is the smallest radius brown dwarf yet discovered, with a mass just below the H-burning limit. It has the highest density of any planet, substellar mass object, or main-sequence star discovered so far. Its density is in close agreement to theoretical predictions in this mass regime. We will discuss the evidence that the known transiting brown dwarfs form two discrete populations, which may be related to different formation mechanisms.	4
Becker, Juliette	University of Michigan	Effects of Unseen Planetary Companions on Compact Exoplanetary Systems	The Kepler spacecraft has discovered an unprecedented number of compact planetary systems with many (4 or more) planets. Upcoming missions are expected to increase the number of such systems known. The favorable geometry of these tightly packed systems enables all these planets to transit, but it is very possible that there are extra, unseen planets in these systems that exert dynamical effects but cannot be seen. In this talk, I will explain some such effects and their observational implications. I will explain how this process of perturbation by an unseen companion can help explain the Kepler Dichotomy, and a test-case of this effect, the WASP-47 system, which has three closely packed planets and one additional perturbing planet at roughly 1.4 AU.	5

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Bell, Keaton	University of Texas at Austin	A New Outburst Phenomenon in Cool Pulsating White Dwarf Stars	Extensive Kepler and K2 photometry have recorded by far the most complete record of white dwarf pulsations to date. Besides enabling the precise determination of pulsation periods for asteroseismology, they also reveal a new outburst-like phenomenon in stars near the cool edge of the ZZ Ceti instability strip. These quasi-periodic events recur on timescales of days and last for many hours. They cause a global increase of the stellar flux of up to 15%, with instantaneous flux enhancements reaching as high as 45%. The outbursts are observed to affect the pulsations in ways that can constrain theories for a physical mechanism. Since the empirically determined cool edge of the instability strip has not been successfully reproduced by theoretical calculations, this new behavior likely represents important missing physics from our theory of white dwarf pulsations.	6
Biersteker, John	Massachusetts Institute of Technology	Searching for Exoplanetary Oblateness Using Transit Depth Variations	The measurement of an exoplanet's oblateness and obliquity would provide insight into the planet's internal structure and formation history. Previous work using small differences in the shape of the transit light curve has been moderately successful, but was hampered by the small signal and extreme photometric precision required. The measurement of changes in transit depth, caused by the spin precession of an oblate planet, was proposed as an alternative method. Using photometry from the primary Kepler mission, we attempted to observe this effect for promising gas giants. I will present preliminary results from this effort.	7
Castanheira Endl, Barbara	Baylor University	Asteroseismology of white dwarfs observed by Kepler and K2	In this poster, we will present the seismological analysis of all white dwarf stars observed by Kepler and K2. We compared the observed independent pulsation models with our model grid. Our models were calculated using the evolutionary code WDEC, where polytrope functions are cooled, and excited periods are computed. We have calculated millions of models, varying effective temperature, surface gravity, hydrogen mass layer, and helium mass layer. As white dwarf stars pulsate with just a few modes, we chose not to vary the core structure and composition, keeping it to a fixed 50/50 mix of C/O. We also included the amplitudes of the observed modes as weights for the periods. We will also discuss the different results when we vary the fitting techniques and model grids, in order to estimate the external uncertainties in our fits.	8
Chang, Han Yuan	Graduate Insititute of Astronomy, National Central University, Taiwan	Hyper-flares phenomena of M dwarfs	M dwarfs are known to be magnetically active displaying impulsive energy release effects in terms of stellar flares. According to our previous study (Chang et al 2016.), flare occurrences are highly related with the stellar spin period. Fast rotators (spin period < 20 days) are often found with super-flares or even hyper-flares (> 100% stellar luminosity). To further investigate the hyper-flare phenomena, we extend our sample by selecting 4000 M dwarfs with Teff between 2500 to 3900 and Log(g) larger than 4. We discovered that 61 M dwarfs have hyper-flare events among 4000 M dwarfs. Particularly, 7 M dwarfs have hyper-flare events with > 1000% stellar luminosity. The total energy of the events can reach to 1035 ergs, which is 10000 times of the M dwarf energy at quiescent state. In this study, we will present more detail of these events.	9
Chontos, Ashley	Institute for Astronomy, University of Hawaii	Asteroseismology of Kepler Exoplanet Hosts	Transits measure properties relative to the star, hence understanding stellar properties are important to characterize planets. Asteroseismology is one of the best ways to determine these fundamental properties. Recent studies have been done on seismic Kepler exoplanet hosts, with ~100 known to date. However, in mid 2016, there was a re-release of short-cadence data after a calibration error was noticed. Here we present the first asteroseismic study of Kepler exoplanet hosts since the final release of short-cadence data in order to find additional seismic hosts. We present the discovery of one new seismic exoplanet host detected so far, which has a planetary companion of ~5 Earth radii. By using asteroseismology, we are able to reduce the uncertainty from ~50% to less than 5%. We will follow up this target and any future candidate targets on Keck/HIRES, using RV methods to obtain masses. By combining these masses with the precise radius measurements obtained through seismic analysis, we can get the most precise densities of exoplanets. Lastly, we are still analyzing known seismic hosts, to see if any were affected by the short-cadence error. In one case, we have found a target that does not appear to be oscillating using the new data. The goal is to present a final catalog of seismic Kepler exoplanet host properties that include both new seismic hosts and updated values for already known seismic hosts.	10
Clarke, Riley	Western Washington University	Age-Activity Relationships in Kepler Wide Binaries	We present an analysis of flare activity in wide binary stars using a combination of data sets from the NASA Kepler mission. The target list is from Janes (2017), and contains a set of known wide binary star systems identified by proper motions in the Kepler field. We crossmatched these systems with data on relative flare luminosity for ~200,000 stars in the Kepler field from Davenport (2016). This combined data set allows us to compare flare activity between stars in co-eval binaries. We find that in some wide binaries, both components are of the same spectral type and mass, but display significantly different levels of stellar activity. This may be due to these systems being α Centauri-like hierarchical triple systems. We also hope to learn if flare rates are a useful metric for age, like gyrochronology, in these wide binary systems.	11

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Cody, Ann Marie	NASA Ames Research Center	K2 Spies on the Lagoon	During Campaign 9 of K2, several hundred young stars in the Lagoon Nebula (M8/NGC 6530) were targeted for photometric time series monitoring. We carried out a simultaneous campaign using the Spitzer Space Telescope (min-infrared), the Vista Survey Telescope (optical), and the Very Large Telescope (spectroscopy). We present the resulting light curves and classify the K2 data by their times series morphology. The ~3 Myr old stars display behavior consistent with accretion as well as obscuration by circumstellar material.	12
Colon, Knicole	NASA Goddard Space Flight Center	Preparing for JWST: Ground-Based Near-Infrared Studies of K2 Exoplanets	In operation since 2014, NASA's K2 mission continues to discover many interesting exoplanet systems located in fields along the ecliptic. K2 is essentially acting as a pathfinder for NASA's TESS mission, which is slated to launch in 2018 and will perform an all-sky search for transiting exoplanets. The discoveries from both K2 and TESS are important for identifying key exoplanet targets that should be characterized with NASA's James Webb Space Telescope (JWST). I will present results from programs that involve characterization of K2 exoplanets and their host stars using near-infrared photometry and spectroscopy. First, I will present results from the 3.8-meter UK InfraRed Telescope (UKIRT) to collect near-infrared spectra of cool K2 exoplanet host stars from Campaigns 0 and 3. The spectra are used to better characterize the fundamental stellar parameters and therefore provide more robust measurements of the planet properties. I will also present new results from an ongoing program for near-infrared transit photometry of K2 exoplanets conducted with the 3.5-meter WIYN telescope at Kitt Peak National Observatory. This program of high-precision, high-cadence, high-spatial-resolution near-infrared transit photometry will ultimately provide a diverse sample of K2 exoplanets with improved orbital and physical properties. The WIYN program also complements an ongoing Spitzer program to observe K2 exoplanets and demonstrates WIYN's capabilities for observations of exoplanets to be discovered by TESS. Together, these programs will ultimately contribute to the identification of prime targets for detailed characterization with JWST.	13
Coughlin, Jeffrey	SETI Institute	The Kepler Robovetter	Kepler's final planet candidate catalog (DR25) employs a fully automated method of vetting potential transiting planet detections, called the Robovetter. In this poster, we visually show how the Robovetter works and demonstrate the various tests and metrics that it uses to make decisions, highlighting the various types of false positives it identifies. A new feature of the Robovetter in DR25, called the "disposition score", measures the confidence in the Robovetter's decision for each detection. We display examples of systems with various score values to demonstrate how to use the score for both calculating accurate occurrence rates and selecting individual objects of interest for follow-up observations. Finally, we will show users where they can access the DR25 catalog and various related data products, including the Robovetter source code and its input/output files.	14
Curtis, Jason	Columbia University	A Warm Brown Dwarf Transiting a Solar Twin in a Benchmark Cluster: Discovered with an iPhone 6 at Disneyland	We discuss the discovery of a warm brown dwarf transiting a solar analog in the benchmark open cluster Ruprecht 147 (R147, 3 Gyr, 300 pc). Using K2 precision photometry viewed on an iPhone 6, we detected an object transiting the solar twin every 5.29 days. With TRES radial velocities, we derive a mass of 35 times Jupiter's and an orbital eccentricity, e = 0.19. The solar twin is chromospherically overactive for its age, and given its 12.7 day rotation period, we suggest that the brown dwarf orbit is in the process of circularizing, which is spinning up the star and enhancing its magnetic dynamo.	15
Dai, Fei	MIT	Stellar Obliquity from Spot-crossings and Transit Mapping	The obliquity of a planet-hosting star may bear crucial information regarding the formation and migration history of planets. One method to measure obliquity is by interpreting spot-crossing events, when a transiting planet occults dark spots on the photosphere. The obliquity can sometimes be deduced from the resulting pattern of anomalies in a sequence of transit light curves. I will present recent applications of this method using short-cadence K2 observations of Qatar-2 and WASP-107. I will also present a new method of analysis, "Transit Mapping", which is more objective and more easily automated than previous implementations of this method. Rather than identifying and modeling individual starspot-crossing events, the new method seeks evidence for a low obliquity through statistical correlations in the residuals of a sequence of light curves. Unlike previous methods, Transit Mapping gives more objective confidence levels, and can be applied in an automated fashion to thousands of planets from Kepler, K2, and TESS. I will present our initial results from Kepler and K2 data, which have led to new identifications of low-obliquity planets.	16

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Dalba, Paul	Boston University	Non-existent "phantom stars" and erroneous transit depth dilution	The camera onboard the Kepler spacecraft has an image scale of 3.98 arcseconds per pixel. Optimal photometric apertures typically contain several pixels and therefore may capture flux from sources other than the target. This added flux dilutes an exoplanet transit. Transit depth dilution is a well-known issue that can cause erroneous interpretations of transit light curves. High-resolution imaging and statistical model comparison are regularly used to identify nearby background sources and test various astrophysical false-positive scenarios. Interestingly, a supposed source of contamination that does not actually exist can be just as troubling as an unknown source of contamination that does exist. Here, I will present transit observations from the Discovery Channel Telescope that reveal the existence of a "phantom star"--one that is present in the Kepler Input Catalog and the pre-search data conditioning, but not an actual star. This phantom star is associated with Kepler-445, a metal-rich M4 dwarf star hosting a compact multiple system of exoplanets. One of these exoplanets, Kepler-445c, appears to resemble GJ 1214b, making it an appealing candidate for atmospheric characterization. However, a phantom star originating in the USNO-B catalog contaminated the aperture crowding metric of Kepler-445 and artificially increased the radius of each planet in the system. Although recent improvements to the Kepler pipeline reduced its susceptibility to phantom stars, future transit surveys such as TESS will rely on stellar catalogs that may contain spurious sources. Artifacts that are mistakenly federated into stellar input catalogs have the potential to affect statistical studies containing numerous systems, where individual follow-up of each is not possible. With even larger pixels than Kepler, TESS will be especially susceptible to uncertainty caused by stellar crowding and stellar catalog errors.	17
Davenport, James	Western Washington University	Rotating stars from Kepler observed with Gaia	Kepler stars with rotation periods measured via starspot modulations in their light curves have been matched against the astrometric data from Gaia Data Release 1. A total of 1,299 bright rotating stars were recovered, most with temperatures hotter than 5000 K. From these, 894 were selected as being near the main sequence. These main sequence stars show a bimodality in their rotation period distribution, centered at a ~600 Myr rotation-isochrone. This feature matches the bimodal period distribution found in cooler stars with Kepler, but was previously undetected for solar-type stars due to sample contamination by subgiants. A tenuous connection between the rotation period and total proper motion is found, suggesting the period bimodality is due to the age distribution of stars within ~300pc of the Sun, rather than a phase of rapid angular momentum loss.	18
Domagal-Goldman, Shawn	NASA Goddard Space Flight Center	Planet Classification, Beyond the Habitable Zone	In this presentation we will discuss planet abundances within a new classification scheme. The idea behind this scheme is to develop a single framework for classifying planets based on current observables that is predictable of future spectroscopic measurements. Because most of our measurements deal with the size of the planet (in mass and/or radius) and its orbital properties, our scheme will classify planets based on these properties. Along the "size axis" considerable work has been done to show that there are three major groups: rock-dominate planets, rock/gas "transition worlds", and gas-dominated planets. Along the "orbit" axis, the major impact is through changing the stellar energy coming into the planet. Others have shown that for many types of planets this can influence which volatiles condense in the planetary atmosphere. Building on that prior work, we suggest that as an overarching way to classify planets based on their semimajor axis (combined with host star luminosity). Although the goal of this project was to think "beyond the habitable zone" we note that these processes can also define the habitable zone itself, as the region where rock-dominated worlds are massive enough to retain a planetary atmosphere, and at the right orbit for water clouds and not carbon dioxide clouds to condense in that atmosphere. In this presentation, we will discuss the overarching scheme we propose, and apply it to the known catalog of planets, including Kepler/K2 data. This provides us with abundance information for the different planet classes, and yield predictions for future observations that would test the various hypotheses associated with this planet classification scheme. We will also try to discuss the many caveats to this scheme.	19
Faigler, Simchon	Tel-Aviv University School of physics and astronomy	The dearth of short-period Neptunian exoplanets and its sharp edge: separating hot Jupiters and short-period super-Earths	A few studies have reported a significant dearth of exoplanets with Neptune mass and radius with orbital periods below 2-4 d. This cannot be explained by observational biases because many Neptunian planets with longer orbital periods have been detected. The existence of this desert is similar to the appearance of the so-called brown-dwarf desert that suggests different formation mechanisms of planets and stellar companions with short orbital periods. Similarly, the Neptunian desert might indicate different mechanisms of formation and evolution for hot Jupiters and short-period super-Earths. We here follow a previous study and examine the location and shape of the desert in both the period-mass and period-radius planes, using the currently available large samples of planets. The desert in the period-mass plane has a relatively sharp upper edge, with a planetary mass that is inversely proportional to the planetary orbital period. We discuss the statistical significant of the desert and its sharp edge and how they could have been formed.	20

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Ford, Eric	Penn State University	The Occurrence Rate of Planetary Architectures	Published studies of exoplanet occurrence rates based on Kepler observations have focused on the rate of planets within a given range of orbital periods and planet size or mass. Due to a combination of geometric transit probability and detection efficiency, not all planets in a given planetary system will be detected. Therefore, likelihood-based methods for characterizing the occurrence rate of planetary systems would require marginalizing over implausibly high-dimensional parameter space and are not computationally feasible. Approximate Bayesian Computing provides a rigorous framework for making likelihood-free inferences about the rate and distribution of various planetary system architectures. Our research team has begun applying Hierarchical Bayesian models (HBMs) and Approximate Bayesian Computing (ABC) to address a variety of questions about the occurrence rates of planets and planetary architectures, including orbital eccentricities, inclinations, multiplicity and the exoplanet mass-radius relationship. We show this method yields excellent agreement for easily detected planets, but find a significant increase in the occurrence rate for small planets at long orbital periods. This approach allows us to measure conditional probabilities, such as the probability of given transiting planet having additional planets (either transiting or non-transiting) within a given range of periods. These can help inform the design of follow-up observing campaigns for planets discovered by K2, TESS or Plato.	21
Fukui, Akihiko	Okayama Astrophysical Observatory, NAOJ	Multiband Photometry of K2 Transiting Planets with MuSCAT and MuSCAT2	Simultaneous multiband photometry is a useful tool to validate planetary candidates, improve transit parameters, and roughly investigate atmospheres of known transiting planets. In this contribution we will introduce the optical multiband imager MuSCAT, which we have recently developed for the 1.88m telescope at Okayama Astrophysical Observatory in Japan. We will show recent scientific results on photometric followup observations of some K2 planets and planetary candidates (detected by the KESPRINT collaboration) that we have obtained with MuSCAT. In addition, we will present the prospects for MuSCAT2, which is a copy of MuSCAT for the 1.5m TCS telescope at Teide Observatory in the Canary Islands, Spain, slated for completion in this summer.	22
Giampapa, Mark	National Solar Observatory	Rotation and Activity in the Suns of M67	Our primary observational objective in this program is to obtain estimates of rotation periods for the sunlike stars in M67, using K2 data from Campaign 5, along with contemporaneous measurements of chromospheric activity utilizing the 3.5-m WIYN telescope with the Hydra instrument under the auspices of the NN-EXPLORE program. The results from this program provide important constraints for (1) the relationship between activity and rotation near solar age and (2) angular momentum evolution in sun-like stars. In addition, the combined K2 and NN-EXPLORE data-set for M67 is a critical first step towards the characterization of the conditions of the habitable zones in sun-like stars in a solar-age cluster in which RV planets have been discovered. The measurement of periodic variability at low amplitudes in faint stars is a challenging task, even with K2 photometry. We apply a novel treatment of the time series to remove systematics followed by the computation of the Lomb-Scargle periodogram and the construction of wavelet contour maps to measure rotation periods. Focusing on a subset of our data consisting of solar counterparts that are single members of M67, we find a mean rotation period and standard deviation of 19.4 ± 3.1 days for the sample with most objects in the broad range of ~ 15 – 25 days. Solar-like periods of ≥ 26 days are not detected. In the case of binary systems with a solar-type primary, we deduce a more rapid mean rotation and larger spread of 14.3 ± 6.5 days. Differential rotation is identified in an active, rapidly rotating solar-type member that is an SB1 binary with a prior v sini measurement (Reiners & Giampapa 2009; ApJ, 707, 852). Among the single stars in our subset, the rotation–activity diagram exhibits considerable scatter. We discuss our results in the context of implications for the rotational evolution of sunlike stars, rotation-age relationships (gyrochronology), and rotation-activity correlations at solar-like rotation periods.	23

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Goldin, Alexey	Teza Technologies	Using astrometry and Independent Component Analysis to separate flux from unresolved targets in Kepler data	Numerous Kepler targets are variable and have unresolved companions. Disentangling photometric signals coming from blended sources may be challenging, especially when the neighbors are close to target stars, such as the case with unknown binary systems. The motion of the moment-based centroid correlated with the observed light curve (VIM) is very useful to reveal the presence of blended sources and, in some cases, to determine where it is located. However, the structure of VIM becomes complicated and the problem poorly constrained if more than one source is significantly variable and the components can not be separated physically in the digital aperture by PCA or other orthogonal linear methods. Applying ICA (Independent Component Analysis) to LC light curves in conjunction with astrometric time series (available in the Kepler archive) allows us to separate signals from different unresolved sources -- the task, impossible without using the astrometric data. This new method is demonstrated on the testbed triple system GJ 1245 AC and B, where powerful flares come from both A and B components, but we also detect a possible signal from the unresolved C component. Furthermore, this method is being applied to poorly studied nearby M dwarfs with monster flares and extreme MIR excesses.	24
Gonzales, Erica	University of Notre Dame	Candidate Companions to K2 Stars From High-Resolution Follow-up Observations and the Effect on Planet Radii Due to Transit Dilution	We present the results of high-resolution adaptive optics (AO) imaging of Kepler-2 (K2) targets in Campaigns 5-8 (C5-8). We observed 190 of the 197 targets in these campaigns in either the optical, near-IR or both. Of the 190 observed targets, we find 107 candidate companions to 38 stars. We present their projected separation and difference in magnitude for the candidate companions. We also derive the correction factor for the planet radii around these targets. With this information we can add to the catalog of planet hosting stars with possible dilution due to close companions. The effect of adjusted planet radii is crucial to planning the search of small planet transits with the imminent TESS mission.	25
Grziwa, Sascha	RIU-PF at the University of Cologne	The KESPRINT collaboration	The KESPRINT collaboration S. Grziwa and the KESPRINT team The concept of a community-driven mission as practiced in K2 and the direct access to the scientific data gives the scientific community the chance to participate in the successor of the Kepler mission. The huge amount of data and the different expertise required calls for the establishment of collaborations for successful analysis, effective work and to avoid wasting technical resources (e.g. telescope time). Scientists with experience from previous missions (CoRoT, Kepler and ground based observation) founded two independent collaborations (KEST (1) and ESPRINT (2)) which joined in 2016 and merged to KESPRINT. The KESPRINT collaboration unites scientists of 20 universities and scientific organizations from 8 countries (Denmark, Germany, Italy, Japan, Netherlands, USA, Spain and Sweden). It includes specialist with vast experience covering all aspects for the characterization of exoplanets: light curve processing, transit detection, transit characterization, Doppler measurements, and spectral analysis. KESPRINT focuses on precise determinations of radii, masses and bulk densities of exoplanets - the key parameters to investigate their composition and internal structure. The KESPRINT collaboration has published so far 13 papers on 18 confirmed K2 planets with precise mass and radius determinations. (1) K2 Exopl. Sci Team (2) Equipo de Seguimiento de Planetas Rocosos INterpretando sus Tránsitos	26
Grziwa, Sascha	RIU-PF at the University of Cologne	Wavelet based filter methods for the advanced detection of transiting planets in K2 light curves.	Wavelet based filter methods for the advanced detection of transiting planets in K2 light curves. S. Grziwa, J. Korth, M. Pätzold The Rheinisches Institut für Umweltforschung (RIU-PF) has developed the software EXOTRANS to detect transits of exoplanets in stellar light curves. The first versions of the software were used for the detection of exoplanets during the CoRoT space mission (2006-2013). EXOTRANS was improved with different wavelet based filter methods (VARLET and PHALET) during the following years to separate stellar variation, orbital disturbances and instrumental effects from light curves of actual and future space missions (Kepler, K2, Cheops, TESS and PLATO). The VARLET filter separates faint transit signals from stellar variations without using a-priori information about the target star. VARLET considers variations by frequency, amplitude and shape simultaneously. VARLET is also able to extract most instrumental jumps and glitches. The PHALET filter separates periodic features independent of their shape. PHALET is implemented in our “Advanced-BLS” detection algorithm to remove detected transits from light curves to search for additional transiting planets. The combination of both filter techniques together with our “Advanced-BLS” algorithm lowers the detection limit, reduces false alarms and simplifies the detection of faint transits in variable stellar light curves. Many new candidates were detected in K2 light curves by EXOTRANS which were successfully confirmed by ground-based follow-up observations of the KESTPRINT collaboration (formally KEST(1) & ESPRINT(2)). The KESPRINT collaboration published 13 papers on 18 confirmed K2 planets with determined radius and mass since 2016. (1) K2 Exoplanet Science Team (2) Equipo de Seguimiento de Planetas Rocosos INterpretando sus Tránsitos	27

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Guo, Xueying	MIT	Ensemble Atmopheric Properties of Small Planets around M Dwarfs	With the growing number of planets discovered by the Kepler mission and ground-base surveys, people start to try to understand the atmospheric features of those uncovered new worlds. While it has been found that hot Jupiters exhibit diverse atmosphere composition with both clear and cloudy/hazy atmosphere possible, similar studies on ensembles of smaller planets (Earth analogs) have been held up due to the faintness of most of their host stars. In this work, a sample of 20 Earth analogs of similar periods around M dwarfs with existing Kepler transit information and Spitzer observations is composed, complemented with previously studies GJ1214b and GJ1132b, as well as the recently announced 7 small planets in the TRAPPIST-1 system. We evaluate their transit depths with uncertainties on the Spitzer 4.5 micron band using the “pixel-level decorrelation” method, and together with their well analyzed Kepler data and Hubble data, we put constraints on their atmosphere haze slopes and cloud levels. Aside from improving the understanding of ensemble properties of small planets, this study will also provide clues of potential targets for detailed atmospheric studies using the upcoming James Webb Telescope.	28
Haas, Michael	NASA-Ames Research Center	Kepler's Product Menagerie	A vast menagerie of products has been developed since the Kepler satellite was launched in March, 2009. These products provide a multitude of entry points for scientists who wish to participate in the scientific discovery enabled by this paradigm-changing mission. This poster introduces the Kepler products and highlights their interrelationships and evolution over time, so that users can quickly identify the products of most interest and discover their optimum entry point into Kepler science. Some of Kepler’s general-purpose products were planned before launch and regularly released through out the mission. Others have arisen organically and changed with time as our scientific understanding has grown, particularly those associated with finding and characterizing exoplanets. For example, a number of synthetic data sets have been created to aid in exploring the completeness and reliability of Kepler’s final planet catalog. Similarly, the final version of Kepler’s search algorithm has been extensively scrutinized and characterized to aid in recovering the underlying planet population implied by that final catalog. As the Kepler project prepares for close-out in September, 2017, these efforts are culminating in Data Release 25 (DR25). This final release delivers a full set of reprocessed light curves, a uniformly vetted planet catalog, and a significant number of new and revised occurrence rate products. Our goal has been to create a consistent and comprehensive menagerie of products that will continue to foster scientific discovery and promote the Kepler legacy for years to come.	29
Hardegree-Ullman, Kevin	University of Toledo/IPAC	Spitzer Transit Follow-up of the HD 3167 System	HD 3167 is a 9th magnitude K0V star with two planets discovered using K2 mission data. HD 3167 b is a super-Earth with an orbital period of about 1 day, and HD 3167 c is a warm sub-Neptune orbiting every 30 days. A third planet, HD 3167 d, was recently discovered in a non-coplanar 8.5 day orbit using high-precision radial velocity measurements, presenting us with a dynamically interesting system. To date, 581 multiple planet systems have been discovered, but few of those systems are as bright as HD 3167, which makes it an ideal target for follow-up studies. Here we present new transit observations of HD 3167 b and c from the Spitzer Space Telescope. Our refined planet ephemerides will be useful in planning future JWST observations of the system, particularly for HD 3167 c, which is a strong candidate for atmospheric study using transmission spectroscopy.	30
Hardegree-Ullman, Kevin	University of Toledo	Planet Occurrence Rates Around Mid-Type M Dwarfs in the Kepler Field	Planet occurrence rates increase toward later spectral types; therefore, M dwarf systems are our most promising targets in the search for exoplanets. The identification and characterization of stars in the original Kepler field was accomplished using photometry alone, resulting in large uncertainties for late-type stars like M dwarfs. In order to more accurately compute the planet occurrence rate around mid-type M dwarfs, we need to better constrain stellar radii, which strongly correlate with temperature and metallicity. These measurements need to be performed on a statistically significant population of stars including systems with and without planets. Therefore, we have begun to characterize the properties of the 559 probable mid-type M dwarfs in the Kepler field using optical spectra from WIYN and the Discovery Channel Telescope and infrared spectra from IRTF in order to constrain the planet occurrence rate for such stars. I will be presenting results from our spectroscopic observations, including new stellar parameters and preliminary planet occurrence rates for mid-type M dwarfs.	31

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Henderson, Cassandra	UCSC	A new statistical method for characterizing the atmospheres of extrasolar planets	By detecting light from extrasolar planets, we can measure their compositions and bulk physical properties. The technologies used to make these measurements are still in their infancy, and a lack of self-consistency suggests that previous observations have underestimated their systemic errors. We demonstrate a statistical method, newly applied to exoplanet characterization, which uses a Bayesian formalism to account for underestimated errorbars. We use this method to compare photometry of a substellar companion, GJ 758b, with custom atmospheric models. Our method produces a probability distribution of atmospheric model parameters including temperature, gravity, cloud model (fsed), and chemical abundance for GJ 758b. This distribution is less sensitive to highly variant data, and appropriately reflects a greater uncertainty on parameter fits.	32
Hoffman, Kelsey	SETI	Using Molecular Dynamics to Study the Material Properties of Exoplanet Interiors	The number of exoplanets has vastly increased over the last decade, and observations are indicating a large diversity of basic properties amongst the population. The discovery that Super-Earth an sub-Neptune planets are very common yet have no Solar System analogue questions traditional core-accreation formation models. There is strong evidence of a large diversity of bulk density revealed through mass and radius measurements which allows us to begin to place constraints on the interior structure of exoplanets. In order to interpret exoplanet compositions, equations of state of various materials have been calculated or estimated, but most of these calculations assume no temperature dependence under conditions likely present in the rocky inner cores and mantles of extrasolar planets. We have begun to use molecular dynamics simulations to examine the temperature dependence of pressure-density relationships for possible compositions of exoplanet interiors. The inclusion of temperature dependence allows for estimates of important effects such as phase transitions to be included in exoplanet structure models which could have serious implications on the potential habitability of distance world. Here we present of initial results of simulations of iron at high densities, pressures and temperatures using classical molecular dynamics simulations.	33
Huber, Daniel	Institute for Astronomy, University of Hawaii	Asteroseismology and Gaia: Testing Scaling Relations Using 2200 Kepler Stars with TGAS Parallaxes	We present a comparison of parallaxes and radii from asteroseismology and Gaia DR1 (TGAS) for 2200 Kepler stars spanning from the main sequence to the red giant branch. We show that previously identified offsets between TGAS parallaxes and distances derived from asteroseismology and eclipsing binaries have been partially overestimated for stars beyond 100pc, and can be in part compensated by adopting a hotter Teff scale (such as the infrared flux method) instead of spectroscopic temperatures for dwarfs and subgiants. Residual systematic differences are at the ~2% level in parallax across three orders of magnitude. We use TGAS parallaxes to empirically demonstrate that asteroseismic radii are accurate to ~5% or better for stars between ~0.8-8Rsun. We find no significant offset for main-sequence (<~1.5Rsun) and low-luminosity RGB stars (~3--8Rsun), but seismic radii appear to be systematically underestimated by ~5% for subgiants (~1.5-3Rsun). We find no systematic errors as a function of metallicity between [Fe/H] ~ -0.8 to +0.4 dex, and show tentative evidence that corrections to the scaling relation for the large frequency separation (Dnu) improve the agreement with TGAS for RGB stars. Finally, we demonstrate that beyond ~3kpc asteroseismology will provide more precise distances than end-of-mission Gaia data, highlighting the synergy and complementary nature of Gaia and asteroseismology for studying galactic stellar populations.	34
Ikuta, Kai	Kyoto University	Estimation of starspot properties on superflare stars with a new technique on the basis of Bayesian method	Superflares are energetic explosions in the stellar atmosphere by releasing magnetic energy near starspots. We discovered many superflares on G-type main sequence stars like the Sun by analyzing Kepler photometric light curves. The energy range is the order of 10^33-38 erg, which is 10^1-6 times larger than that of the largest solar flare. The existence of large starspots on the stellar surface is suggested by the quasi-periodic brightness variation, and this is supported by spectroscopic observations of several dozens of superflare stars. Superflare stars have high magnetic activity, and the light curves are characterized by the stellar properties (inclination angle, rotational period, the degree of differential rotation) and the spot properties (temperature, location, time development of the size). We estimated these values with application of adaptive Replica Extended Monte Carlo (aREMC) method to the observed light curves. This method is an extended version of Markov Chain Monte Carlo (MCMC) method, and enables us to estimate the prior probability distributions of multi-dimensional parameters more efficiently without problems of the MCMC method such as being trapped in a local mode and spending the calculation for a long time. In this presentation, we show the first results on several superflare stars.	35

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Isaak, Kate	ESA/ESTEC	CHEOPS: CHaracterising ExOPlanet Satellite	CHEOPS (CHaracterising ExOPlanet Satellite) is the first exoplanet mission dedicated to the search for transits of exoplanets by means of ultrahigh precision photometry of bright stars already known to host planets, with launch readiness foreseen by the end of 2018. It is also the first S-class mission in ESA's Cosmic Vision 2015-2025. The mission is a partnership between Switzerland and ESA's science programme, with important contributions from 10 other member states. It will provide the unique capability of determining accurate radii for a subset of those planets in the super- Earth to Neptune mass range, for which the mass has already been estimated from ground- based spectroscopic surveys. It will also provide precision radii for new planets discovered by the next generation of ground-based transit surveys (Neptune-size and smaller). By unveiling transiting exoplanets with high potential for in-depth characterization, CHEOPS will also provide prime targets for future instruments suited to the spectroscopic characterisation of exoplanetary atmospheres. The high photometric precision of CHEOPS will be achieved using a photometer covering the 0.35 - 1.1um waveband, designed around a single frame-transfer CCD which is mounted in the focal plane of a 30 cm equivalent aperture diameter, f/5 on-axis Ritchey-Chretien telescope. 20% of the observing time in the 3.5 year nominal mission will be available to Guest Observers from the Community. Proposals will be requested through open calls from ESA that are foreseen to be every year, with the first 6 months before launch. In this poster I will give overview of the CHEOPS mission, its capabilities and its current status.	36
Jenkins, Jon	NASA Ames Research Center	Status of the TESS Science Processing Operations Center (SPOC)	The Transiting Exoplanet Survey Satellite (TESS) was selected by NASA's Explorer Program to conduct a search for Earth's closest cousins starting in 2018. Tess will conduct an all-sky transit survey of F, G and K dwarf stars between 4 and 12 magnitudes and M dwarf stars within 200 light years. TESS is expected to discover ~1,000 small planets less than twice the size of Earth, and to measure the masses of at least 50 of these small worlds The TESS science pipeline is being developed by the Science Processing Operations Center (SPOC) at NASA Ames Research Center based on the highly successful Kepler pipeline. Like the Kepler pipeline, the TESS pipeline will provide calibrated pixels, simple and systematic error-corrected aperture photometry, and centroid locations for all 200,000+ target stars observed over the 2-year mission, along with associated uncertainties. The pixel and light curve products are modeled on the Kepler archive products and will be archived to the Mikulski Archive for Space Telescopes (MAST). In addition to the nominal science data, the 30-minute Full Frame Images (FFIs) simultaneously collected by TESS will also be calibrated by the SPOC and archived at MAST. The TESS pipeline will search through all light curves for evidence of transits that occur when a planet crosses the disk of its host star. The Data Validation pipeline will generate a suite of diagnostic metrics for each transit-like signature discovered, and extract planetary parameters by fitting a limb-darkened transit model to each potential planetary signature. The results of the transit search will be modeled on the Kepler transit search products (tabulated numerical results, time series products, and pdf reports) all of which will be archived to MAST. This paper provides an overview of the TESS science pipeline and describes the development of the SPOC remaining before launch in March 2018, and the innovations allowing us to scale the Kepler design to meet TESS' demanding requirements.	37

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Jenkins, Jon	NASA Ames Research Center	The Kepler Data Processing Handbook: A Field Guide to Prospecting for Habitable Worlds	The Kepler telescope hurtled into orbit in March 2009, initiating NASA's first mission to discover Earth-size planets orbiting Sun-like stars. Kepler simultaneously collected data for ~165,000 target stars at a time over its four-year mission, identifying over 4700 planet candidates, over 2300 confirmed or validated planets, and over 2100 eclipsing binaries. While Kepler was designed to discover exoplanets, the long-term, ultra-high photometric precision measurements it achieved made it a premier observational facility for stellar astrophysics, especially in the field of asteroseismology, and for variable stars, such as RR Lyrae. The Kepler Science Operations Center (SOC) was developed at NASA Ames Research Center to process the data acquired by Kepler from pixel-level calibrations all the way to identifying transiting planet signatures and subjecting them to a suite of diagnostic tests to establish or break confidence in their planetary nature. Detecting small, rocky planets transiting Sun-like stars presents a variety of daunting challenges, including achieving an unprecedented photometric precision of ~20 ppm on 6.5-hour timescales, and supporting the science operations, management, processing, and repeated reprocessing of the accumulating data stream. A newly revised and expanded version of the Kepler Data Processing Handbook (KDPH) has been released to support the legacy archival products (https://archive.stsci.edu/kepler/manuals/KSCI-19081-002-KDPH.pdf). The KDPH details the theory, design and performance of the algorithms supporting each data processing step. This paper presents an overview of the KDPH and features illustrations of several key algorithms in the Kepler Science Data Processing Pipeline. Kepler was selected as the 10th mission of the Discovery Program. Funding for this mission is provided by NASA, Science Mission Directorate.	38
Johnson, Marshall	The Ohio State University	Warm Jupiters and their Spin-Orbit Misalignments from Kepler, K2, and Doppler Tomography	Warm Jupiters are a key class of planets for constraining planet formation and migration models. Multiple formation pathways have been proposed, and there may be multiple populations of warm Jupiters, but observational constraints on the details of these processes and populations, and the relationship between hot and warm Jupiters, are few and somewhat contradictory. Investigations of these planets are hampered by the small number of known transiting warm Jupiters around stars bright enough for thorough follow-up observations (V<~13-14). K2 is helping to solve this problem by observing brighter stars than the Kepler prime mission. I will highlight the discovery by the KESPRINT collaboration of the first two confirmed transiting warm Jupiters found using K2, K2-99 b and EPIC 218916923 b, whose hosts are among the brightest stars known to have such planets. An important avenue to solve the questions surrounding warm Jupiters is to measure the alignment (or lack thereof) between the planetary orbital and stellar spin angular momentum vectors. This is a key parameter for constraining the dynamical histories of these systems, and thus the origins of warm Jupiters. An ideal method to measure warm Jupiters' spin-orbit misalignments is Doppler tomography, where we spectroscopically resolve the perturbation to the stellar line profile during the transit due to the Rossiter-McLaughlin effect. Unlike radial velocity Rossiter-McLaughlin observations, Doppler tomography is feasible even if only a part of a transit is observed, as is often the case for warm Jupiters due to their long transit durations. With very high resolution spectrographs (R>100,000), such as PEPSI on LBT, Doppler tomography is feasible even for stars rotating as slowly as vsini~3 km/s. I will present initial results from this work. These measurements of the spin-orbit misalignments of transiting warm Jupiters will help to unravel the origins of these planets, as well as those of their hot Jupiter cousins.	39
Jontof-Hutter, Daniel	University of the Pacific	A targeted sample of low-mass exoplanet characterizations from transit timing.	The majority of exoplanets that have been characterized via transit timing variations (TTVs) were identified from their large near-resonant signals either as polynomial trends in early confirmations or from systematically compiled TTV catalogs. An alternative way to identify systems of interest, especially where high frequency "chopping" signals are indistinguishable from noise to the eye, is to predict the expected TTV signal-to-noise ratio from the orbital periods of planets in multi-transiting systems, a minimum possible mass given their planetary radii and the diversity of densities observed among low-mass planets, and their transit timing precision. Our sample of systems allows useful upper limits on planetary masses and a more targeted characterization of detection biases than the current ad-hoc sample. We identify population level trends in our sample, including density ratios and relative eccentricities, and we identify several interesting low-mass exoplanets that merit further investigation.	40

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Kaleida, Catherine	The Space Telescope Science Institute	The MAST Kepler and K2 Archive	The Mikulski Archive for Space Telescopes (MAST) holds Kepler and K2 official products such as light curves, target pixel files, full frame images, engineering data, and documentation. As the Kepler mission is closing out this year, MAST is transitioning to hosting the Kepler Legacy Archive and working to ensure that all of the Kepler and K2 products, tools, and documentation are readily accessible for users for many years to come. MAST also hosts community-contributed High Level Science Products from both Kepler and K2, including detrended light curves and eclipsing binary/planet candidate catalogs, and welcomes future additions. For the K2 mission, the MAST archive releases raw data from each campaign to the public with no proprietary period, usually within a few days of the campaign's end. An exciting example of this process was the release of the Campaign 12 raw data in March 2017, which included the TRAPPIST-1 observations. For this campaign and data release MAST also hosted a special webpage with links to the raw data and to community-contributed software, as well as a forum where scientists could share their findings. This forum facilitated some rapid discoveries from data release to publication, the first of which was completed roughly 1 week after the raw data were released! The MAST Data Discovery Portal is the search interface that allows users to find data across all the missions archived at MAST and the Virtual Observatory. The Portal supports table import/export, spatial cross-matching, and includes a graphical AstroViewer complete with dataset footprints. Some specific uses of the Portal relevant to Kepler and K2 are highlighted.	41
Kane, Stephen	San Francisco State University	A Catalog of Kepler Habitable Zone Exoplanet Candidates	A primary goal of the Kepler mission is to determine the occurrence rate of terrestrial-size planets within the Habitable Zone (HZ) of their host stars. The Habitable Zone Working Group (HZWG) was created to form a core group of Habitable Zone experts to properly vet and characterize the increasing number of Kepler exoplanet candidates whose orbital location and physical size make them prime candidates for habitability. A major product of the HZWG is a list of HZ exoplanet candidates from the Kepler Data Release 24 Q1-Q17 data vetting process. We used a variety of criteria regarding HZ boundaries and planetary sizes to produce complete lists of HZ candidates, including a catalog of 104 candidates within the optimistic HZ and 20 candidates with radii less than two Earth radii within the conservative HZ. We cross-match our HZ candidates with the Data Release 25 stellar properties and confirmed planet properties to provide robust stellar parameters and candidate dispositions. We also performed dynamical analysis simulations for multi-planet systems that contain candidates with radii less than two Earth radii as a step toward validation of those systems. The four different categories of candidates allow the community to adopt the criteria that are most useful for a particular follow-up program. Our analysis of the radii distributions for candidates in the HZ compared with the general candidate population shows that the two are very similar within the constraints of selection effects and systematic noise that impacts longer-period terrestrial planets. The implication is that the distribution of planets outside of the HZ is representative of the distribution of planets that exist within the HZ. This presentation will describe the highlights of the HZ catalog and the plans for further validation of HZ candidates and follow-up studies.	42
Kosiarek, Molly	UCSC	New Mass Measurements of K2-3 and GJ3470 from Radial Velocity Measurements	We report masses and densities for two planetary systems, K2-3 and GJ3470, derived from Keck HIRES radial velocity measurements. Both systems orbit bright, nearby M dwarf stars. K2-3 hosts three super-Earth planets between 1.5 - 2 Earth Radii at orbital periods between 10 and 45 days. GJ3470 hosts one 4 Earth Radii planet at an orbital period of 3.3 days. These planets are high-priority targets for atmospheric transmission spectroscopy with JWST and HST in order to characterize their atmospheric compositions.	43
Kostov, Veselin	NASA GSFC	Tatooine's Future	Inspired by the recent Kepler discoveries of circumbinary planets (CBPs) around close binary stars, we explore the fate of the former as the latter evolve off the main sequence. We combine binary star evolution models with dynamical simulations to study the orbital evolution of these planets as their hosts undergo common-envelope stages. Five of the Kepler CBP systems experience at least one Roche-lobe overflow and common-envelope stages. Their planets predominantly remain gravitationally bound at the end of the common-envelope phase, migrate to larger orbits, and may gain significant eccentricity; their orbital expansion can be more than an order of magnitude and can occur over the course of a single planetary orbit. The orbits these CBPs can reach are qualitatively consistent with those of the currently known post-common-envelope, eclipse-time variations circumbinary candidates. Additionally, unlike Mercury orbiting the Sun, a circumbinary planet with the same semi-major axis can survive the common envelope evolution of a close binary star with a total mass of 1 MSun.	44

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Kruse, Ethan	University of Washington	K2 Planet Candidates Using Everest and QATS	We present our planet search results through the first 10 campaigns of K2 data. We use the Everest light curves and search for planets using our modified QATS algorithm that can find both periodic and quasi-periodic planets modified by transit timing variations. Using this technique we have discovered hundreds of planet candidates, many of which were missed by other searches. We are sensitive to planets at all period ranges from ultra-short periods (less than one day) out to single transit events. We highlight some of the most interesting candidates, including considerably more multi-planet systems than have been published to date (e.g the first 6-planet system in K2).	45
Kuchar, Thomas	Boston College/ Institute for Scientific Research	Dying Stars in the Kepler Field: A Progress Report	We are using the Kepler Full Frame Images (FFIs) images to generate a uniform census of galactic disk long-period variables (LPVs). We are processing the monthly FFIs for the entire 116 square-degree Kepler field to identify the LPVs and extract the period, pulsation mode, and amplitude measured with the same instrument for the 4+ year mission. Our goal is to understand how these dying stars eject their envelopes and enrich the interstellar medium with new fusion products and dust. Our current effort is to extract point sources from each FFI and calibrate the stellar fluxes with well-characterized stars known to be stable – those with exoplanets. We present here the first results of using SExtractor software (Bertin & Arnouts 1996) with extractions using both the default aperture photometry settings and the modeled point response functions (PRFs) filters for the individual FFI subfields. When cross-correlating fields from different epochs, the data showed a decrease in extracted fluxes with epoch, as well as an annual cycle related to the quarterly rotation of the telescope. After removing a linear trend with epoch, we discovered that some extractions in the time series had anomalously large deviations in the trending. These deviations mostly tracked with fitted positions that dramatically strayed from the mean of the fitted positions. In this poster, we present our corrections for mitigating these problems and our progress towards calibrating our data and finding the variable stars. This work is supported by NASA ADAP grant NNX16AF45G.	46
Lee, Chien-Hsiu	Subaru Telescope, NAOJ	Properties of eclipsing binaries from all-sky surveys	Eclipsing binaries play pivotal roles in our understanding of stellar properties. In the era of all-sky surveys, thousands of eclipsing binaries have been charted, yet their light curves remain unexplored. I will show how to use light curves and broad-band photometry to extract physical parameters of the binary systems in lieu of spectroscopic information. We used the Detached Eclipsing Binary Light curve fitter (DEBiL) and the Method for Eclipsing Component Identification (MECI) to derive basic properties of the binary systems identified by the All-Sky Automated Survey, the Northern Sky Variability Survey, the Lincoln Near Earth Asteroids Research, and the Catalina Sky Surveys. We derive the mass, fractional radius, and age for thousands of binary systems; with MECI, we are able to estimate the distance to individual eclipsing binary system and use them to probe the large-scale structure of the Milky.	47
Livingston, John	University of Tokyo	Spitzer Confirmation of Planet Candidates from K2	We present Spitzer transit observations of planet candidates discovered by the K2 mission, including the validated planets K2-52b, K2-53b, K2-87b, and K2-90b. Our precision photometry at 4.5 μm and simultaneous analysis of the K2 light curves yield improved transit parameter estimates, as well as multi-wavelength constraints on possible false positive scenarios. We statistically validate previously unconfirmed planet candidates and refine estimates of orbital and physical characteristics for the entire sample. By significantly refining the ephemerides, our observations pave the way for efficient atmospheric studies with future telescopes such as JWST.	48
Livingston, John	University of Tokyo	200 Candidates and Validated Planets from Year Two of K2	We present over two hundred candidates and planets discovered by the NASA K2 mission during its second year (Campaigns 5-8). We statistically validate a large fraction of these systems based on our analysis of the K2 photometry, as well as intensive follow-up stellar spectroscopy and high resolution imaging, which also provide precise physical parameters for most systems. Of particular interest are candidates in multi-planet systems, those with bright host stars amenable to characterization, and small planets receiving Earth-like irradiation. K2 demonstrates that community-driven science is an efficient discovery strategy, and that well-coordinated follow-up will play an important role in the TESS era and beyond.	49

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Luhn, Jacob	Penn State University	RVs with K2: Jitters, A New Planet, and Transit Probabilities for Subgiants	Recently, Bastien et al. (2014) have shown that short timescale photometric variations from high-precision Kepler light curves, coined "flicker", can be linked to radial velocity (RV) noise, or "jitter", in chromospherically inactive stars. We extend the relation between flicker and jitter to stars with flicker measurements from K2 campaigns, more doubling the original sample size. The initial Kepler sample included 12 stars with surface gravities 3 < log(g) < 4.5, effective temperatures 4900 < Teff< 5900, and chromospheric activity -5.3 < log(R'HK) < -5.0. Our sample includes over 50 stars across a slightly wider range of surface gravities (2.5 < log(g) < 5), effective temperatures (4700 < Teff < 6100), and much larger range of chromospheric activity (-5.4 < log(R'HK) < -4.1). The wider range of stellar parameters will allow for predictions of stellar jitter for stars with high-precision light curves from K2 or TESS. We also present the discovery of an almost 2 Jupiter-mass planet around a roughly solar-mass subgiant. Finally, we present transit times, durations, and probabilities for a large sample (40) of subgiants with radial velocity observations that host planets as a resource for future TESS observations. We report 4 planets with transit probability greater than 10%.	50
Masuda, Kento	Princeton University	Reassessment of the Null Result of the HST Search for Planets in 47 Tucanae	We revisit the null result of the Hubble Space Telescope search for transiting planets in the globular cluster 47 Tucanae, in the light of improved knowledge of planet occurrence from the Kepler mission. Gilliland and co-workers expected to find 17 planets, assuming the 47 Tuc stars have close-in giant planets with the same characteristics and occurrence rate as those of the nearby stars that had been surveyed up until 1999. We update this result by assuming that 47 Tuc and Kepler stars have identical planet populations. The revised number of expected detections is 4.0(+1.7,−1.4). When we restrict the Kepler stars to the same range of masses as the stars that were searched in 47 Tuc, the number of expected detections is reduced to 2.2(+1.6,−1.1). Thus, the null result of the HST search is less statistically significant than it originally seemed. We cannot reject even the extreme hypothesis that 47 Tuc and Kepler stars have the same planet populations, with more than 2-3σ significance. More sensitive searches are needed to allow comparisons between the planet populations of globular clusters and field stars.	51
Mathur, Savita	Space Science Institute	Re-analysis of solar-like stars observed in short cadence by Kepler and effect of magnetism on acoustic modes	More than 2500 stars have been observed by the Kepler mission in short cadence for at least 1 month. While a subsample of these stars are either red giants, classical pulsators or eclipsing binaries, we study the detectability of the short cadence solar-like pulsations during the survey phase (Chaplin et al. 2011) using the latest data release of the mission. This will provide the most complete set of solar-like stars with acoustic-mode detection. Magnetic activity can be responsible for decreasing acoustic-mode amplitudes as it can be observed for the Sun and a few solar-like stars (e.g. Garcia et al. 2010). Chaplin et al. (2011) studied the magnetic activity of these stars and found some correlation between the standard deviation of the light curves and the non detection of modes. However using all the long cadence data available it has been possible to determine that the original sample of 2000 stars was polluted by other types of stars, such as red giants and classical pulsators. For the remaining stars expected to present solar-like oscillations, we determined the surface rotation and then computed the magnetic activity index, Sph, as described in Mathur et al. (2014) and Garcia et al. (2014). The comparison with the solar Sph shows that more than 40% of the stars without oscillations detected have a magnetic activity level higher than the Sun. This suggests that the magnetic activity of these stars is responsible for the suppression of the modes. Interestingly, an important fraction of stars with low Sph does not show pulsations. For these stars, the mode depression or suppression could be due to metallicity (Samadi et al. 2011), the presence of a possible companion or a low inclination angle preventing the detection of photospheric activity. We will discuss some of these effects.	52
Matson, Rachel	NASA Ames/GSU	Radial Velocities of Kepler Eclipsing Binaries	Eclipsing binaries are vital for directly determining stellar parameters without reliance on models or scaling relations. Spectroscopically derived parameters of detached and semi-detached binaries allow us to determine component masses that inform theories of stellar and binary evolution. Here we present moderate resolution ground-based spectra of stars in close binary systems with and without (detected) tertiary companions observed by NASA's Kepler mission and analyzed for eclipse timing variations. Radial velocities and spectroscopic orbits for these systems are used to determine individual masses for 35 double-lined spectroscopic binaries, five of which have detected tertiaries. The resulting mass ratio (M2/M1) distribution is bimodal, dominated by binaries with like-mass pairs and semi-detached classical Algol systems that have undergone mass transfer.	53

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Mayo, Andrew	Harvard College Observatory	197 Candidates and 102 New Validated Planets in C0-C10 of K2	Since 2014, the K2 mission has observed large portions of the ecliptic plane in search of transiting planets, and thus far discovered over 500 planet candidates in the first 10 campaigns. With observations planned up to at least campaign 16, many more planet candidates will continue to be discovered. We present here our identification of 197 planet candidates suitable for validation from campaigns 0-10 of the K2 mission. We subject these planets to a validation process in order to calculate the false positive probability (FPP), and find that 102 are validated (FPP < 0.001), 61 remain candidates (0.001 < FPP), and 34 are of an unknown disposition (we were unable to or chose not to report the false positive probability). Of the 102 newly validated planets, 32 have already been validated elsewhere, 37 have merely been identified as candidates elsewhere, and 33 have never been identified before. We describe the process of data reduction, candidate identification, and validation. We also explore the demographics of the newly validated planets. This research, in addition to dramatically increasing the population of validated K2 planets, will also provide new targets for follow-up observations, as well as serve as a framework for validating candidates from upcoming K2 campaigns and candidates identified through the Transiting Exoplanet Survey Satellite (TESS), expected to launch in early to mid 2018.	54
Morello, Giuseppe	University College London	High-precision stellar limb-darkening in exoplanetary transits	The Kepler/K2 mission provides photometric time series of several hundred thousand stars with unprecedented precision, including many transiting exoplanets for which the transit depth can be measured at the level of about 10 parts per million (ppm) relative to the stellar flux. A similar precision can be achieved in modelling only if other astrophysical eff ects, such as exoplanetary phase curves, stellar activity and limb-darkening, are accounted for properly. I explore the limits on precision due to the mathematical formulas currently adopted to approximate the stellar limb-darkening, and to the use of limb-darkening coefficients obtained either from stellar-atmosphere models or empirically. To date, only up to two-coefficient limb-darkening laws have been tested on observational data, because parameter degeneracies hamper convergence when fitting more complex formulas. However, in most cases two-coefficient limb-darkening laws fail to approximate well the stellar intensity profiles and introduce large biases (also wavelength-dependent) in other astrophysical parameters such as the transit depth. I will demonstrate how these biases can be avoided, with particular emphasis (but not limited) to the cases in which spectroscopic observations allow breaking the parameter degeneracies. I will show preliminary results obtained on simulated data (Morello et al., submitted), as well as reanalyses of archive data (Morello et al., in prep.). Next- generation instruments, such as the ones onboard the James Webb Space Telescope (JWST) are expected to achieve about 10 ppm precision from the infrared to optical wavelengths, hence enabling wide application of the presented approaches (synergy with Kepler/K2).	55
Morris, Brett	University of Washington	The Active Latitudes of HAT-P-11	Transiting planets map the brightness of their host stars, as the flux lost during exoplanet transits is proportional to the integrated flux occulted by the planet. We analyze four years of Kepler short cadence photometry of HAT-P-11 – an active K4 dwarf with a 29 day rotation period, orbited by a hot-Neptune. Due to its highly misaligned orbit, the planet occults most stellar latitudes during each transit, and the latitude distribution of spots is encoded in the transit light curves. We model each spot occultation in transit to create a spot map of HAT-P-11, which reveals two active latitudes near ±17 degrees. We investigate whether the spot distribution changes in time, and we compare the spot latitude distributions of HAT-P-11 and the Sun throughout the solar activity cycle.	56
Murphy, Simon	University of Sydn	A planet in an 840-day orbit around a *Kepler* main-sequence A star	We have detected a 12 MJup planet orbiting in or near the habitable zone of a main-sequence A star via the pulsational phase shifts induced by orbital motion. The planet has an orbital period of 840 +/- 20 days and an eccentricity of 0.15. All known planets orbiting main-sequence A stars have been found via the transit method or by direct imaging. The absence of astrometric or radial velocity detections of planets around these hosts makes ours the first discovery using the orbital motion. It is also the first A star known to host a planet within 1 sigma of the habitable zone. We find evidence for planets in a large fraction of the parameter space where we are able to detect them. This supports the idea that A stars harbor high-mass planets in wide orbits. Our method is capable of finding a range of exotic objects, including brown dwarfs, neutron stars, black holes, and hierarchical triple systems.	57

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Nemec, James	Camosun College, Victoria, BC, CANADA	METAL ABUNDANCES FOR ~500 RR LYRAE STARS OBSERVED BY K2 (CAMPAIGNS 0-6)	Metal abundances are presented for $\sim$500 Ecliptic Plane RR~Lyrae stars observed with the {\it Kepler} space telescope during K2 Campaigns 0 to 6. The analyses were made using photometry pre-processed using the Extended Aperture Photometry (EAP) pipeline of the Kepler Asteroseismeic Science Consortium (KASC) RR~Lyrae Star Working Group. Several different period-finding methods (including the classical O-C method) were used to derive the mean pulsation periods, and both time and frequency domain Fourier methods were used to establish quantitative descriptions of the light curves. The photometric metal abundances, [Fe/H], were computed using period-ϕ_{31}-[Fe/H] relations. More than half of the stars exhibit both frequency and amplitude modulations, and many of the modulations are multiperiodic. For the Blazhko stars special care was required in establishing the [Fe/H] values and their uncertainties. Only two of the 12 RRd stars appear to be metal poor, the majority having metal abundances similar to those of OoI systems (eg, M3).	58
Nemec, James	Camosun College, Victoria, CANADA	DOUBLE-MODE RR LYRAE STARS OBSERVED DURING K2 CAMPAIGNS 1-6	High-precision photometry of 12 double-mode RR~Lyrae (RRd) stars observed during Campaigns 1-6 of NASA's {\it Kepler}-K2 Mission has been analyzed using Fourier methods. One of the stars, EPIC\,201585823, is the `rare triple-mode RRd star' studied in detail by Kurtz {\it et al.} (2016, MNRAS, 455, 1237). Another star, EPIC\,205209951, exhibits frequency and amplitude modulations ({\it i.e.}, Blazhko effect) and pulsates primarily in the fundamental radial mode; with P_1/P_0=0.7409 it appears to be similar to the `anomalous' RRd stars found in Messier\,3, in the bulge of our Galaxy, and in the Magellanic Clouds (see Soszy\'nski {\it et al.} 2016 MNRAS,463,1332). The relatively long pulsation periods of EPIC\,211072039 and EPIC\,212547473 suggest that their metal abundances are low like the RRd stars present in Oosterhoff Type\,II globular clusters (e.g., M15) and in the Draco dwarf galaxy. Nine of the 12 stars appear to be similar to the RRd stars in Oosterhoff Type\,I globular clusters (e.g., IC4499, M3). A detailed frequency analysis has found that the non-radial mode at $P_{\rm nr}/P_1$\sim$0.616 is present in all of the non-Blazhko RRd stars.	59
Nemec, James	Camosun College, Victoria, BC, CANADA	SX PHE STARS IN THE KEPLER FIELD	A spectroscopic and photometric analysis has been carried out for thirty-two {\it candidate} SX\,Phe variable blue straggler stars in the {\it Kepler}-field (Balona \& Nemec 2012). Radial velocities (RVs), space motions (U,V,W), projected rotation velocities (v\,sin\,i), spectral types, and atmospheric characteristics ($T_{\rm eff}$, $\log g$, [Fe/H], ξ_t, $\zeta_{\rm RT}$, etc.) are presented for 30 of the 32 stars. Although several stars are metal-weak with extreme halo orbits, the mean [Fe/H] of the sample is near solar, thus the stars are more metal-rich than expected for a typical sample of Pop.\,II stars, and more like halo metal-rich A-type stars (Perry 1969). Two thirds of the stars are fast rotators with v\,sin\,i $>$ 50~km/s, including four stars with v\,sin\,i $>$ 200 km/s. Three of the stars have (negative) RVs $>$ 250 km/s, five have retrograde space motions, and 21 have total speeds (relative to the LSR) $>$ 400 km/s. All but one of the 30 stars have positions in a Toomre diagram consistent with the kinematics of {\it bona fide} halo stars (the exception being a thick-disk star). Observed R{\o}mer time delays, pulsation frequency modulations and light curves suggest that at least one third of the stars are in binary (or triple) systems with orbital periods ranging from 2.3 days to more than four years.	60
Notsu, Yuta	Kyoto University	Statistical properties of superflares on solar-type stars with Kepler data	Superflares are flares that release total energy 10-10^4 times greater than that of the biggest solar flares with energy of ~10^32 erg. We searched superflares on solar-type stars (G-type main sequence stars) using the Kepler 1-min and 30-min cadence data. We found 187 superflares on 23 stars from 1-min cadence data (Q0-17) and more than 1500 superflares on 279 stars from 30-min cadence data (Q0-6) (Maehara+2012, Nature; Shibayama+2013, ApJS; Maehara+2015, EPS). The bolometric energy of detected superflares ranges from the order of 10^32 erg to 10^36 erg. Using these data, we found that the occurrence frequency (dN/dE) of superflares is expressed as a power-law function of flare energy (E) with the index of ~ -1.5 for 10^33<e<="" td=""></e	61

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Notsu, Yuta	Kyoto University	Spectroscopic observations of solar-type superflare stars found from Kepler	Superflares are flares that release total energy 10-10^4 times greater than that of the biggest solar flares (~10^32 erg). Recent Kepler-space-telescope observations found more than 1000 superflares on a few hundred solar-type stars (Maehara+2012, Nature; Shibayama+2013, ApJS; Maehara+2015, EPS). Such superflare stars show quasi-periodic brightness variations with the typical period of from one to a few tens of days. Rotation period and starspot coverage can be estimated from these brightness variations (cf. Notsu+2013 ApJ; Maehara+2017 PASJ). However, spectroscopic observations are needed in order to investigate whether the variation is really due to the rotation, and whether superflares can occur on ordinary single stars similar to our Sun. We have carried out spectroscopic observations for 50 solar-type superflare stars with Subaru/HDS (Notsu+2015a&b, PASJ). As a result, more than half (34 stars) of the target stars show no evidence of binarity, and the atmospheric parameters of these stars are in the range of solar-type stars. The detailed analyses for these 34 stars show that (1) the projected rotational velocities (v sin i) are consistent with the rotational velocities estimated from the brightness variations, (2) there is a correlation between the brightness variation amplitude and the intensity of Ca II IR triplet line. In particular, the latter correlation suggests that as for starspot coverage, results from Kepler and those from spectroscopic observations are consistent. These support that the brightness variation discussed above is explained by the rotation of a star with large starspots.	62
Ofir, Aviv	Weizmann Institute of Science	A spectral approach to transit timing variations	Transit timing variations (TTVs) proved to be a valuable tool for the study of exoplanets. Astrophysically, the high planetary multiplicity uncovered by Kepler mean that TTVs are not the exception but rather the rule, and only our ability to detect them limits us. Here we introduce the Spectral Approach to TTVs technique that allows creating a more complete TTVs catalog towards the low TTV amplitude, short orbital period, and shallow transit depth ends. The usual procedure for measuring TTVs is biased to long-period, deep transit planets whereas most transiting planets have short periods and shallow transits. We remove these biases by assuming that a sinusoidal TTV exists in the data and then calculating the improvement in the fit this assumption allows over the linear ephemeris model. The Spectral Approach is more sensitive due to the reduced number of free parameters in its model and its unbiased nature. We used it to: (a) detect well over >100 new periodic TTVs in Kepler data (an increase of >50% over a previous TTV catalog); (b) Constrain the TTV period of 34 long-period TTVs; (c) Identify more cases of multi-periodic TTVs (that may allow absolute mass determination); (d) Previously-identified TTVs have their amplitude determined ~37% more precisely (median factor). We use perturbation analysis at the detection stage to linearize much of the search, greatly improving the detection speed (few seconds per star).	63
Olmedo Aguilar, José Manuel	Instituto Nacional de Astrofísica Optica y Electrónica	Near-UV Excesses and Variability of 660,000 Sources in the Kepler Field	The Kepler field has been entirely observed with the GALEX space telescope, as part of the Complete All-Sky UV Survey Extension (CAUSE), in the NUV band (PI James Lloyd). For about 40 days in August and September of 2012, GALEX conducted a total of 17 visit, on average, of the whole field. In 2015, we published the GALEX CAUSE Kepler Catalog (GCK) of more than 660,000 NUV point-like sources with limiting magnitude of NUV~22.6 at 3 sigma. In this presentation we show the comparison of NUV observed fluxes with predictions from classical model atmospheres aimed at identifying objects that display NUV excesses over the expected photospheric flux. The excess, as an activity proxy, will eventually be used to elaborate on the stellar ages and on the impact of the UV flux on exoplanetary atmospheres. Additionally, we used the GCK catalog as the base to compute the photometry for every single source in each visit and we produced a catalog of NUV light curves. We detected strong NUV variability in more than 5,500 objects. We present here selected examples of light-curves of these variable sources to illustrate the relevance of this data base for the study of the UV properties of stars.	64

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Pál, András	Konkoly Observatory	TESS in the Solar System	The Transiting Exoplanet Survey Satellite (TESS), expected to be launched during the spring of 2018, will observe nearly the full sky providing time-series data in campaigns with a duration of ~27 days. In the primary mission of TESS, one out of the four of the cameras is going to observe field of 24x24 degrees, centered at the ecliptic latitude of 18 degree. Hence, while the ecliptic plane itself is not covered (incl. planets), the characteristics scale height of the main asteroid belt and Kuiper belt implies that a significant amount of small Solar System bodies will cross the field-of-view of this camera. In this presentation, we review the main analogues and differences between the Kepler/K2 mission and the TESS mission focusing on scientific implications related to our Solar System. Regarding to the comparison of the supposed amount information of TESS and K2, we can compute the cumulative étendue of the two optical setups. This comparison results in roughly comparable étendue, therefore one can predict roughly same amount of scientific output at the first glance. However, many principles of the data acquisition and optical setup are clearly different, including the level of confusion of background sources, full-frame integration and cadence, the field-of-view centroid with respect to the apparent position of the Sun as well as the campaign duration. As one can expect, TESS will yield time-series photometry and hence rotational properties for only brighter objects, but in terms of spatial and phase space coverage, this sample will be more homogeneous and complete. We also mention the relations between TESS and ground-based full-sky surveys with approximately the same plate scale and/or étendue - such as Fly's Eye or Evryscope.	65
Paudel, Rishi R.	University of Delaware	K2 Survey of Ultracool Dwarfs	We report the results of our ongoing project which is focused on studying white light flare frequency distribution (FFD) of ultracool dwarfs (UCDs) by analyzing Kepler K2 short cadence (1 min) data in various campaigns. Our sample of UCDs contain one M6, four M7, three M8 (TRAPPIST-1 is one of them) and two L0 dwarfs. Most of them are old low mass stars and few are (probable) brown dwarfs. We identified >250 good flare candidates on them. Our flare sample contains flares with energies log EKp ~(29 - 33.5) erg. It is seen that white light FFD of all these UCDs follow a power law of form log $\nu^{\sim} = \alpha - \beta$ log EKp, where EKp is Kepler flare energy and $\nu^{\sim}$ is cumulative flare frequency which represents the number of flares with energy > EKp. One L0 dwarf: 2MASS J12321827-0951502 has a very shallow slope (β ~0.31), while another L0 dwarf: 2MASS J12212770+0257198 has steeper slope (β ~1.24). The L dwarfs' FFD seem to have two different slopes: a steeper slope for low energy and a shallower slope for high energy. The steeper slope covers very narrow range of low energy. The slopes of other UCDs lie within range 0.50-0.90. To some extent, we found a decreasing trend in slope for later spectral types for energies greater than 1030 erg. One huge flare is observed on 2MASS J12321827-0951502, during which it brightens by a factor of ~145 times the photospheric level (~360 counts/s). Likewise, we also observed huge flare on another target 2MASS J08352366+1029318 (possibly a brown dwarf) during which it brightens by a factor of ~50 relative to it's photospheric level (~890 counts/s). The photometery of these flares will be very helpful to understand the gradual decay phase of flares in cooler objects. We compare the flare activity of TRAPPIST-1 to other ultracool dwarfs. It is more active than M8.5 dwarf 2MASS J03264453+1919309 but less active than another M8 dwarf 2MASS J12215066-0843197.	66
Ragozzine, Darin	Brigham Young University	The Importance of Multi-Transiting Probability for Debiased Exoplanetary System Architectures	Kepler's discovery of ~1500 transiting planets is systems with multiple candidate planets has been essential for developing and testing theories of planet formation and evolution. Systems with multiple transiting planets are the most information rich outside our solar system as evidenced by the hundreds of papers with thousands of citations on these systems. However, connecting the underlying distribution of planetary architectures to the observations is more complicated in these systems due to the complex geometric biases inherent in multiple exoplanetary systems. Some of the most important questions in the field (e.g., the Fraction of Stars with Planets) can only be answered by carefully accounting for these biases. Here, we highlight several aspects of planetary system architecture understood better with these biases in mind. We find an empirical fit for the period ratio distribution and show that the intrinsic prevalence of resonances may be lower than expected. We identify population-level trends in the relationships between periods and radii in individual systems (e.g., the preference for planets of similar sizes and the preference for similar period ratios). Finally, we will review how the community can move forward in connecting Kepler results to theories of planet formation and evolution.	67

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Ranc, Clément	USRA/NASA Goddard Space Flight Center	Simultaneous K2 Photometry and Light Curves Modeling for the Analysis of K2C9 Microlensing Observations	K2C9 was dedicated to the observation of microlensing events toward the Galactic Bulge. This is a large space-based microlensing survey that aims to build the Galactic distribution of exoplanets. While the photometric light curve of a microlensing event observed from the ground provides important constraints on the lens physical parameters, in many cases the lens mass and distance from Earth remain degenerated. Joint space- and ground-based observations enable to break this degeneracy by providing a key parallax information. Several planets detection and characterization are expected using K2C9. The analysis of the K2C9 observations is still an on-going process. The main challenge is to deal with an under-sampled crowded field photometry which suffers from numerous systematic effects. Recently, a causal data-driven approach has been developed to model the Kepler data (Wang et al. 2016). This method (CPM), successful in detecting transiting planets, removes the systematic effects in the time series of one pixel of interest by using the variability of many other pixels observing many independent stars. Recent attempts to use this method to extract microlensing light curves were successful for short timescale events (~2 days). However, the CPM method seems not to be reliable to derive the light curve of the most common events, i.e. with a long timescale. Therefore, developing the CPM method has become the center of attention in the microlensing community. In particular, I will show that the simultaneous combination of the light curve modeling and the CPM algorithm provides a suited way to get rid of the systematic effects and model long timescale events. More generally, this simultaneous "CPM and light curve modeling" approach might be used in many different contexts, from the analysis of transiting planets to the analysis of any kind of stellar variability adulterated by systematics, thus useful to other science beyond microlensing.	68
Rowden, Pamela	The Open University	Kepler as a calibrator for the false positive rate in future transiting exoplanet surveys	The Kepler main mission has provided valuable information on the population of eclipsing binaries, publicly available in the Kepler Eclipsing Binary Catalogue (Prsa et al, 2011; Slawson et al, 2011; Kirk et al, 2016). At the same time, the BiSEPS Binary Stellar Evolution Population Synthesis code has been used to generate a synthetic field matching the on sky area observed by Kepler during the main mission (Farmer, Kolb & Norton, 2013). By matching primary and secondary eclipse depths, the effective temperature and the orbital period of systems in the Kepler Eclipsing Binary Catalogue with corresponding systems in the synthetic field, independent support is given to findings in Raghavan et al (2010) on the mass distribution and period distribution of binaries. These results are of interest in understanding the evolution of eclipsing binary systems, which may themselves be the inner pairs of triples or higher hierarchies. They also provide a tool to calibrate the predicted false positive rate due to astrophysical sources in future transiting exoplanet surveys, in particular PLATO 2.0 (Rauer et al, 2014), due to launch in 2024. This is part of the Kepler legacy.	69
Rustamkulov, Zafar	University of California, Santa Cruz	A New Model for High-Resolution Exoplanet Transmission Spectroscopy	The recent boom in observations of exoplanet atmospheres has prompted the need for robust theoretical models to better explore their properties. High resolution infrared spectra taken by instruments such as CRIRES and ESPRESSO on the VLT, and the future MIRI and NIRSpec instruments aboard JWST, present astronomers the opportunity to study exoplanets in great detail. The properties of exoplanet atmospheres are imprinted in their transmission spectra, allowing for constraints on their structure, composition, formation, and evolution. In this study, we build a novel transmission spectrum model to characterize the properties of exoplanet atmospheres. The model expands on a previously validated opacity code and an analytic geometric path length distribution prescription to produce high-resolution spectra spanning the near- and mid-infrared range. The model’s flexibility allows for rapid iterations through many atmospheric parameters to fit existing observational data, given initial pressure-temperature and abundance profiles and cloud models. The model outputs show good agreement with other models for terrestrial and Jovian planets alike.	70
Schlieder, Joshua	NASA GSFC	On The Trail of Jovians Transiting Low-Mass Stars with K2	Jovian planets on short period orbits are known to be very rare around low-mass stars, with estimated frequencies <1%. The current sample of approximately Jupiter size planets transiting stars cooler than 4500 K numbers fewer than ten. K2 observes thousands of low-mass stars and is well poised to increase the sample of transiting gas-giants at the bottom of the main-sequence. We will present the sample of transiting Jovian planet candidates we have identified in the first 2 years of K2 data. This sample includes classic hot-Jupiters, warm Saturns, and giant-planets in or near the habitable zone. With ongoing follow-up, confirmation of these systems will shed light on the true frequency of short period Jovian planets orbiting low-mass stars, provide further insight into planet formation, and yield priority targets for atmospheric characterization.	71

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Scott, Nic	NASA ARC	Speckle imaging follow-up for Exoplanet Validation and characterization	NESSI and `Alopeke are two new speckle imagers built at NASA's Ames Research Center for community use at the WIYN and Gemini telescopes. The two instruments are functionally similar and include the capability for wide-field imaging in additional to speckle interferometry. A primary role of these instruments is exoplanet validation for the Kepler, K2, TESS, and many RV programs. The diffraction-limited imaging available through speckle effectively eliminates distortions due to the presence of Earth's atmosphere by `freezing out' changes in the atmosphere by taking extremely short exposures and combining the resultant speckles in Fourier space. This technique enables angular resolutions equal to the theoretical best possible for a given telescope, that is as if that telescope was in space. Our instruments provide the highest spatial resolution available today on any single telescope. Contrast ratios of 6 or more magnitudes are easily obtained and the instrument uses two emCCD cameras providing simultaneous dual-color observations help to characterize detected companions. High resolution imaging enables the identification of blended binaries that contaminate many exoplanet detections, leading to incorrectly measured radii. In this way small, rocky systems, such as Kepler-186b and the TRAPPIST-1 planet family, may be validated and thus the detected planets radii are correctly measured.	72
Sheets, Holly	McGill University	A Statistical Characterization of Reflection and Refraction in the Atmospheres of sub-Saturn Kepler Planet Candidates	We present the results of our method to detect small atmospheric signals in Kepler's close-in, sub-Saturn planet candidate light curves. We detect an average secondary eclipse for groups of super-Earth, Neptune-like, and other sub-Saturn-sized candidates by scaling and combining photometric data of the groups of candidates such that the eclipses add constructively. This greatly increases the signal-to-noise compared to combining eclipses for individual planets. We have modified our method for averaging short cadence light curves of multiple planet candidates (2014, ApJ, 794, 133), and have applied it to long cadence data, accounting for the broadening of the eclipse due to the 30 minute cadence. We then use the secondary eclipse depth to determine the average albedo for the group. In the short cadence data, we found that a group of close-in sub-Saturn candidates (1 to 6 Earth radii) was more reflective (geometric A ~ 0.22) than typical hot Jupiters (geometric A ~ 0.06 to 0.11: Demory 2014, ApJL, 789, L20). With the larger number of candidates available in long cadence, we improve the resolution in radius and consider groups of candidates with radii between 1 and 2, 2 and 4, and 4 and 6 Earth radii. We also modify our averaging technique to search for refracted light just before and after transit in the Kepler candidate light curves, as modeled by Misra and Meadows (2014, ApJL, 795, L14).	73
Shporer, Avi	Caltech	K2 Warm Jupiters with the LCO TECH Team	In contrast to the large number of known transiting hot Jupiters there are only a handful of known transiting warm Jupiters - gas giant planets receiving irradiation less than about 2x10^8 erg/s/cm^2 corresponding to orbital periods beyond about 10 days around Sun-like stars. Warm Jupiters can help fill critical gaps in our knowledge of exoplanets. Farther from their host stars, these planets experience weaker irradiation and tides. Increasing that sample will shed light on critical questions including the mechanisms responsible for the inflation of hot Jupiters and the processes shaping their orbital evolution. It will also supply targets for planetary atmosphere studies of cooler atmospheres, and obliquity studies of systems with a decreased star-planet tidal interaction. Discovering and confirming transiting warm Jupiters is the goal of this project, undertaken by the Las Cumbres Observatory (LCO) Transiting Exoplanet CHaracterization (TECH) team and is part of an ongoing LCO Key Project. We are using K2 as our main source of transiting warm Jupiter candidates. LCO telescopes are being used for obtaining additional ground-based transit light curves, which are critical for confirming and refining the K2 transit ephemeris as outliers during ingress or egress of the few transit events observed by K2 can bias the measured ephemeris. Further ground-based follow-up data, including spectroscopy, radial velocities, and high angular resolution imaging, are obtained by facilities directly accessible by LCO TECH team members. In addition, LCO's Network of Robotic Echelle Spectrographs (NRES) is now being deployed and will allow obtaining spectroscopy and radial velocities with LCO facilities. We have already published the first discovery from this project and I will present candidates that we have now confirmed and will be published soon. These include K2 transiting candidates that were validated statistically as exoplanets, but that we have identified as brown dwarfs or small stars.	74

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Socia, Quentin	San Diego State University	KIC 9832227: Testing the "Red Nova" Merger Prediction Using Vulcan Data	KIC 9832227 is an 11-hour period contact binary star with a rapidly decreasing orbital period. The two stars are predicted to merge in early 2022 resulting in a rare red nova outburst (Molnar et al. 2017). The prediction is based on the exponential-like curvature in the O-C diagram, and is highly dependent on a data point taken in the year 2000 by the Northern Sky Variability Survey (NSVS). Fortunately, KIC 9832227 was observed with the Vulcan Photometer in 2003 as part of the NASA Ames Vulcan Project to search for transiting exoplanets. Using the archived Vulcan CCD data, we will measure the eclipse times and add a new data point to the Molnar et al. O-C diagram. Because of its well-placed epoch in the O-C diagram (near the start of the observations), this Vulcan timing measurement will either substantially strengthen or refute the prediction for the 2022 outburst.	75
Somers, Garrett	Vanderbilt University	Testing models of M dwarf angular momentum evolution with K2 young cluster rotation rates	Observations of nearby open clusters by the ongoing K2 mission have yielded a wealth of new information about the rotational properties of young, fully-convective M dwarfs, which have generally been too dim to for previous large-scale spot modulation studies. In particular, the recent K2 rotation data sets from the ~10 Myr old Upper Scorpius association, the ~125 Myr old Pleiades, and the ~700 Myr old Praesepe have dramatically revealed the rotational evolution of M dwarfs during their first billion years of life. These three star clusters offer an unprecedented testing ground for models of M dwarf angular momentum evolution, which until now have remained largely unconstrained by data. Using these three open clusters, field M dwarf rotation rates from the MEarth survey (Newton et al. 2016), and a state-of-the-art rotating stellar evolution code, we constrain the angular momentum loss of fully-convective stars, and critically test the predictions of modern stellar wind laws for single M dwarfs from the pre-main sequence to the field. Our results show that certain features of the M dwarf spin down pattern — e.g., the decline in rotation period with decreasing mass at fixed age, and the gradual steepening of this relation for several hundred Myrs — are generically predicted by the Kawaler (1988) and Matt et al. (2012) wind law models. However, other features — e.g., the bimodal slow and fast branches, present by Praesepe age at ~0.3Msun and for all M dwarf masses in the field population — cannot be explained by traditional theory. The mixed success of these models suggests that physics not included in standard wind laws spin certain M dwarfs down faster than others. We discuss candidate mechanisms for this phenomenon, measure the empirical spin-down rate as a function of mass, and consider implications of these data for future studies of angular momentum evolution.	76
Stauffer, John	Spitzer Science Center, Caltech	The Role of Binarity in the Angular Momentum Evolution of M Dwarfs	We have analysed K2 light curves for of order a thousand low mass stars in each of the 8 Myr old Upper Sco association, the 125 Myr age Pleiades open cluster and the ~700 Myr old Praesepe cluster. A very large fraction of these stars show well-determined rotation periods with K2, and where the star is a binary, we usually are able to determine periods for both stars. In Upper Sco, where there are nearly 150 M dwarf binaries with K2 light curves, the binary stars have periods that are much shorter on average and much closer to each other than would be true if drawn at random from the Upper Sco M dwarf single stars. The same is true in the Pleiades, though the size of the differences from the single M dwarf population is smaller. By Praesepe age, the M dwarf binaries are still somewhat rapidly rotating but their period differences are not significantly different from what would be true if drawn by chance from the singles. We assume the Upper Sco to Pleiades to Praesepe differences represent an evolutionary sequence driven by PMS and main sequence angular momentum loss mechanisms. We will discuss possible implications of these results and followup observations we have planned.	77

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Stefansson, Gudmundur	Penn State University	Extreme precision photometry from the ground with beam-shaping diffusers to follow-up Kepler, K2, and TESS targets	We demonstrate a reliable path to achieving some of the highest differential photometric precisions from the ground by using custom-fabricated beam-shaping diffusers. Produced using specialized nanofabrication technologies, such beam-shaping diffusers are capable of molding the image of a star at a telescope focal plane to be a broad, stable top-hat shape, minimizing photometric errors due to non-uniform detector pixel response, atmospheric seeing effects, imperfect guiding, and telescope-induced variable aberrations seen in telescope defocussing. By reshaping the stellar image into a uniform, stable pattern spanning many pixels, we significantly increase the achievable dynamic range of our observations, which in turn increases observing efficiency and minimizes atmospheric scintillation noise. We have demonstrated 62ppm diffuser-assisted photometric precision in 30 minute bins (or 300ppm in 1minute bins) on a nearby bright star 16 Cygni A (V~6, I~5) using the ARCTIC imager on the 3.5m telescope at Apache Point Observatory—within a factor of 2 of Kepler's precision—in a head to head comparison with Kepler photometry on the same star. With the diffuser on ARCTIC, we have achieved photometric precision levels matching or surpassing the expected photometric precisions of TESS across a wide magnitude range of stars from I ~ 5 to I ~ 11. This technology is inexpensive, scalable, customizable and easily adaptable for use on telescopes large and small to routinely achieve high photometric precision levels, and can have an important and immediate impact on observations of transits and secondary eclipses of exoplanets. We will present our latest results on our ongoing diffuser-assisted photometry follow-up efforts of transiting K2 candidates and other exoplanet systems.	78
Stello, Dennis	UNSW	Asteroseismic masses of planet-hosting `retired A stars'	Over the past decade, a controversy has arisen about the inferred occurrence rate of gas-giant planets around evolved intermediate-mass stars – the so-called 'retired A-stars'. The high masses of these evolved planet hosts, derived using spectroscopic information and stellar evolution models, has been called into question. Here we address the controversy by determining the masses of eight retired A-stars using asteroseismology. We find a significant one-sided offset between the previous spectroscopy-based masses and our seismic masses among the stars where the original spectroscopic masses in the planet discovery papers were above ~1.5Msun. We conclude that the adopted spectroscopy-based masses for our sample stars are likely to have been overestimated by about 15–20%.	79
Thompson, Susan	SETI Institute/ NASA Ames Research Center	Kepler DR25 Exoplanet Catalog Highlights	We present a graphical overview of the Kepler's latest uniformly vetted Kepler Object of Interest catalog. This catalog was created by searching all 17 quarters of the Kepler DR25 light curve data, and vetting those detections (TCEs) with our fully automated Robovetter. All potentially transit-like objects are included in the catalog and are given a full transit fit using Markov chain Monte Carlo error bars to provide a robust measurement of the planet parameters. Here, we highlight the exoplanets found in some of the more scientifically interesting aspects of the catalog. We also present our estimates of the completeness and reliability of the candidate catalog based on simulated injections and false positives. The entire catalog as well as the data used to understand its completeness and reliability are available at the NASA Exoplanet Archive, http://exoplanetarchive.ipac.caltech.edu.	80
Thorngren, Daniel	UC Santa Cruz	Bayesian Inference of Hot Jupiter Radius Anomalies Points to Ohmic Dissipation	The large and growing collection of well-characterized giant exoplanets presents the opportunity for population-level inference of their properties. We have constructed a suite of structural evolution models to match observed exoplanet radii, masses, ages, and stellar insolation. Using the planet mass-metallicity trend derived from cool (uninflated) giant planets as a prior on composition, we derive a distribution of possible anomalous powers which inflate hot Jupiter radii. While these are not particularly informative for each individual planet, by combining them within a Bayesian hierarchical model, we are able to test different functional forms for the anomalous power as a function of incident stellar flux. Using a Gaussian process to guide our model choices, we fit several functions to the data, including the step, power-law, logistic, and Gaussian functions. The model selection statistic WAIC favors the Gaussian model with a high statistical significance. In this model, inflation efficiency starts to become significant at planetary T_eff~1000 K, peaks at a few percent of the incident flux at around T_eff~1600 K, and then decreases back down towards zero at high planetary T_eff. This matches a central prediction of the Ohmic heating scenario, which (unlike other mechanisms) predicts such a decline at high effective temperatures as a result of magnetic drag induced by the high atmospheric ionization. As such, our data strongly favor Ohmic heating as the principal cause of the hot Jupiter radius anomaly effect, potentially solving one of the oldest problems in exoplanetary physics.	81

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Trust, Otto	Mbarara University of Science and Technology	Age of rotating stars in NGC 6811 Open cluster	"Stars have a life span during which they undergo a series of evolution processes. Among these processes, they lose their rotation velocities at a rate dependent on stellar mass as they evolve. Using NASA's Kepler space-craft high-precision data, asteroseismic parameters, dominant frequency (fg) and period spacing (ΔP) were obtained. It is shown that for cool g-mode pulsating main sequence rotating stars in NGC 6811, fg relates very well with effective temperature (Teff) and rotation velocity (Vrot) as fg = 0.1735(0.1125) + 0.0004489(0.0002267)Vrot log(Teff) – 0.002697(0.003949)Vrot^2. With this relation, 55 stars were confirmed to be members of the cluster. Differential rotation and flattening (ΔR/R) among these stars were found to be negligible with relative shear α < 0.3 and ΔR/R of order 10^{–6} . This is insignificant to affect the period-color(mass)-age relation. With the period-color(mass)-age relation, the individual ages of these stars were determined and the average age of the confirmed members was found to be 0.88 ± 0.02 Gyrs." Scope: Rotating stars in NGC 6811 open cluster, their membership, differential rotation and age. The poster presentation can be attended my as many people as available. Goals: Discuss how efficient the model in the abstract is, especially at confirming the stellar membership of that type of stars in NGC 6811. Discuss how precisely age of an individual star is determined.	82
Tucker, Brad	Mt Stromlo Observatory, the Australian National University	GLUV - A High-Altitude Balloon-Borne UV Survey	GLUV is a balloon-borne system, with a plan to simultaneous fly 50 telescope systems in multi-month campaigns. GLUV will perform the first UV time-domain survey using small, wide-field telescopes in the near-UV (250 - 350nm). The main focus of GLUV will be supernova, gravitational wave follow-up, and exoplanet atmospheres. However, with a large, community-driven component and open-data policies, we expect GLUV to benefit the entire astronomical community.	83
Van Saders, Jennifer	Carnegie Observatories	A K2 Stellar Astrophysical Study of the Old Open Cluster M67	M67 is among the best studied of all star clusters. Being at an age and metallicity very near solar, at an accessible distance of 850 pc with low reddening, and diverse in content, M67 is a cornerstone of stellar astrophysics. K2 Campaign 5 obtained long-cadence observations of M67, both within a central superaperture and in the cluster halo. Our M67 K2 team has produced and uploaded to MAST light-curves of 2422 stars, 1432 of which are likely cluster members. The team has a) made the first unambiguous detection of solar-like oscillations in 32 red giants of M67, enabling for each direct measurement of stellar radius, mass and age (Stello et al. 2016); b) found no significant mass loss along the giant branch, unexpected in solar abundance giants; c) measured a mass of 2.9 ± 0.2 Mo for the yellow giant S1237, revealing it to be an evolved blue straggler (Leiner et al. 2016); d) discovered four detached eclipsing systems; and e) discovered candidate "blue stragglers" among the main-sequence stars. M67 represents a critical test of standard stellar spin-down relations. One campaign window permits only 2-3 solar-like rotation cycles, and so is fraught with false detections. Our study integrates the work of three different teams independently processing the data and determining rotation periods using different methods. Analyses of A- and early-F-type main-sequence stars by all teams yield significant detections of periods at 25-35 days, even for stars with light curves showing true rotation periods of 1-5 days. Clearly these false detections are the result of systematics. Injection tests underway will define the period-amplitude domains of accurate measurement. Finally, we have searched for transiting planets in the M67 data with various methods and codes, finding none. Our team estimated that a K2 M67 survey should yield between 7 and 13 planet candidates based on the yield of the Kepler mission's survey of field stars. We are currently modeling the lack of detections in M67 in order to place an upper limit on exoplanet frequency. This work is supported by NASA grant NNX15AW24A to the University of Wisconsin – Madison.	84

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Vega, Laura	Vanderbilt University	Evidence for Possible Disk Obscuration in Kepler Observations of the Pulsating RV Tau Variable DF Cygni	RV Tau variables are pulsating stars typically identified by the signature pattern of alternating deep and shallow minima in their light curves. There are two types: RVa stars maintain a relatively constant mean magnitude while RVb stars show an additional long-period variation in the order of 600-1500 days in mean magnitude with amplitudes that can reach up to 2 mag in V. The spectral characteristics of RV Tau stars suggest they may be post-asymptotic giant branch stars. Some studies have argued that RV Tau stars might be binary systems due to the infrared excess in their spectral energy distributions that possibly indicate the presence of circumbinary discs, but the precise nature of RV Tau stars remain a mystery. During its primary mission, Kepler observed the archetype RVb star, DF Cygni, producing a 4-year light curve of unparalleled precision and cadence for any RV Tau star to date. We present here results from our analysis of this light curve. First, we measured its formal period (the time interval between two successive deep minima) to be 49.84 ± 0.02 days, and a long-term cycle period of ≈795±5 days. There are precisely 16 deep and shallow minima cycles in one long-term cycle, suggesting a long-term cycle period of ≈795±5 days. Next, we argue that binarity may naturally explain this long-term periodicity in DF Cyg. From 2MASS and WISE observations, the spectral energy distribution of DF Cyg features an infrared excess indicative of a disk possibly linked to a binary companion. Finally, we argue from kinematics and geometric arguments that the most likely interpretation for the ~90% change in flux during the long-period cycle, as well as the reduction of the short-term pulsation amplitude, is periodic occultation of DF Cyg by a glowing disk surrounding the star and its binary companion. Looking forward, K2 is poised to observe additional RV Tau variables, allowing a systematic survey of their pulsation characteristics in unprecedented detail.	85
Vrard, Mathieu	Instituto de Astrophísica e ciências do espaço (IA), Porto, Portugal	Amplitudes and lifetime of radial modes in red giant star spectra observed by Kepler	The space mission Kepler has provided seismic data of unprecedented quality which brought new ways to precisely measure the stellar seismic parameters in red giant star spectra. With now four years of observations, the precise characterization of the seismic mode parameters can be carried out. Here, we present the results of a large study realized on red giant stars which aim to characterize precisely their pressure mode amplitude and linewidth in their spectra. These two parameters are linked to the mode excitation and damping. Measuring it will, then, bring constraints on the physical processes behind pressure mode excitation and damping in solar-like pulsators. We will detail the automated procedure used to determine the pressure mode parameters throughout the star spectra. We will then present the results and analyze them throughout the stellar evolution in function of the star physical parameters. Finally, the implications of the results on the physical processes behind the excitation and damping of the pressure modes in red giant stars will be developed.	86
Wang, Songhu	Yale	Kepler-9 -- A New Look at a Classic Planetary System	The Kepler-9 system harbors three known transiting planets. The system is of significant interest as a consequence of (1) the proximity of the outer two planets to 2:1 orbital commensurability, (2) their presence in the planetary mass ``desert'' that is generally associated with the rapid gas agglomeration phase of the core accretion process, and (3) the attractive prospects for accurately measuring both the sky-projected stellar spin-orbit misalignments and the mutual orbital inclination between the planets. We report the photometric relocation of Kepler 9b's aperiodic transit, and we carry out extensive dynamical modeling of the system which greatly improves estimations of the planetary masses and orbital elements. We also discuss how this result transmits clues regarding the origins of hot Jupiters, the origin of the intermediate-mass exoplanet desert, and th origins of stellar spin -- planetary orbit misalignments.	87
Weiss, Lauren	Université de Montréal	The California Kepler Survey V: Stellar and Planetary Properties of Kepler's Multiplanet Systems	[Poster is an extension to the contributed talk] As part of the California Kepler Survey (CKS), we present a catalog of precise stellar and planetary properties for 391 Kepler multi-planet systems containing 1008 transiting planets. Using this catalog, we conduct an unbiased comparison of the properties of systems with one versus multiple transiting planets. We also examine how stellar and planetary properties vary with planet multiplicity. We find (1) there is no difference in the masses of stars hosting one versus multiple transiting planets, (2) hot stars with low vsini have one transiting planet, not multiple transiting planets, (3) lone transiting planets have larger radii than planets in multi-planet systems, (4) planets of varying multiplicities exhibit a bimodal radius distribution around the Fulton gap at 1.8 Earth radii, as presented in Paper III in the CKS series, and (5) planets in multi-transiting systems are over-represented at 0.1 AU compared to lone transiting planets, which exhibit a broader distribution of orbital separations. In addition, we find that in systems of high multiplicity (4 or more planets), the planets tend to be similar in size and regularly spaced. Using empirical mass-radius relationships, we estimate the mutual Hill separations of planet pairs. We find that planet pairs are at least 10 mutual Hill radii apart, and that a spacing of 20 mutual Hill radii is typical.	88

Poster Abstracts

Name	Institution	Title	Abstract	Poster Number
Werner, Michael	JPL	Spitzer Meets K2 - A Status Report	Spitzer Meets K2 – A Status Report. M.Werner, V.Gorjian, F.Morales, JPL/Caltech; J.Livingston, U.Tokyo; I.Crossfield, UCSC: R.Akeson, C.Beichman, J.Christiansen, D.Ciardi, J.Krick, IPAC/Caltech; B. Benneke, C. Dressing, A. Howard, H.Knutson, E.Petigura, Caltech; S.Howell, NASA/Ames; J.Schlieder, GSFC; K.Hardegree-Ullman, U.Toledo. We summarize the results and future plans for an 800+ hour Spitzer program for study of exoplanets identified by the K2 mission. The program began in Cycle 11 and will continue through the end of Cycle 13 in the Spring of 2019. To date, transits and eclipses have been observed for 44 planets, many of which have been observed multiple times. The principal scientific focus has been on planets of the Neptune-Uranus class or smaller, including planets in or near the habitable zone. We have provided improved ephemerides for the K2-3 system and for K2-18b which will facilitate study of these small planets by JWST. We have selected four systems, K2-19, K2-21, K2-24, and K2-32 to search for TTV's, and observed at least two planets in each of four other multi-planet systems: K2-3, K2-93, K2-96, and HD106315. New results from observations of K2-24, K2-33b (a.k.a. USco1610b), and other K2 targets, will be presented. All of the data from this program are publicly available at the IRSA site, and we welcome suggestions of other K2 targets which might be observed with Spitzer. — This work is based [in part] on observations made with the Spitzer Space Telescope, which is operated by the Jet Propulsion Laboratory, California Institute of Technology under a contract with NASA. Support for this work was provided by NASA through an award issued by JPL/Caltech	89
Windemuth, Diana	University of Washington	Searching for Tatooines	Kepler has revolutionized our understanding of planets orbiting around single host stars. The majority of stars, however, reside in binary systems. Constraining planet formation and evolution in general therefore requires a statistical sample of planets around all modes of stellar multiplicity. To date, a dozen giant circumbinary planets (CBPs) have been discovered, by eye; this is in stark contrast to the thousands of confirmed and candidate KOIs around single stars that span a large range in planetary size, period, and system architecture. Here, we present a homogeneous search for transiting circumbinary planets around ~detached Kepler eclipsing binaries (EBs). Our pipeline differs from previous efforts in two significant ways. First, we account for binary-induced transit timing variations (TTVs) by convolving the EB-removed light curve with a simple CBP model corresponding to the searched planet size and period. This boosts the detection significance, allowing us to search for smaller, i.e., terrestrial CBPs. To accommodate EB and transit model uncertainties, we use the Quasiperiodic Automated Transit Search algorithm (QATS, Carter & Agol 2012), which allows for aperiodicities in the search window with user-specified bounds. We perform a detailed injection and recovery analysis to quantify the biases and completenesses of our pipeline. We report the results of our search and infer characteristics of the CBP population, such as the frequency of CBPs as a function of planet size, radius, and binary mass ratio.	90
Ziegler, Carl	University of North Carolina at Chapel Hill	The Robo-AO KOI Survey: LGS-AO Imaging Of Every Kepler Planetary Candidate Host Star	The Robo-AO Kepler Planetary Candidate Survey is observing every Kepler planetary candidate host star (KOI) in high resolution, made possible using the unprecedented efficiency provided by automation of LGS adaptive optics. In 3313 observations, we find 477 stars within 4" (approximately the Kepler pixel scale) of KOIs. These nearby stars, contaminating the Kepler photometry, may be the source of false positive transit signals or, if a bona fide planet is in the system, dilute the observed transit signal, leading to incorrect planet radii measurements. We use this large set of planet hosting multiple star systems to search for correlations between stellar multiplicity and the observed planetary properties which may provide insight into the mechanisms behind the formation and evolution of planets in our galaxy. We look at the impact to rocky, habitable zone planets in systems with secondary stars and preview a follow-up study of planets orbiting in quadruple stellar systems. Finally, we discuss future all-sky, kilo-target surveys made possible by the addition of a Southern Robo-AO analog.	91