Benjamin James ("BJ") Fulton

California Institute of Technology (Caltech) Texaco Postdoctoral Fellow (408) 528-4858 bfulton@caltech.edu astro.caltech.edu/~bfulton

Education

- Doctor of Philosophy in Astronomy from the Institute for Astronomy at the University of Hawaii, Manoa, July 2017
- Master of Science in Astronomy from the Institute for Astronomy at the University of Hawaii, Manoa, September 2014
- Bachelor of Science in Physics with a Minor in Astronomy and Planetary Science from the University of California, Santa Barbara, June 2009

Publication statistics

- Seven first author & major contributions in four second author refereed publications
- 89 total refereed publications
- Contributions in three Nature publications
- 2293 citations
- h-index = 25

Research Experience

- Discovered a gap in the radius distribution of small planets found by Kepler. This has significant implications for our understanding of the formation and evolution of these planets (Fulton et al. 2017).
- Developed a highly extensible and open source software package for the analysis of radial velocity time-series data written in object-oriented Python (radvel.readthedocs.io)
- Wrote software that allows the Automated Planet Finder (APF) telescope at Lick Observatory to be a fully operational and autonomous observatory. Thanks in large part to my automation and scheduling software, the telescope has been operating autonomously on a nightly basis collecting high-precision radial velocities for the last 5 years
- Developed a new technique to extract radial velocities from low signal-to-noise spectra which enabled the discovery of the Jupiter-size transiting exoplanet KELT-8b (Fulton et al. 2015b)
- Published two papers (<u>Fulton et al. 2015a, Fulton et al. 2016</u>) announcing the discovery of 5 new low-mass planets orbing four nearby stars. These discoveries were made possible, in large part, by the APF facility.
- Worked extensively with collaborators at the Space Telescope Science Institute on a project to revolutionize the way that radial velocities are calculated from gas absorption cell spectroscopy
- Published a paper (Fulton et al., 2013) for which I modeled the Rossiter-McLaughlin (R-M) effect to measure the stellar obliquity of HAT-P-17. I ported/adapted an existing Differential Evolution Markov Chain Monte Carlo code from IDL to Python, and wrote the model calculation code from scratch to take advantage of a new semi-analytical model of the R-M effect.
- Developed an automated planet detection algorithm to search for Keplerian signals in heterogeneous radial velocity datasets and characterize pipeline completeness using injection-recovery tests (<u>Howard & Fulton 2016</u>)
- Published a paper for which we searched for transit timing variations in the HAT-P-13 planetary system and refined the system parameters (<u>Fulton et al. 2011</u>). This required me to become familiar with exoplanet transit light curve modeling, and the theory of transit timing variations.
- Contributed to a paper that appeared in Nature (<u>Howard et al. 2013</u>) in which we made the first mass measurement of an Earth-size exoplanet.
- Contributed to a paper led by Peter Nugent constraining the explosion time of the nearby supernova in M101 that appeared
 in Nature (Nugent et al. 2011).
- Transformed the Byrne Observatory at Sedgwick reserve from an unused and forgotten facility, into a fully operational and robotic observatory.
- Wrote a pipeline to search for and model the effects of ellipsoidal variations, reflection and relativistic beaming in Kepler data
- Contributed observations for seven Minor Planet Circulars, and have been credited with the discovery of two new Marscrossing asteroids.
- I was previously involved with a project to measure the orbital motion of astrometric binaries using lucky imaging and speckle interferometry.

Teaching and Mentoring Experience

- Designed curriculum and instructed university-level "Introduction to Astronomy" summer course at the University of Hawaii at Manoa (2015)
- Three-time research advisor at the HISTAR program for gifted K-12 students (2012, 2013, 2015)

Observing Experience

- 65 full or partial nights using the HIRES instrument on the Keck I telescope located on Maunakea
- Nearly 700 nights on the Automated Planet Finder Telescope at Lick Observatory (mostly robotic running on my software)
- Approximately 20 nights using the OPTIC imager on the University of Hawaii 2.2 m telescope located on Maunakea
- Approximately 7 nights on the Nickel 1.0 m at Lick Observatory
- Approximately 180 nights on the Sedgwick telescope of the Las Cumbres Observatory network (mostly robotic running on my software)

Academic Awards

- Texaco prize postdoctoral fellowship at Caltech
- ARCS Foundation Honolulu 2016 Scholar of the Year
- 2016 Columbia ARCS Award in Astronomy
- Student Excellence in Research Award at the University of Hawaii at Manoa in 2015
- National Science Foundation Graduate Research Fellowship in 2014
- Physics Research Honors award upon graduation from UCSB in 2009

Publications

First Author

- Fulton, B.J. et al. (2017); The California-Kepler Survey. III. A Gap in the Radius Distribution of Small Planets, AJ, 154, 109 (2017AJ....154...109F)
- Fulton, B.J. et al. (2016); Three Temperate Neptunes Orbiting Nearby Stars, ApJ, 830, 46 (2015ApJ...830...1F)
- Fulton, B.J. et al. (2015b); KELT-8b: A Highly Inflated Transiting Hot Jupiter and a New Technique for Extracting Highprecision Radial Velocities from Noisy Spectra, ApJ, 810, 30 (2015ApJ...810...30F)
- Fulton, B.J. et al. (2015a); Three Planets Orbing HD 7924, ApJ, 805, 175 (2015ApJ...805..175F)
- Fulton, B.J. et al. (2014); A Search for Planetary Eclipses of White Dwarfs in the Pan-STARRS1 Medium-deep Fields, ApJ, 796, 114 (2014ApJ...796..114F)
- Fulton, B. J. et al. (2013); The Stellar Obliquity and the Long-period planet in the HAT-P-17 Exoplanetary System, ApJ, 772, 80 (2013ApJ...772...80F)
- Fulton, B. J. et al (2011); Long-term Transit Timing Monitoring and Refined Light Curve Parameters of HAT-P-13b, 2011, AJ, 142, 84 (2011AJ...142...84F)

Significant Contributions

- Howard, A. W., and Fulton, B. J. (2016); Limits on Planetary Companions from Doppler Surveys of Nearby Stars, PASP, 128, 969, (2016PASP..128k4401H) Performed all analysis, produced all plots, and wrote most of the methods section
- Street, R. A., Fulton, B. J. et al (2015); Extended Baseline Photometry of Rapidly Changing Weather Patterns on the Brown Dwarf Binary Luhman-16, ApJ, 812, 161, (2015ApJ...812..161S) Extracted the photometry in an initial reduction (the photometry was eventually superseded in the referee process)
- Knutson, H., Fulton, B. J. et al (2014); Friends of Hot Jupiters. I. A Radial Velocity Search for Massive, Long-period Companions to Close-in Gas Giant Planets, ApJ, 785, 126, (2014ApJ...785..126K) – Performed all radial velocity analysis, and wrote some of the methods section
- Sinukoff, E.; Fulton, B. J.; Scuderi, L.; Gaidos, E. (2013); Below One Earth The Detection, Formation, and Properties of Subterrestrial Worlds, Space Science Reviews, 10.1007 (http://dx.doi.org/10.1007/s11214-013-0019-1) – Performed analysis and wrote text for one of the major sections of the paper involving Kepler photometry

High Impact Journals

- Gaudi, B. S. et al. (2017); A giant planet undergoing extreme-ultraviolet irradiation by its hot massive-star host, Nature, Volume 546, Issue 7659, pp. 514-518 (2017Natur.546..514G)
- Howard, A. W. et al. (2013); A rocky composition for an Earth-sized exoplanet, Nature, Volume 503, Issue 7476, pp. 381-384 (2013Natur.503..381H)
- Nugent, P., et al. (2011); Supernova SN 2011fe from an exploding carbon-oxygen white dwarf star, Nature, Volume 480, Issue 7377, pp. 344-347 (2011Natur.480..344N)

Other Publications

- Grunblatt et al. (2017); Seeing Double with K2: Testing Re-inflation with Two Remarkably Similar Planets around Red Giant Branch Stars, AJ, 154, 254 (2017AJ....154..254G)
- Dressing et al. (2017); Characterizing K2 Candidate Planetary Systems Orbiting Low-mass Stars. II. Planetary Systems
 Observed During Campaigns 1–7, AJ, 154, 207 (2017AJ...154..207D)
- Lund et al. (2017); KELT-20b: A Giant Planet with a Period of P ~ 3.5 days Transiting the V ~ 7.6 Early A Star HD 185603, AJ, 154, 194 (2017AJ....154..194L)
- Shporer et al. (2017); K2-114b and K2-115b: Two Transiting Warm Jupiters, AJ, 154, 188 (2017AJ....154..188S)
- Shporer et al. (2017); Three Statistically Validated K2 Transiting Warm Jupiter Exoplanets Confirmed as Low-mass Stars, ApJ, 847, 18 (2017ApJ...847L...18S)
- Christiansen et al. (2017); Three's Company: An Additional Non-transiting Super-Earth in the Bright HD 3167 System, and Masses for All Three, AJ, 154, 122 (2017AJ....154..122C)
- Johnson et al. (2017); The California-Kepler Survey. II. Precise Physical Properties of 2025 Kepler Planets and Their Host Stars, AJ, 154, 108 (2017AJ....154..108J)
- Petigura et al. (2017); The California-Kepler Survey. I. High-resolution Spectroscopy of 1305 Stars Hosting Kepler Transiting Planets, AJ, 154, 107 (2017AJ....154..107P)
- Sinukoff, E., et al. (2017); K2-66b and K2-106b: Two Extremely Hot Sub-Neptune-size Planets with High Densities, AJ, 153, 271 (2017AJ....153..271S)
- Weiss, L., et al. (2017); New Insights on Planet Formation in WASP-47 from a Simultaneous Analysis of Radial Velocities and Transit Timing Variations, AJ, 153, 265 (2017AJ....153..265W)
- McLeod, K., et al. (2017); KELT-18b: Puffy Planet, Hot Host, Probably Perturbed, AJ, 153, 263 (2017AJ....153..263M)
- Crossfield, I., et al. (2017); Two Small Transiting Planets and a Possible Third Body Orbiting HD 106315, AJ, 153, 255 (2017AJ....153..255C)
- Rappaport, S., et al. (2017); EPIC 220204960: A Quadruple Star System Containing Two Strongly Interacting Eclipsing Binaries, MNRAS, 467, 2 (2017MNRAS, 467, 2160R)
- Zheng, W., et al. (2017); Discovery and Follow-up Observations of the Young Type Ia Supernova 2016coj, ApJ, 841, 64Z (2017ApJ...841...64Z)
- Pepper, J., et al. (2017); KELT-11b: A Highly Inflated Sub-Saturn Exoplanet Transiting the V = 8 Subgiant HD 93396, AJ, 153, 215 (2017AJ....153...215P)
- Zhou, G., et al. (2017); HAT-P-67b: An Extremely Low Density Saturn Transiting an F-subgiant Confirmed via Doppler Tomography, AJ, 153, 211 (2017AJ....153..211Z)
- Stevens, D., et al. (2017); KELT-12b: A P~5 day, Highly Inflated Hot Jupiter Transiting a Mildly Evolved Hot Star, AJ, 153, 178 (2017AJ...153..178S)
- Petigura, E., et al. (2017); Four Sub-Saturns with Dissimilar Densities: Windows into Planetary Cores and Envelopes, AJ, 153, 142 (2017AJ....153..142P)
- Oberst, T., et al. (2017); KELT-16b: A Highly Irradiated, Ultra-short Period Hot Jupiter Nearing Tidal Disruption, AJ, 153, 97 (2017AJ....153...97O)
- De Wit, J., et al. (2017); Planet-induced Stellar Pulsations in HAT-P-2's Eccentric System, ApJ, 836, 17 (2017ApJ...836L..17D)
- David, T., et al. (2017); A Transient Transit Signature Associated with the Young Star RIK-210, ApJ, 835, 168 (2017ApJ...835..168D)
- Sinukoff, E., et al. (2017); Mass Constraints of the WASP-47 Planetary System from Radial Velocities, AJ, 153, 70 (2017AJ....153...70S)
- Rappaport, S., et al. (2017); EPIC 220204960: A Quadruple Star System Containing Two Strongly Interacting Eclipsing Binaries, MNRAS (2017MNRAS.tmp..145R)
- Bayliss, D., et al. (2017); EPIC 201702477b: A Transiting Brown Dwarf from K2 in a 41 day Orbit, AJ, 153, 15 (2017AJ....153...15B)
- Samuel, K., et al. (2016); K2-97b: A (Re-?)Inflated Planet Orbiting a Red Giant Star, AJ, 152, 185 (2016AJ....152..185G)
- Hartman, J., et al. (2016); HAT-P-65b and HAT-P-66b: Two Transiting Inflated Hot Jupiters and Observational Evidence for the Reinflation of Close-in Giant Planets, AJ, 152, 182 (2016AJ....152..182H)
- Zhou, G., et al. (2016); KELT-17b: A Hot-Jupiter Transiting an A-star in a Misaligned Orbit Detected with Doppler Tomography, AJ, 152, 136 (2016AJ....152..136Z)
- Crossfield, I. J., et al. (2016); 197 Candidates and 104 Validated Planets in K2's First Five Fields, ApJS, 226, 7 (2016ApJS..226...7C)
- Sinukoff, E. et al. (2016); Eleven Multiplanet Systems from K2 Campaigns 1 and 2 and the Masses of Two Hot Super-Earths, ApJ, 827, 78 (2016ApJ...827...78S)
- Ciceri, S. et al. (2016); HATS-15b and HATS-16b: Two Massive Planets Transiting Old G Dwarf Stars, PASP, 128, 4401 (2016PASP..128q4401C)
- Wong, I. et al. (2016); 3.6 and 4.5 µm Spitzer Phase Curves of the Highly Irradiated Hot Jupiters WASP-19b and HAT-P-7b, ApJ, 823, 122 (2016ApJ...823..122W)

- Bryan, M. L. et al. (2016); Statistics of Long Period Gas Giant Planets in Known Planetary Systems, ApJ, 821, 89 (2016ApJ...821...89B)
- Buhler, P. B. et al. (2016); Dynamical Constraints on the Core Mass of Hot Jupiter HAT-P-13b, ApJ, 821, 26 (2016ApJ...821...26B)
- Weiss, L. et al. (2016); Revised Masses and Densities of the Planets around Kepler-10, ApJ, 819, 83 (2016ApJ...819...83W)
- Kirk, B. et al. (2016); Kepler Eclipsing Binary Stars. VII. The Catalog of Eclipsing Binaries Found in the Entire Kepler Data Set, AJ, 151, 68 (2016AJ...151...68K)
- Schlieder, J. E. et al. (2016); Two Small Temperate Planets Transiting Nearby M Dwarfs in K2 Campaigns 0 and 1, ApJ, 818, 87 (2016ApJ...818...87S)
- Petigura, E. A. et al. (2016); Two Transiting Low Density Sub-Saturns from K2, ApJ, 818, 36 (2016ApJ...818...36P)
- Eastman, J. D. et al. (2016); KELT-4Ab: An Inflated Hot Jupiter Transiting the Bright (V~10) Component of a Hierarchical Triple, AJ, 151, 45 (2016AJ...151...45E)
- Hartman, J. D. et al. (2015); HAT-P-50b, HAT-P-51b, HAT-P-52b, and HAT-P-53b: Three Transiting Hot Jupiters and a Transiting Hot Saturn From the HATNet Survey, AJ, 150, 168 (2015AJ....150..168H)
- Zhou, G. et al. (2015); A High Obliquity Orbit for the Hot-Jupiter HATS-14b Transiting a 5400K Star, ApJ, 814, 16 (2015ApJ...814L..16Z)
- Bakos, G. A. et al. (2015); HATS-7b: A Hot Super Neptune Transiting a Quiet K Dwarf Star, ApJ, 813, 111 (2015ApJ...813...111B)
- Wong, I. et al. (2015); 3.6 and 4.5 μm Phase Curves of the Highly Irradiated Eccentric Hot Jupiter WASP-14b, ApJ, 811, 122 (2015ApJ...811..122W)
- Kammer, J. A. et al. (2015); Spitzer Secondary Eclipse Observations of Five Cool Gas Giant Planets and Empirical Trends in Cool Planet Emission Spectra, ApJ, 810, 118 (2015ApJ...810...118K)
- Bayliss, D. et al. (2015); HATS-8b: A Low-density Transiting Super-Neptune, AJ, 150, 49 (2015AJ....150...49B)
- Bieryla, A. et al. (2015); KELT-7b: A Hot Jupiter Transiting a Bright V = 8.54 Rapidly Rotating F-star, AJ, 150, 12 (2015AJ....150...12B)
- Demming, D. et al. (2015); Spitzer Secondary Eclipses of the Dense, Modestly-irradiated, Giant Exoplanet HAT-P-20b Using Pixel-level Decorrelation, ApJ, 805, 132 (2015ApJ...805..132D)
- Ruprecht, J. D. et al. (2015); 29 November 2011 stellar occultation by 2060 Chiron: Symmetric jet-like features, Icarus, 252, 271 (2015Icar..252..271R)
- Crossfield, I. J. M. et al. (2015); A Nearby M Star with Three Transiting Super-Earths Discovered by K2, ApJ, 804, 10 (2015ApJ...804...10C)
- Graham, M. L. et al. (2015); Time-Varying Potassium in High-Resolution Spectra of the Type Ia Supernova 2014j, ApJ, 801, 136 (2015ApJ...801...136G)
- Zhao, Ming et al. (2014); Characterization of the Atmosphere of the Hot Jupiter HAT-P-32Ab and the M-dwarf Companion HAT-P-32B, ApJ, 796, 115 (2014ApJ...796..115Z)
- Wong, lan et al. (2014); Constraints on the Atmospheric Circulation and Variability of the Eccentric Hot Jupiter XO-3b, ApJ, 794, 134 (2014ApJ...794..134W)
- Biddle, Lauren I. et al. (2014); Warm ice giant GJ 3470b II. Revised planetary and stellar parameters from optical to near-infrared transit photometry, MNRAS, 443, 1810 (2014MNRAS, 443, 1810B)
- Hartman, J. D. et al. (2014); HAT-P-44b, HAT-P-45b, and HAT-P-46b: Three Transiting Hot Jupiters in Possible Multi-planet Systems, ApJ, 791, 89 (2014AJ....147...128H)
- Gaidos, E. et al. (2014); Trawling for transits in a sea of noise: a search for exoplanets by analysis of WASP optical light curves and follow-up (SEAWOLF), MNRAS, 437, 3133 (2014MNRAS.437.3133G)
- Bryan, Marta L. et al. (2014); Erratum: "Qatar-2: A K Dwarf Orbited by a Transiting Hot Jupiter and a More Massive Companion in an Outer Orbit", ApJ, 782, 121, (2014ApJ...782..121B)
- Collins, Karen A. et al. (2014); KELT-6b: A P ~ 7.9 Day Hot Saturn Transiting a Metal-poor Star with a Long-period Companion, AJ, 147, 39 (2014AJ...147...39C)
- Brown, T. M. et al. (2013); Las Cumbres Observatory Global Telescope Network, PASP, 125, 931 (2013PASP..125.1031B)
- Hartman, J. D. et al. (2013); HAT-P-44b, HAT-P-45b, and HAT-P-46b: Three Transiting Hot Jupiters in Possible Multi-Planet Systems, arXiv1308.2937 (2013arXiv1308.2937H, submitted to AJ)
- Collins, K. A. et al. (2013); KELT-6b: A P~7.9 d Hot Saturn Transiting a Metal-Poor Star with a Long-Period Companion, arXiv1308.2296 (2013arXiv1308.2296C, submitted to AJ)
- Quintana, E. V. et al. (2013); Confirmation of Hot Jupiter Kepler-41b via Phase Curve Analysis, arXiv1303.0858 (2013arXiv1303.0858Q, Accepted to ApJ)
- Steinfadt, J. D. et al. (2012); A Search for Pulsations in Helium White Dwarfs, 2012 PASP, 124, 911 (2012PASP..124....1S)
- Boisse, I. et al. (2012); HAT-P-42b and HAT-P-43b. Two Inflated Transiting Hot Jupiters from the HATNet Survey, A&A 558, A86 (2013A&A...558A..86B)
- Siverd, R., et al. (2012); KELT-1b: A Strongly Irradiated, Highly Inflated, Short Period, 27 Jupiter-mass Companion Transiting a Mid-F Star, ApJ, 761, 123 (2012ApJ...761..123S)

- Barclay, T. et al. (2012); Photometrically Derived Masses and Radii of the Planet and Star in the TrES-2 System, ApJ, 761, 53 (2012ApJ...761...53B)
- Maguire, K. et al. (2012); Hubble Space Telescope studies of low-redshift Type Ia supernovae: evolution with redshift and ultraviolet spectral trends, MNRAS, 426, 2359 (2012MNRAS.426.2359M)
- Pepper, J. et al. (2012); KELT-3b: A Hot Jupiter Transiting a V=9.8 Late-F Star, ApJ, 773, 64, (2013ApJ...773...64P)
- Hartman, J.D., et al. (2012); HAT-P-39b-HAT-P-41b: Three Highly Inflated Transiting Hot Jupiters, AJ, 144, 139 (2012AJ....144..139H)
- Law, N. et al. (2012); Three New Eclipsing White-dwarf-M-dwarf Binaries Discovered in a Search for Transiting Planets around M-dwarfs, ApJL, 757, 133 (2012ApJ...757..133L)
- Beatty, T. et al. (2012); KELT-2Ab: A Hot Jupiter Transiting the Bright (V = 8.77) Primary Star of a Binary System, ApJ, 756, 39 (2012ApJ...756L..39B)
- van Eyken, J. et al. 2012; The PTF Orion Project: A Possible Planet Transiting a T-Tauri Star, ApJ, 755, 42 (2012ApJ...755...42V)
- Bryan, M. et al. (2011); Qatar-2: A K Dwarf Orbited by a Transiting Hot Jupiter and a More Massive Companion in an Outer Orbit, ApJ, 750, 84 (2012ApJ...750...84B)
- Arcavi, I. et al. (2011); SN 2011dh: Discovery of a Type IIb Supernova from a Compact Progenitor in the Nearby Galaxy M51, ApJL, 742, L18 (2011ApJ...742L..18A)
- Levitan, D. et al. (2011); PTF1 J071912.13+485834.0: An Outbursting AM CVn System Discovered by a Synoptic Survey, ApJ, 739, 68 (2011ApJ...739...68L)
- Shporer, A. et al. (2010); Ground-based Multisite Observations of Two Transits of HD 80606b, ApJ, 722, 880 (2010ApJ...722..880S)

Invited Talks

- Panelist on occurrence rate panel at the 2017 ExoPAG16 meeting
- FLASH seminar speaker at the University of California at Santa Cruz (2017)
- Seminar speaker at the Center for Habitable Worlds at Penn State University (2016)
- Public talk at a conference of The American Congress of Obstetricians and Gynecologists (2013)

Conferences and Meetings

- Co-Chair of "observing strategy" breakout session at the Extremely Precise Radial Velocities III conference at Penn State
- Poster at the Extremely Precise Radial Velocities III conference at Penn State
- Contributed talk at the Kepler & K2 SciCon IV (2017)
- Contributed talk at the 2017 Aspen Winter Conference: Formation and Dynamical Evolution of Exoplanets
- Poster at the Exoplanets I conference in Davos, Switzerland (2016)
- Poster at the Extreme Solar Systems III conference in Waikaloa, HI (2015)
- Poster at the Sagan Workshop in Pasadena, CA (2015)
- Poster at the Extreme Precision Radial Velocity workshop in New Haven, CT (2015)
- Poster at the Toward Other Earths II conference in Porto, Potugal (2014)
- Poster at the Sagan Workshop in Pasadena, CA (2014)
- Poster at the Exoplanetary Science conference in Quy Nhon, Vietnam (2014)
- Poster at the Kepler Science Conference II in Mountain View, CA (2013)
- Poster at the American Astronomical Society Winter Meeting in Long Beach, CA (2013)

Work History

Texaco Postdoctoral Fellow California Institute of Technology August 2017 – present

National Science FoundationInstitute for Astronomy,August 2014 – August 2017Graduate Research FellowUniversity of Hawaii

Graduate Research Assistant Institute for Astronomy,
University of Hawaii August 2012 – August 2014

Research Associate (Astronomy) LCOGT, Goleta, CA March 2009 - August 2012

Hobbies and Interests

• Auto racing – SCCA Hawaii Region Solo class champion 2016

 Digital photography, including astrophotography (Astronomy Picture of the Day, 2011/08/26 http://apod.nasa.gov/apod/ap110826.html)

Amateur astronomy