LSST Science Collaborations Status + current activities

PST-SC chairs meeting
October 24, 2018

Solar System SC

Co-Chairs: Meg Schwamb (Gemini Observatory)
David Trilling (NAU)

Update presented by Colin Snodgrass
(University of Edinburgh/
Royal Observatory Edinburgh)

)

@lsstsssc

LSST and the Solar System Workshop

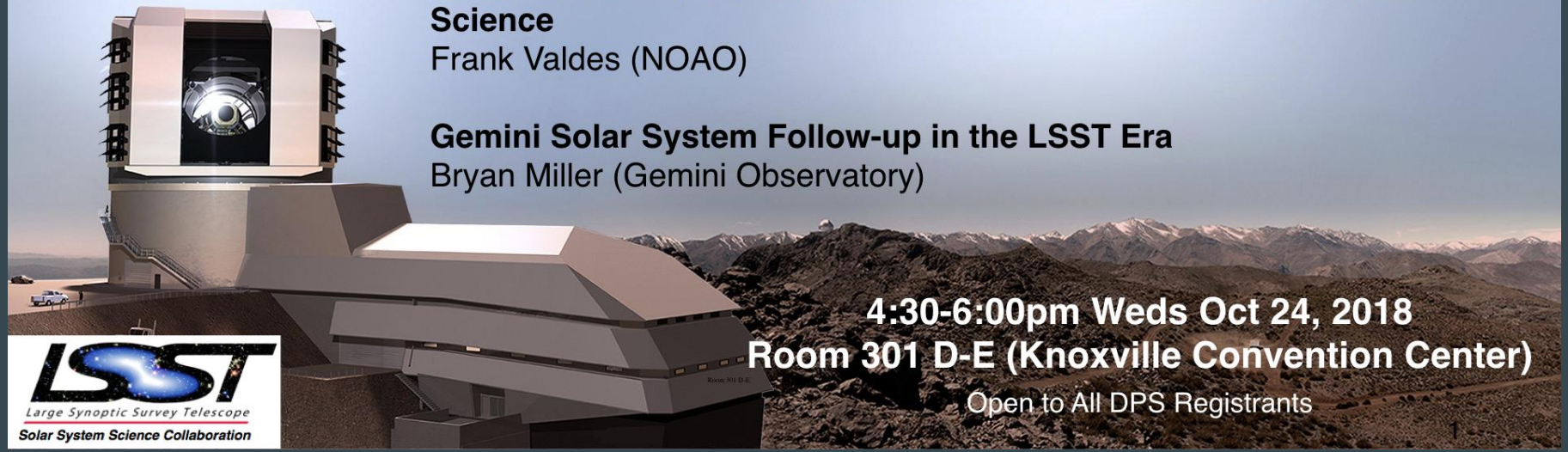
(Happening now: SSSC organized workshop at DPS 50 - why the SSSC Co-chairs are not on this call)

LSST Project & Solar System Data Status Update
Mario Jurić (University of Washington/LSST) &
Siegfried Eggl (University of Washington/LSST)

LSST Solar System Science Collaboration (SSSC) Update
Meg Schwamb (Gemini Observatory) & David Trilling (NAU)

NOAO Data Lab Capabilities in Support of (LSST) Solar System Science
Frank Valdes (NOAO)

Gemini Solar System Follow-up in the LSST Era
Bryan Miller (Gemini Observatory)



LSST
Large Synoptic Survey Telescope
Solar System Science Collaboration

4:30-6:00pm Weds Oct 24, 2018
Room 301 D-E (Knoxville Convention Center)
Open to All DPS Registrants

LARGE SYNOPTIC SURVEY TELESCOPE SOLAR SYSTEM SCIENCE ROADMAP

Megan E. Schwamb,[1] R. Lynne Jones,[2] Steven R. Chesley,[3] Alan Fitzsimmons,[4] Wesley C. Fraser,[4] Matthew J. Holman,[5] Henry Hsieh,[6] Darin Ragozzine,[7] Cristina A. Thomas,[6,8] David E. Trilling,[8] and Michael E. Brown[9]
on behalf of the LSST Solar System Science Collaboration

https://arxiv.org/abs/1802.01783

[1] *Gemini Observatory, Northern Operations Center, 670 North A'ohoku Place, Hilo, HI 96720, USA*
[2] *Department of Astronomy, University of Washington, 3910 15th Ave NE, Seattle, WA 98195, USA*
[3] *Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA, 91109, USA*
[4] *Astrophysics Research Centre, Queen's University Belfast, Belfast BT7 1NN, UK*
[5] *Harvard-Smithsonian Center for Astrophysics, 60 Garden St., MS 51, Cambridge, MA 02138, USA*
[6] *Planetary Science Institute, 1700 East Fort Lowell Road, Suite 106, Tucson, AZ 85719, USA*
[7] *Brigham Young University, Department of Physics and Astronomy, N283 ESC, Provo, UT 84602, USA*
[8] *Department of Physics and Astronomy, Northern Arizona University, P.O. Box 6010, Flagstaff, AZ 86011, USA*
[9] *Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, CA 91125, USA*

(Published February 2, 2018 - Version 1.0)

ABSTRACT

The Large Synoptic Survey Telescope (LSST) is uniquely equipped to search for Solar System bodies due to its unprecedented combination of depth and wide field coverage. Over a ten-year period starting in 2022, LSST will generate the largest catalog of Solar System objects to date. The main goal of the LSST Solar System Science Collaboration (SSSC) is to facilitate the efforts of the planetary community to study the planets and small body populations residing within our Solar System using LSST data. To prepare for future survey cadence decisions and ensure that interesting and novel Solar System science is achievable with LSST, the SSSC has identified and prioritized key Solar System research areas for investigation with LSST in this roadmap. The ranked science priorities highlighted in this living document will inform LSST survey cadence decisions and aid in identifying software tools and pipelines needed to be developed by the planetary community as added value products and resources before the planned start of LSST science operations.

How do we achieve our LSST Solar System Science Roadmap?
Leads to the LSST Solar System Software Roadmap Effort

Draft expected by end of the month. Final version by end of 2018/early 2019

Image credit: bahahamelly - flickr - https://www.flickr.com/photos/bahahamelly/14900306241/

Collaboration Publication Policy

Committee Formed to Draft and Brainstorm Policy Based on Past SSSC Feedback

Draft Policy expected by end of the month. Final version by end of 2018/early 2019

Image credit: - flickr - https://coffee-channel.com

Current Cadence Optimization White Paper Efforts

1. Deep Drilling Fields (Lead: David Trilling)
2. Northern Ecliptic Spur (Lead: Meg Schwamb)
3. Twilight Survey (Lead: Rob Seaman)
4. Additional white papers ideas that may be explored: Should there be a white paper about 1 versus 2 snaps at each observation or discovery/recovery filter choice?

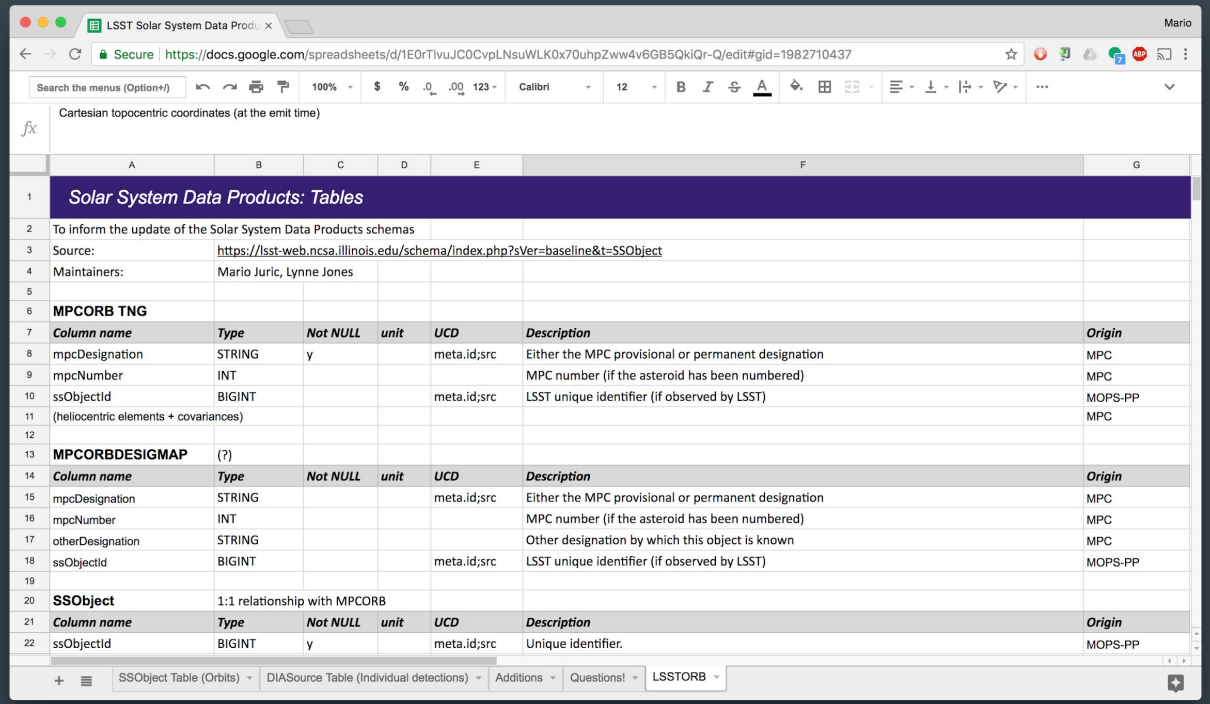
First LSST Solar System Readiness Sprint

July 10-12, 2018

University of Washington, Seattle WA

Readiness Sprint Outcome: Solar System Data Products Updates

- SSSC members+Minor Planet Center representatives updated the schema (data model) for the LSST Solar System Data Products in July.
- Final SSSC feedback given to - now have a finalized schema to go into commissioning with.



Review the new schema at: http://ls.st/j7f

Slide Adapted from Mario Jurić

2nd LSST Solar System Readiness Sprint

June 4-6, 2019
Chicago, IL

ADLER PLANETARIUM

THE PLANETARY SOCIETY

Image credit: - Chris Smith - flickr

LSST Large Synoptic Survey Telescope
Solar System Science Collaboration

AGN SC

Neil Brandt (Penn State)

The LSST AGN Science Collaboration

The LSST AGN Science Collaboration currently has ~ 50 members. New members welcome!

Presently working as a loose confederation, but *hope* to become a hard-core collaboration in the future as LSST construction proceeds.

Given funding constraints, basic plan is to "bootstrap" our way along: e.g., Deep Fields and Stripe 82 - Pan-STARRS - DES - HSC – LSST.

Also gathering key multiwavelength data in DDFs.

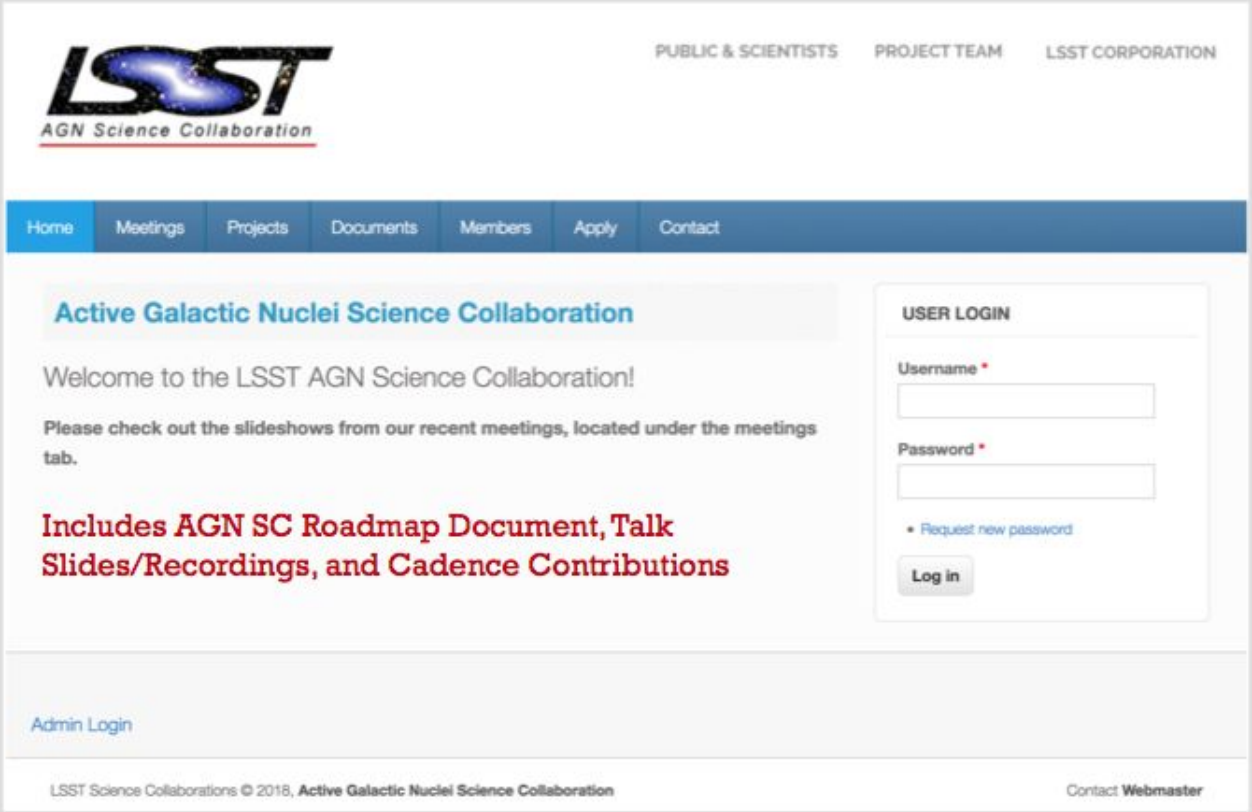
A huge amount of work is needed including on basic AGN selection, analysis of LSST simulations, detailed science planning, and pooling of observational resources.

Feedback welcome at lsst-agn@lsstcorp.org

LSST AGN SC Members

Scott Anderson (Univ Washington)
Roberto Assef (Univ Diego Portales)
David Ballantyne (GA Tech)
Aaron Barth (UC-Irvine)
Franz Bauer (Pont Univ Catolica)
Niel Brandt (Penn State)
Mike Brotherton (Univ Wyoming)
Robert Brunner (Univ Illinois)
George Chartas (College of Charleston)
Claudia Cicone (INAF - Osservatorio Astronomico di Brera)
Paolo Coppi (Yale Univ)
Jorge Cuadra (Pont Catholic Univ)
Wim de Vries (LLNL)
Mike Eracleous (Penn State)
Andres Escala (Univ de Chile)
Xiaohui Fan (Univ Arizona)
Rob Gibson (SimpliVity Corporation)
Alex Gray (GA Tech)
Richard Green (LBTO)
Sebastian Hoenig (Southampton)
Matt Jarvis (Oxford)
Yan-Fei Jiang (UCSB)
Amy Kimball (NRAO, Socorro)
Mark Lacy (NRAO, Charlottesville)
Marco Landoni (INAF - Istituto Nazionale di Astrofisica)
Andy Lawrence (ROE)
Paulina Lira (Univ de Chile)
Chelsea MacLeod (CfA)
Greg Madejski (SLAC)
Ian McGreer (Univ Arizona)
Richard McMahon (Cambridge IoA)
Alberto Moretti (INAF - Osservatorio Astronomico di Brera)
Carole Mundell (Univ Bath)
Jeffrey Newman (Univ Pitt)
Qingling Ni (Penn State)
Tina Peters (Univ Toronto)
Luka Popovic (Ast Obs Belgrade)
Gordon Richards (Drexel Univ)
Jessie Runnoe (Univ Michigan)
Jan-Torge Schindler (Univ Arizona)
Don Schneider (Penn State)
Anil Seth (Univ Utah)
Ohad Shemmer (Univ North Texas)
Howard Smith (Harvard/Smithsonian CfA)
Katrien Steenbrugge (Univ Catolica del Norte)
Michael Strauss (Princeton Univ)
Ezequiel Treister (Univ Concepcion)
Laura Trouille (Adler/Northwestern)
Meg Urry (Yale Univ)
Dan Vanden Berk (St Vincent College)
Guang Yang (Penn State)

The LSST AGN SC Web Site



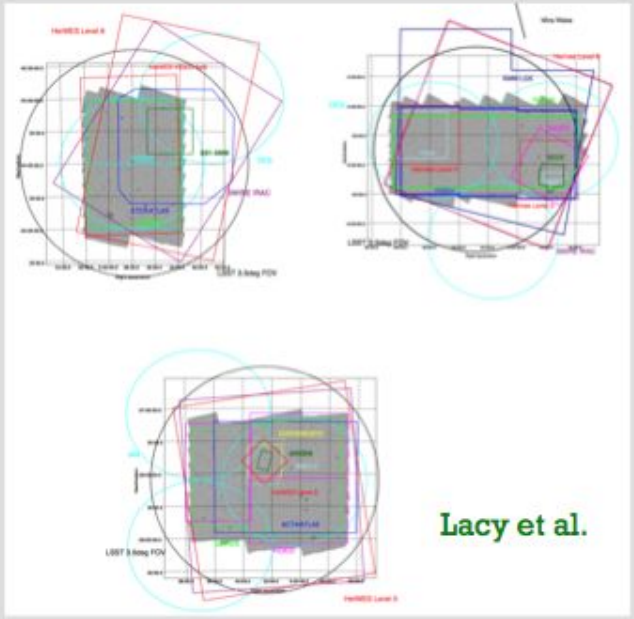
Spitzer DEEPDRILL Survey

Spitzer Space Telescope — General Observer Proposal #11086.

A warm Spitzer survey of the LSST/DES "Deep drilling" fields

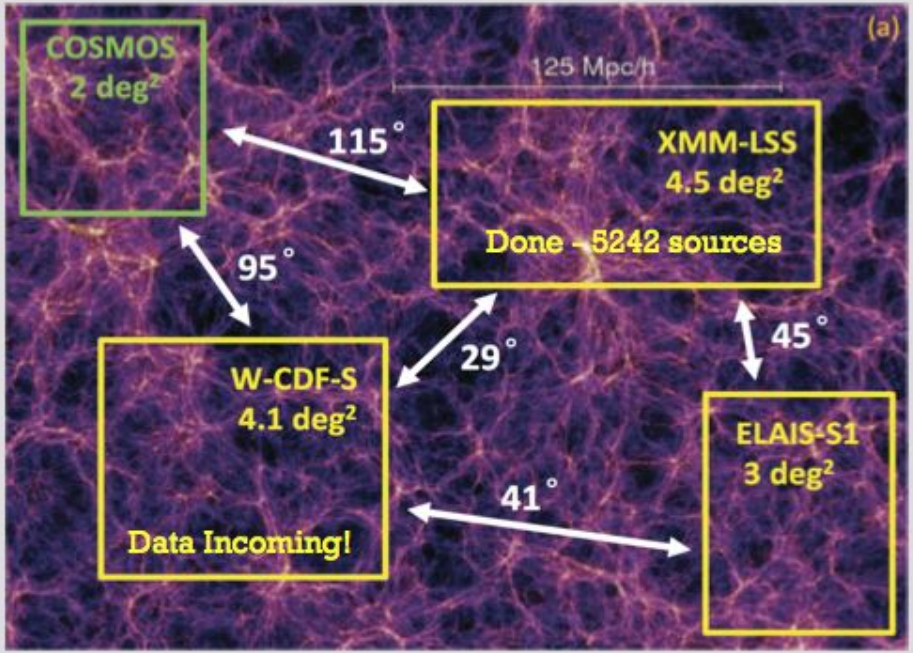
Principal Investigator: Mark Lacy
Institution: National Radio Astronomy Observatory (NRAO)
Electronic mail: mlacy@nrao.edu
Technical Contact: Mark Lacy, National Radio Astronomy Observatory (NRAO)
Co-Investigators: Duncan Farrah, Virginia Tech
Niel Brandt, Penn State
Masao Sako, U Penn
Gordon Richards, Drexel
Ray Norris, CSIRO/Macquarie University
Susan Ridgway, NOAO
Jose Afonso, Lisbon
Robert Brunner, Illinois
Dave Clements, Imperial College et al.

Abstract:
We propose a warm Spitzer survey to microJy depth of the four predefined Deep Drilling Fields (DDFs) for the Large Synoptic Survey Telescope (LSST) (three of which are also deep drilling fields for the Dark Energy Survey (DES)). Imaging these fields with warm Spitzer is a key component of the overall success of these projects, that address the "Physics of the Universe" theme of the Astro2010 decadal survey. With deep, accurate, near-infrared photometry from Spitzer in the DDFs, we will generate photometric redshift distributions to apply to the surveys as a whole. The DDFs are also the areas where the supernova searches of DES and LSST are concentrated, and deep Spitzer data is essential to obtain photometric redshifts, stellar masses and constraints on ages and metallicities for the >10000 supernova host galaxies these surveys will find. This "DEEPDRILL" survey will also address the "Cosmic Dawn" goal of Astro2010 through being deep enough to find all the >10^11 solar mass galaxies within the survey area out to $z\sim6$. DEEPDRILL will complete the final 24.4 square degrees of imaging in the DDFs, which, when added to the 14 square degrees already imaged to this depth, will map a volume of 1-Gpc^3 at $z>2$. It will find ~100 > 10^11 solar mass galaxies at $z\sim5$ and ~40 protoclusters at $z>2$, providing targets for JWST that can be found in no other way. The Spitzer data, in conjunction with the multiwavelength surveys in these fields, ranging from X-ray through far-infrared and cm-radio, will comprise a unique legacy dataset for studies of galaxy evolution.



Lacy et al.

5 Ms XMM-SERVS: X-ray Coverage of the Deep-Drilling Fields



Chen et al. (2018)

Ni et al.

Study SMBH growth across the full range of cosmic environments – voids to massive clusters.

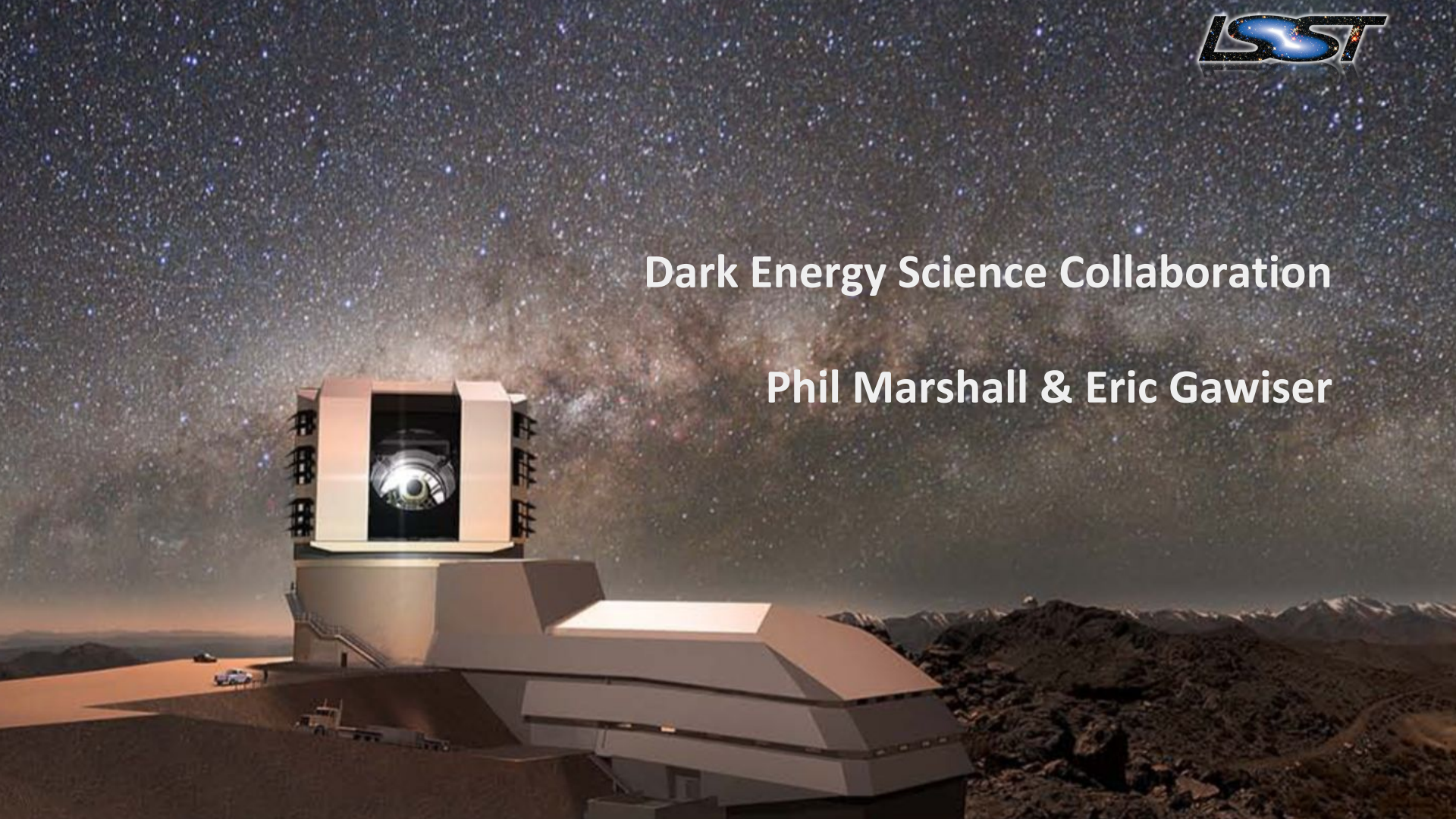
At 50 ks XMM-Newton depth, expect 12,000 AGNs and 760 X-ray groups/clusters. Will provide ground-truth AGN sample to calibrate LSST AGN selection.

Incredible legacy value. ATLAS, MIGHTEE - HerMES, SERVS, VIDEO, VEILS, Euclid - DES, HSC, LSST - PRIMUS, CSI, DEVILS, MOONS, PFS.

AGN Inputs into LSST Cadence

W.N. Brandt	AGN	AGN Science in the LSST DDFs	DDF	Goal is to state the needed total DDF exposures and needed DDF cadences for strong AGN studies. Drivers include SDSS-V/4MOST reverberation mapping, photometric reverberation mapping, and SMBH transient phenomena
G.T. Richards	AGN	LSST Rolling Cadence Optimized for AGN Science	WFD	Goal is to explore what rolling cadence choices would work well/acceptably for variable AGN science in WFD
G.T. Richards	AGN	Twilight Survey at Large Airmass	Twilight	Goal is to investigate the benefits to photo-z of a twilight survey in the g-band at large airmass, levering the effect of differential chromatic refraction. See https://arxiv.org/abs/0904.3909 3

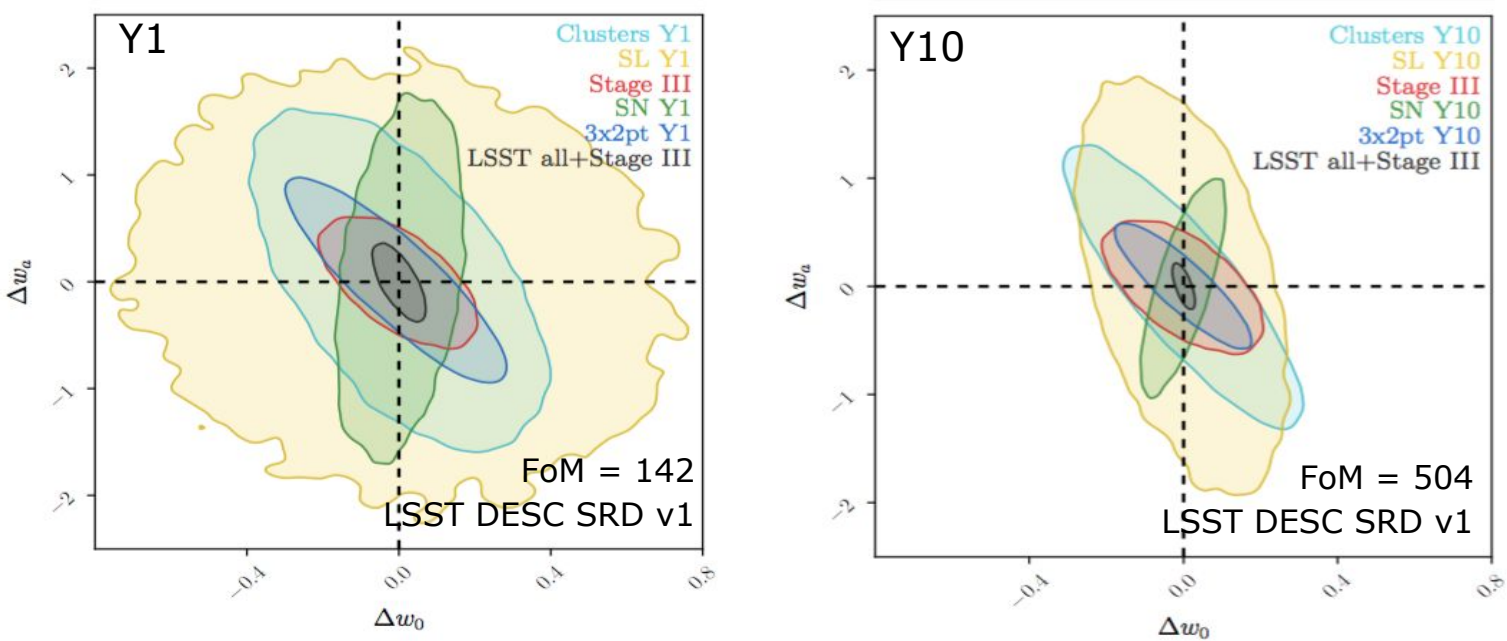
Brandt already has ~ 15 solid pages written and is coordinating productively with the DESC on a joint cadence solution for the DDFs.



Dark Energy Science Collaboration

Phil Marshall & Eric Gawiser

LSST DESC SRD v1



Forecasted 68% credible regions on (w_0, w_a) for individual probes and their combination after 10% (Y1, left) and all (Y10, right) LSST data is analyzed. (LSST DESC SRD v1, https://arxiv.org/abs/1809.01669)

LSST DESC SRD v1

We now have a science requirements document, to support our analysis pipeline development by defining what success looks like.

High-level requirement RH1: DESC dark energy probes will achieve a combined FoM exceeding 500 (∼10× Stage-II) with the full LSST Y10 dataset when including both statistical and systematic uncertainties and using Stage III priors.

Assume data meets LSST SRD, plausible follow-up, then do error budgeting, forecasting, iteration...

Detailed requirement WL4 (Y10): Systematic uncertainty in the PSF model size defined using the trace of the second moment matrix shall not exceed 0.1% in the Y10 DESC WL analysis.

"While the LSST SRD places explicit requirements on how well the PSF model shapes are known, it places no requirement on PSF model size (except the indirect and non-quantitative constraint that most algorithms that can accurately infer the PSF model shape also estimate the PSF model size fairly accurately)."

millimag supernova photometry

Detailed requirement SN1 (Y10): Systematic uncertainty in the $griz$-filter zero points shall not exceed 1 mmag in the Y10 DESC SN analysis. As the $griz$ requirements represent an ambitious improvement versus the LSST SRD (5 mmag in $griz$), an alternative way to meet this requirement is to improve our analysis methods for all probes until the LSST SRD requirement is sufficient.

Detailed requirement SN2 (Y10): Systematic uncertainty in the $griz$-filter mean wavelength shall not exceed 1 Å in the Y10 DESC SN analysis.

"Work that will enable the above requirements to be met occurs in several different contexts. The first two requirements in this subsection, SN1 (zero points) and SN2 (filter mean wavelengths), relate to aspects of photometric calibration that are driven by the LSST Project. These detailed requirements are more stringent than their counterparts in the LSST Project SRD; as indicated at the start of this subsection, by providing additional DESC resources and expertise, and working closely with the LSST Facility, we aspire to achieve, together, a more precise photometric calibration than the Facility is required *to produce on its own. Moreover, the DESC is actively pursuing research methods that might result in eventual loosening of the detailed requirements on photometric calibration."*

Observing Strategy White Papers

We are writing two papers, to be supported with journal articles, with the following recommendations:

- WFD:
  - Move footprint to lowest-extinction 18,000 deg^2 within -70<dec<+12.5
  - Seek spatial uniformity at Y1, Y10, and 2-3 intervals in between
  - Take visit pairs in different (neighboring) filters, with single snap (20-30s) per visit
  - Find strategies that reduce long (15-day) gaps between observations
  - Redistribute some *y*-band visits into *griz*
- DDFs:
  - Add a 5th field to match Euclid/WFIRST in/near the Akari Deep Field-South
  - Longer seasons (>6 months)
  - Uniform 2-3 day cadence in griz, favoring redder filters, but 1-day cadence in COSMOS
  - Add *u,y* in clumps to avoid harming *griz* cadence

PLAsTiCC

The Photometric LSST Astronomical Time-series Classification Challenge launched on Kaggle in September: https://www.kaggle.com/c/PLAsTiCC-2018

- A joint DESC + TVS project, it has attracted > 300 participants
- The dataset is interestingly realistic:
  - 8000-object training set for a 3.5 million object test set
  - Training set is not representative of the fainter test set

DESC and TVS composed and signed an “Inter-Collaboration Agreement” to support the publication of *joint* papers, eg

Malz et al (2018), https://arxiv.org/abs/1809.11145

PLAsTiCC

THE PHOTOMETRIC LSST ASTRONOMICAL TIME-SERIES CLASSIFICATION CHALLENGE (PLAsTiCC): SELECTION OF A PERFORMANCE METRIC FOR CLASSIFICATION PROBABILITIES BALANCING DIVERSE SCIENCE GOALS

A.I. Malz,[1,2] R. Hložek,[3,4] T. Allam Jr,[5] A. Bahmanyar,[4] R. Biswas,[6] M. Dai,[7] L. Galbany,[8] E.E.O. Ishida,[9] S.W. Jha,[7] D. Jones,[10] R. Kessler,[11] M. Lochner,[12,13] A.A. Mahabal,[14,15] K.S. Mandel,[16,17] J.R. Martínez-Galarza,[18] J.D. McEwen,[5] D. Muthukrishna,[16] G. Narayan,[19] H. Peiris,[6,20] C.M. Peters,[4] and C.N. Setzer[6]

(the LSST Dark Energy Science Collaboration and the LSST Transients and Variable Stars Science Collaboration)

DESC and TVS composed and signed an “Inter-Collaboration Agreement” to support the publication of *joint* papers, eg

Malz et al (2018), https://arxiv.org/abs/1809.11145

Google doc available on request, for template purposes!

DC2 Production and Analysis

We are attempting to scale up simulated image and DM Stack processing in our second data challenge:

- Run 2.0i (300 sq deg, up to 10 years, ugrizy) image simulation sprint in September gave us a functioning ImSim (GalSim) workflow, but growing pains with the input catalogs
- Processing of smaller test image sets Run 1.2p and 1.2i (25 sq deg, 5 years, ugrizy) is nearly done, but has taken us to the bleeding edge of the DM Stack development. We are working with our Project liaisons (now including Leanne Guy) to make sure this interaction is productive for LSST development

Starting to think about how we could release DC2 publicly (c. January 2020): it would make most sense to do this through the LSST Science Platform. This would need Project buy-in, but could help “commission” the LSP system.

Sprint Week

Now an annual event, 50 of us are in Edinburgh October 22-26 to work on a range of projects, including:

- DC2 validation and prototype analysis pipeline development
- Object table emulator design
- Photo-z code set-up at NERSC
- PLAsTiCC challenge entries

CMU, July 2018

This meeting, along with our July 2018 and February 2019 collaboration meetings, is supported by an LSSTC Enabling Science grant.

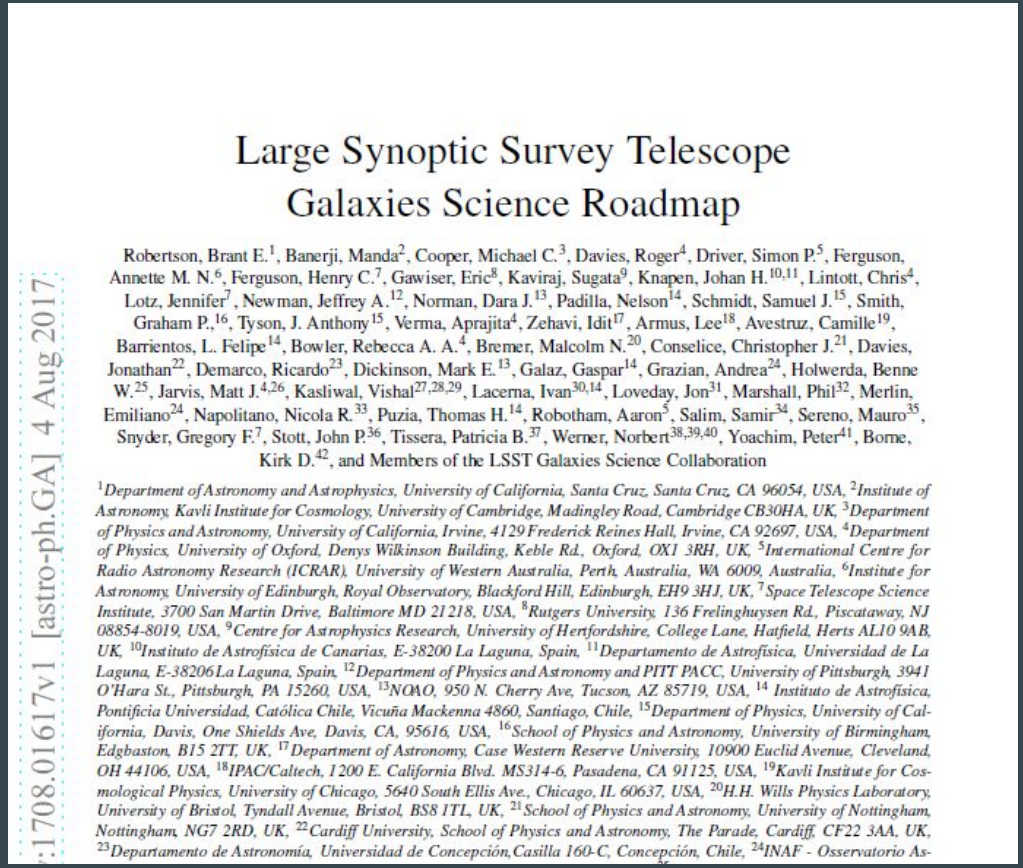
Will there be an LSSTC call for proposals this winter?

Galaxies SC

Sugata Kaviraj and Manda Banerji

Galaxies Science Roadmap

arXiv:1708.01617



Large Synoptic Survey Telescope
Galaxies Science Roadmap

Robertson, Brant E.[1], Banerji, Manda[2], Cooper, Michael C.[3], Davies, Roger[4], Driver, Simon P.[5], Ferguson, Annette M. N.[6], Ferguson, Henry C.[7], Gawiser, Eric[8], Kaviraj, Sugata[9], Knapen, Johan H.[10,11], Lintott, Chris[4], Lotz, Jennifer[7], Newman, Jeffrey A.[12], Norman, Dara J.[13], Padilla, Nelson[14], Schmidt, Samuel J.[15], Smith, Graham P.,[16], Tyson, J. Anthony[15], Verma, Aprajita[4], Zehavi, Idit[17], Armus, Lee[18], Avestruz, Camille[19], Barrientos, L. Felipe[14], Bowler, Rebecca A. A.[4], Bremer, Malcolm N.[20], Conselice, Christopher J.[21], Davies, Jonathan[22], Demarco, Ricardo[23], Dickinson, Mark E.[13], Galaz, Gaspar[14], Grazian, Andrea[24], Holwerda, Benne W.[25], Jarvis, Matt J.[4,26], Kasliwal, Vishal[27,28,29], Lacerna, Ivan[30,14], Loveday, Jon[31], Marshall, Phil[32], Merlin, Emiliano[24], Napolitano, Nicola R.[33], Puzia, Thomas H.[14], Robotham, Aaron[5], Salim, Samir[34], Sereno, Mauro[35], Snyder, Gregory F.[7], Stott, John P.[36], Tissera, Patricia B.[37], Werner, Norbert[38,39,40], Yoachim, Peter[41], Borne, Kirk D.[42], and Members of the LSST Galaxies Science Collaboration

[1]*Department of Astronomy and Astrophysics, University of California, Santa Cruz, Santa Cruz, CA 96054, USA,* [2]*Institute of Astronomy, Kavli Institute for Cosmology, University of Cambridge, Madingley Road, Cambridge CB30HA, UK,* [3]*Department of Physics and Astronomy, University of California, Irvine, 4129 Frederick Reines Hall, Irvine, CA 92697, USA,* [4]*Department of Physics, University of Oxford, Denys Wilkinson Building, Keble Rd., Oxford, OX1 3RH, UK,* [5]*International Centre for Radio Astronomy Research (ICRAR), University of Western Australia, Perth, Australia, WA 6009, Australia,* [6]*Institute for Astronomy, University of Edinburgh, Royal Observatory, Blackford Hill, Edinburgh, EH9 3HJ, UK,* [7]*Space Telescope Science Institute, 3700 San Martin Drive, Baltimore MD 21218, USA,* [8]*Rutgers University, 136 Frelinghuysen Rd., Piscataway, NJ 08854-8019, USA,* [9]*Centre for Astrophysics Research, University of Hertfordshire, College Lane, Hatfield, Herts AL10 9AB, UK,* [10]*Instituto de Astrofísica de Canarias, E-38200 La Laguna, Spain,* [11]*Departamento de Astrofísica, Universidad de La Laguna, E-38206 La Laguna, Spain,* [12]*Department of Physics and Astronomy and PITT PACC, University of Pittsburgh, 3941 O'Hara St., Pittsburgh, PA 15260, USA,* [13]*NOAO, 950 N. Cherry Ave, Tucson, AZ 85719, USA,* [14] *Instituto de Astrofisica, Pontificia Universidad, Católica Chile, Vicuña Mackenna 4860, Santiago, Chile,* [15]*Department of Physics, University of California, Davis, One Shields Ave, Davis, CA, 95616, USA,* [16]*School of Physics and Astronomy, University of Birmingham, Edgbaston, B15 2TT, UK,* [17]*Department of Astronomy, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH 44106, USA,* [18]*IPAC/Caltech, 1200 E. California Blvd. MS314-6, Pasadena, CA 91125, USA,* [19]*Kavli Institute for Cosmological Physics, University of Chicago, 5640 South Ellis Ave., Chicago, IL 60637, USA,* [20]*H.H. Wills Physics Laboratory, University of Bristol, Tyndall Avenue, Bristol, BS8 1TL, UK,* [21]*School of Physics and Astronomy, University of Nottingham, Nottingham, NG7 2RD, UK,* [22]*Cardiff University, School of Physics and Astronomy, The Parade, Cardiff, CF22 3AA, UK,* [23]*Departamento de Astronomía, Universidad de Concepción,Casilla 160-C, Concepción, Chile,* [24]*INAF - Osservatorio As-*

Galaxies SC structure

- 120 members to date
- New SC Chairs have taken over in Sep 2018 - Sugata Kaviraj and Manda Banerji
- Currently in the process of streamlining WG structure to align with Roadmap
  - Low-surface-brightness science
  - Simulations and techniques
  - SED fitting and photo-z
  - Morphology
  - Survey strategy

Galaxies SC whitepapers

- IAC group et al.: Survey characteristics needed to build degree-scale PSFs

- Holwerda: the case for matching U-band on deep drilling fields

Galaxies SC activities in progress

- Publication policy: draft produced by previous Chairs being revised by current Chairs
- Update and adoption of charter
- Code of conduct
- Aiming to complete these activities early in the new year

LSST:UK funding grants

- LSST:UK is a consortium of 33 UK institutions
- Selects 100 academics to have LSST access every year
- LSST:UK being supported by STFC via four funding phases (e.g. Phase A paid for UK buy in - £ 17.7m)
- Cautiously optimistic about two Galaxies related funding streams on LSB science and optical - NIR data fusion

Informatics and Statistics SC

Informatics and Statistics Science Collaboration

Co-Chairs: Tom Loredo (Cornell Astronomy) and Chad Schafer (CMU Statistics & Data Science)

October 2018

The Astro/Data Science Community

LSST Informatics and Statistics Science Collaboration
Over 75 Members

International Astrostatistics Association
Over 400 Members

American Stat. Assoc. Astrostatistics Interest Group
Over 50 Members

Individuals motivated by **advancing science** with **novel data analysis tools**

Who is in the ISSC?

People who are primarily active in another SC, but interested in data science issues…

Salman Habib, Argonne - DESC Simulations and Computing

Federica Bianco, NYU - Transients & Variable Stars

Sam Schmidt, UC Davis - DESC Photo-Z

Who is in the ISSC?

Statistics/ML experts who want access to interesting data and problems…

Yen-Chi Chen, Univ of Washington

Built SDSS filament catalog, with plans to create for LSST

Lior Shamir, Michigan Tech

Developing algorithms and software for automatic analysis of astronomical images of extragalactic objects, currently applied to SDSS and PanSTARRS, but applicable to LSST

Who is in the ISSC?

Individuals trained as astronomers whose expertise and interest is primarily in data analysis...

Tom Loredo, Cornell

Recently funded for photo-z project

Eric Feigelson, Penn State

Astrostatistics and Astroinformatics Summer Schools, Tutorial on Time Series Methods at TVS Workshop

Peter Freeman, CMU

Developing LSST-based projects for use in Data Science courses

Who is in the ISSC?

Statistics/ML types who enjoy the collaborative scientific environment…

Chad Schafer, CMU

- Organizing ISSC and Astro/DS Community
- Attending LSST Meetings
- Teaching in LSST Data Science Fellowship Program
- DESC Internal Reviewer
- Collaborating on projects (mostly DESC)

The (Ideal) Role of the ISSC

The shift from the **variance-dominated era** to the **bias-dominated era** requires careful thought about
methods, not just the scaling of current approaches.

The gap from method to application is larger, and requires

- adaptation of existing tools
- deep knowledge of application
- **expertise on both data science and astronomy sides**

Ongoing Challenges

- Need for Cohesive Focus within SC
- Funding
- Divided attention of members
- The extent of Data Science problems within LSST
- Interdisciplinary communication

Introducing… #ask-the-ISSC

Slack channel for general stats and ML issues

Effort to increase the ISSC's "consulting" reach, and also stimulate collaborations involving the ISSC


Milky Way, Stars, and Local Volume SC

White Paper activities

- Contributions to the TVS Galactic Plane and bulge white papers
- LMC/SMC plus South Celestial Cap
- A WFD Galactic Plane proposal (lead: Jay Strader)
- WFD contributions
- Twilight calibration

Increasingly seeing major contributions from Italy, UK

Conferences/Meetings

- Blending Workshop at Tucson LSST meeting
- LSST Cadence Hackathon
- WFIRST/LSST (Princeton)
- Palermo Meeting
- Precision Astrometry in the 21st Century
- Microlensing22

Key Issues / Roadmap

Crowded Field Photometry -- testing

Astrometry -- Gaia

Stellar Calibration -- Gaia

Star/Galaxy Separation -- ???

Strong Lensing SC

co-chairs Aprajita Verma (Oxford) & Chuck Keeton (Rutgers)

close collaboration with DESC-SLWG (D. Goldstein & T. Collett co-convenors, & past convenors P. Marshall C. Fassnacht)

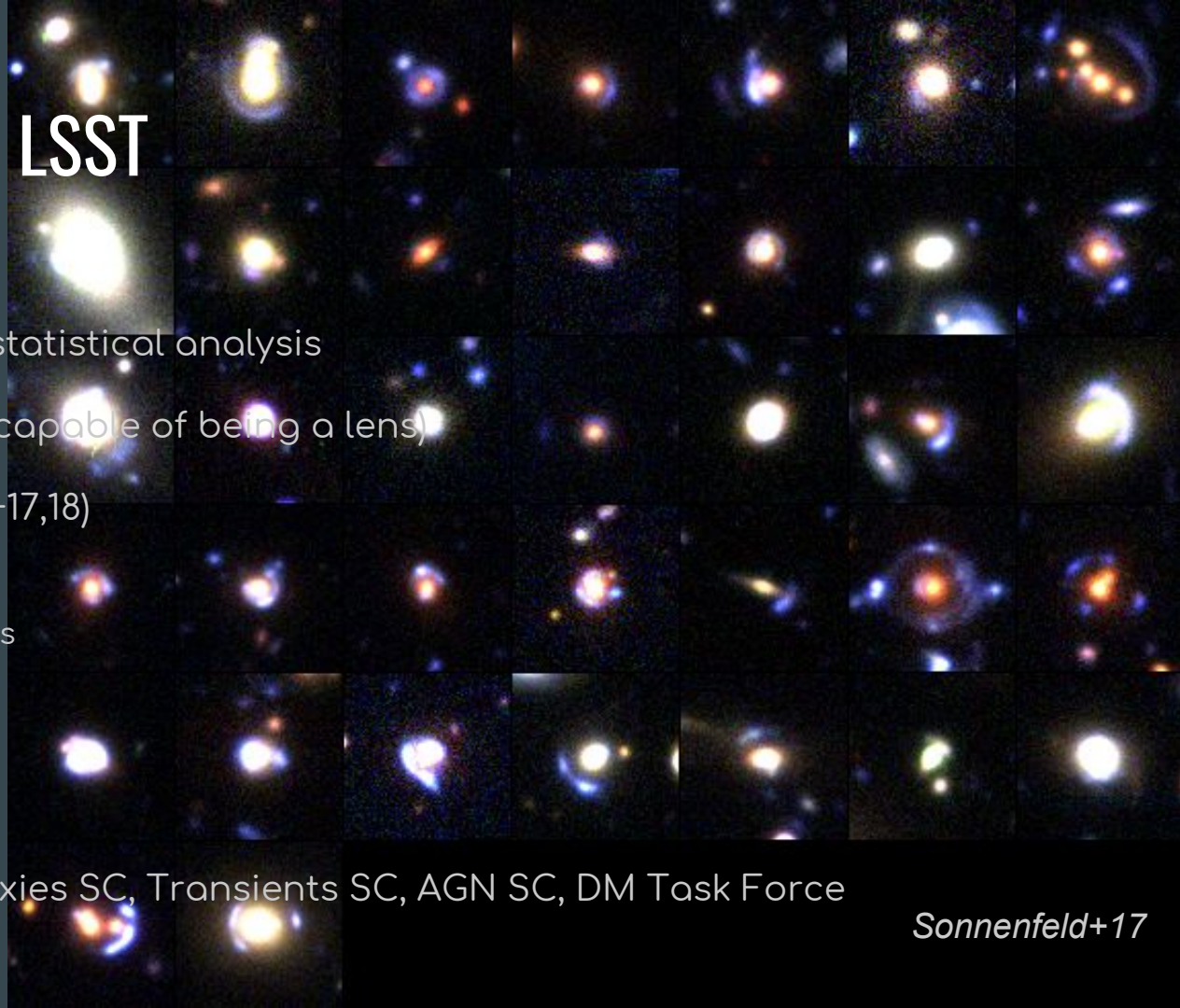
Strong Lensing with LSST

LSST+SL transformational

- single object science → statistical analysis
- SL rare (1 in 10^4 galaxies capable of being a lens)
- Expect (OM10; Goldstein+17,18)
  - 1000s lensed AGN
  - $10^{4\text{-}5}$ galaxy-scale lenses
  - 1000s of clusters
  - 100s of lensed SNe...

Multiple Science Goals

- Overlap with DESC, Galaxies SC, Transients SC, AGN SC, DM Task Force



Sonnenfeld+17

SL Discovery

Image searches

ArcFinder, RingFinder, Yattalens (e.g. More+12, Gavazzi+14, Sonnenfeld+17, etc.)

CNN/ML (e.g. Avestruz+17, Jacobs+17, Jackson & Hartley+17)

Citizen Science (Verma, More, Marshall+ 15,18)

SCARLET (Melchior & Moolkamp) undetected

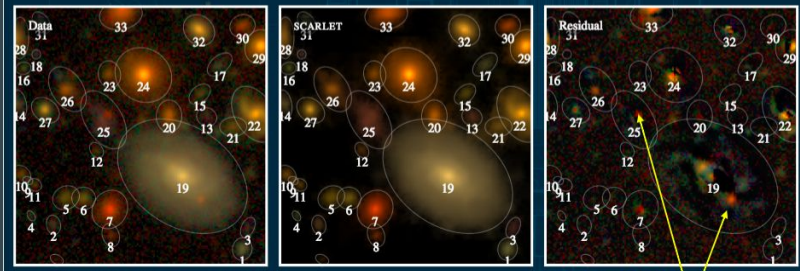
Catalogue searches (e.g. Park & Marshall+)

DESC DC2 (SNe Goldstein+, SL Li+, DC2 & Twinkles task force)

Crowded Field Photometry

Iterative Multiband Detection (future work)

- Detection clearly missed some faint objects
- Some objects need to be modeled with multiple components (eg Bulge-Disk)
- Color residuals clearly show where new components/sources are needed



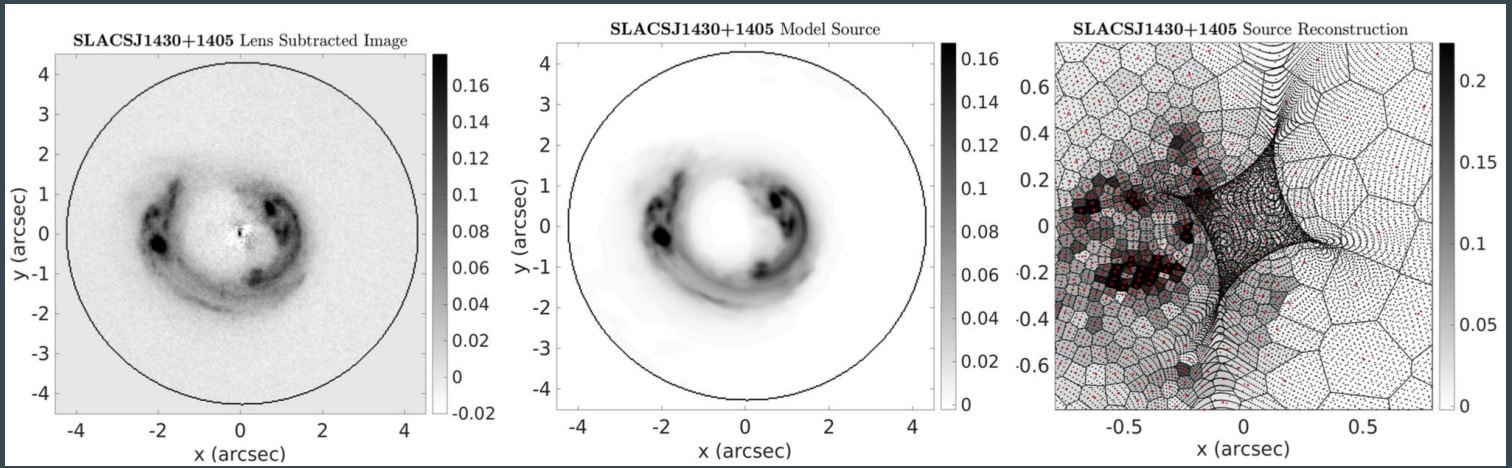
credit: Melchior et al. 2018

SL Characterisation

Fast automated modelling (J. Nightingale+ 15,18)

Free-form Voronoi grid

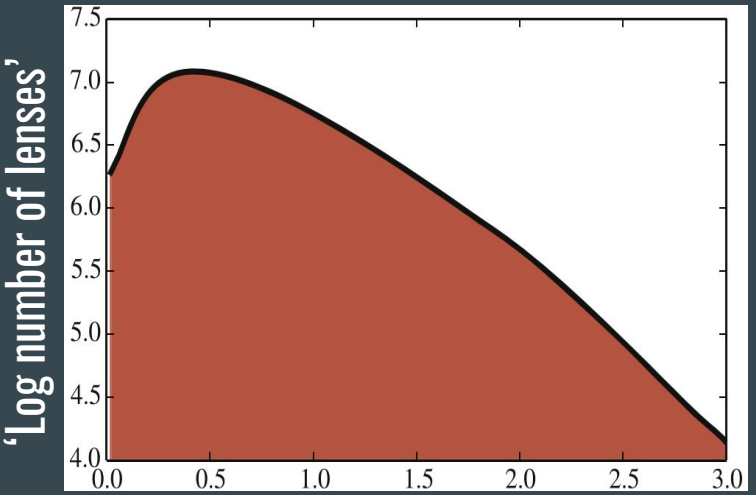
Fast iterative modelling pipeline



SL Observing Strategy Input

- Requirements for general strong lens discovery:
  - Wide area with reasonable sensitivity in all bands (increases sample size)
  - Good image quality (to discern lensed images from lenses, better R_{ein} sampling, accurate image positions, majority have low R_{ein})
  - Blue sensitivity (detect typically blue SFGs)
    - Good “blue” g-band seeing

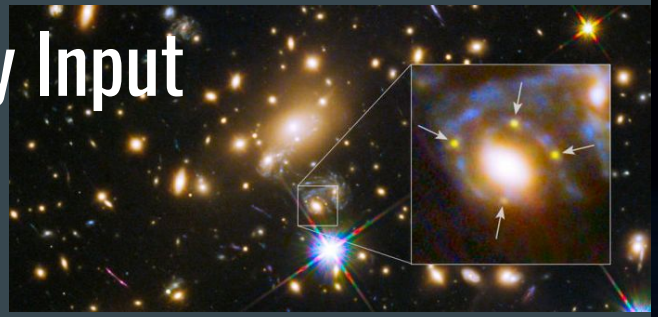
Theoretical Einstein Radius distribution



Collett 2015

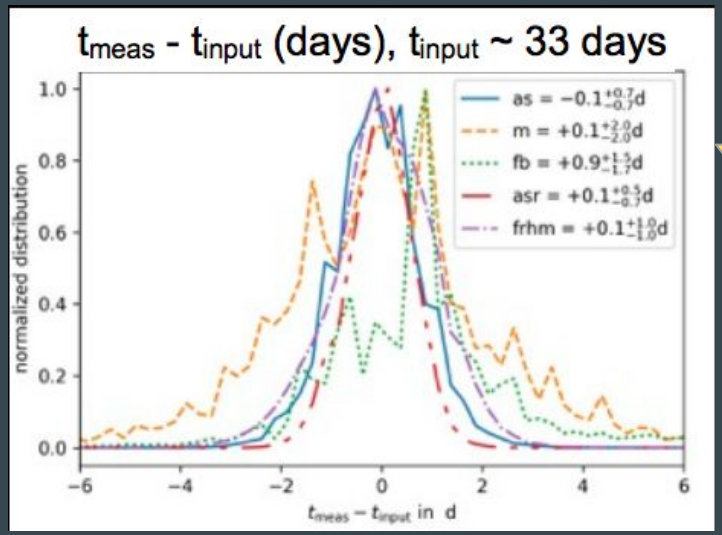
SL Observing Strategy Input

- Strongest observing constraints:
  - Strong gravitational lens **time delays** (lensed QSOs & SNe)
  - Incl. DESC Obs Strat WPs



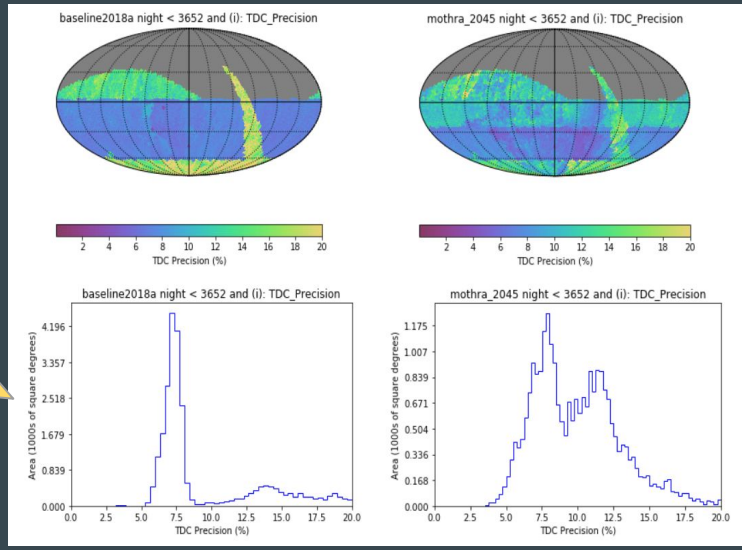
Kelly et al. 2015, 2016

Credit ESA/Hubble, NASA: H0LICOW Suyu, Bonvin et al.



SL SNe
alt_sched_rolling performs best: recover dt_{input} within ~4%
S. Huber & S. Suyu

SL QSOs
Precision is comparable between rolling cadence and baseline
T. Anguita & P. Marshall



SLSC forthcoming priority tasks

Roadmap - draft end of year

CoC & other policy docs

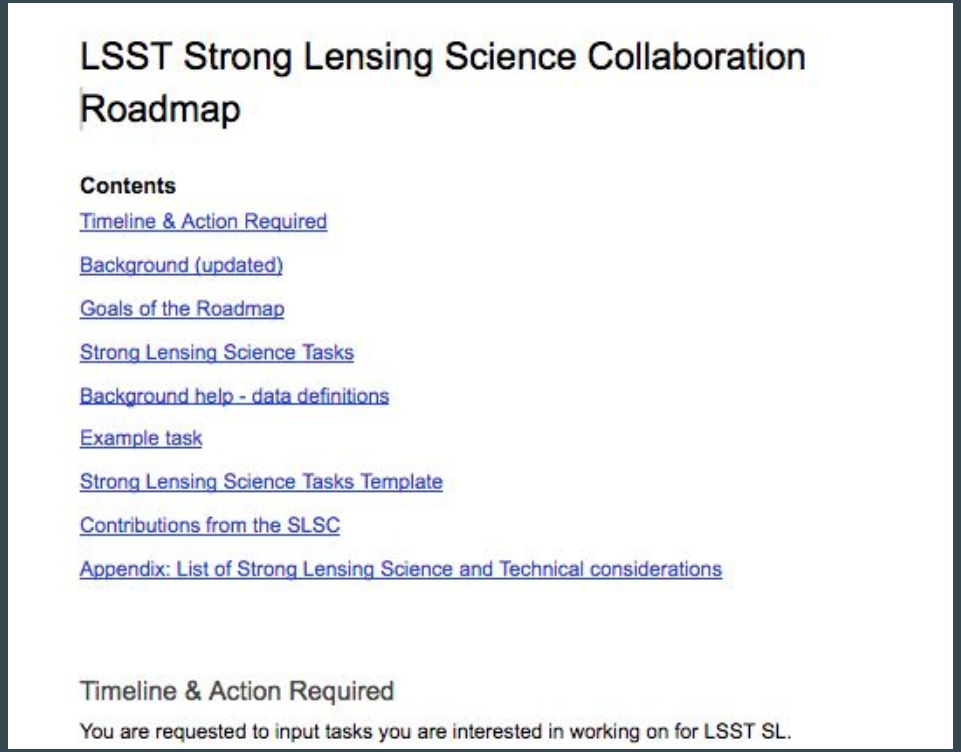
LSST SL simulations & DC2

Obs strategy WP & follow-up

Dark Matter WP

SL discovery & modelling challenges

SLSC/DESC-SLWG face-to-face



LSST Strong Lensing Science Collaboration Roadmap

Contents

Timeline & Action Required

You are requested to input tasks you are interested in working on for LSST SL.

Transients and Variable Stars SC

Rachel Street (LCO)
Federica Bianco (NYU/UDelaware)
co-chairs

TVS Task Forces

Four parallel groups working towards targeted goals

DDF & Minisurvey proposals planning

- Coordinated TVS cadence proposals in preparation for White Papers
- Scientific agenda for TVS cadence workshop

Broker requirements

- Conducted survey of users and developers
- Results documented at https://github.com/LSST-TVSSC/broker-requirements-survey

Stellar variability in crowded fields

- Analysed existing DECam and OGLE data from crowded star fields, shared results with DM team

Review of variability characterization parameters in Level 1 and 2 data products

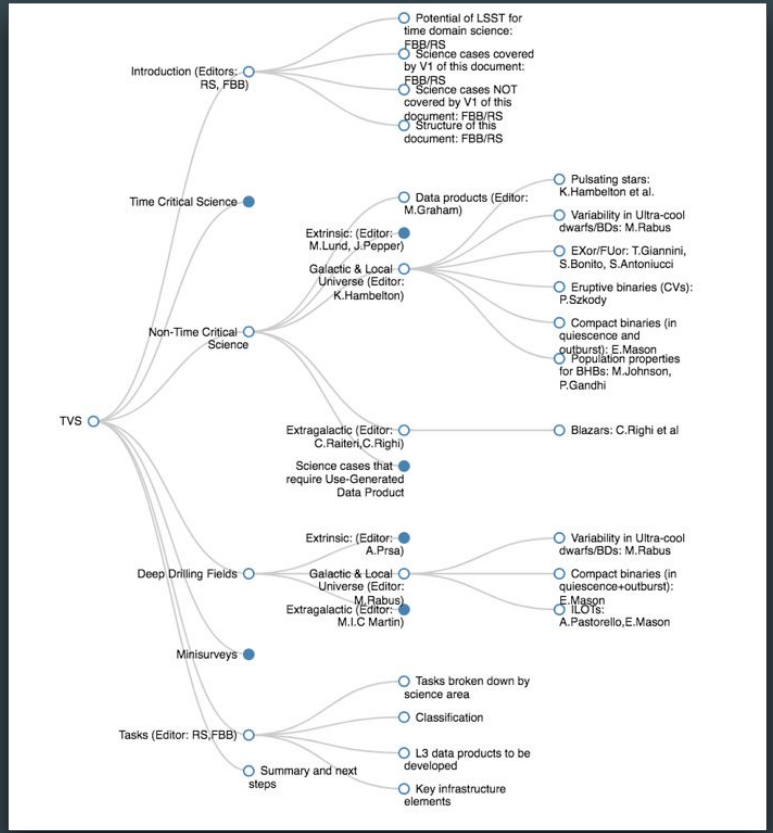
- Outlined analysis of different variability types and associated parameters

TVS Roadmap Development

Cross-subgroup effort to outline scientific goals and the work necessary to prepare for LSST

https://github.com/LSST-TVSSC/LSST_TVS_RoadMap

Goals/strategies may need to be reviewed once the results of the cadence White Papers are agreed



TVS meetings 2018

LSST TVS workshop 2018

Large Synoptic Survey Telescope Corporation

Transients and Variable Stars workshop

Naples April 9-11, 2018

INAF – Osservatorio Astronomico di Capodimonte

LSST TVS Survey Strategy Proposal Preparation Workshop

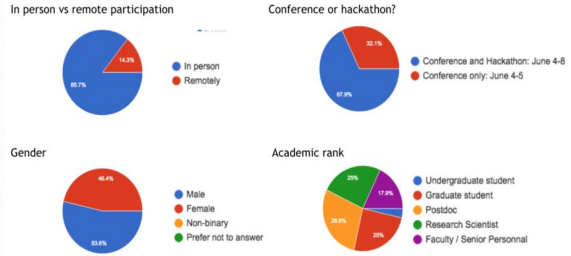
Conference: June 4-5

Unconference-Hackathon: June 6-8

Lehigh University, PA

Enabling Science Program

LEHIGH UNIVERSITY

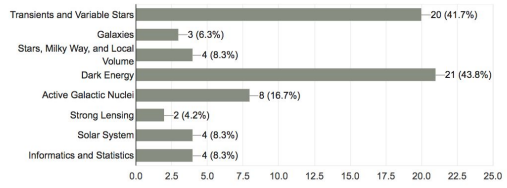


LSST Cadence Hackathon at the Flatiron Institute

September 17, 18, 19, NYC

Which Science Collaboration(s) are you a member of

48 responses



Large Synoptic Survey Telescope

INAF ISTITUTO NAZIONALE DI ASTROFISICA

DiFC

8-10 October
Palazzo dei Normanni
Palermo

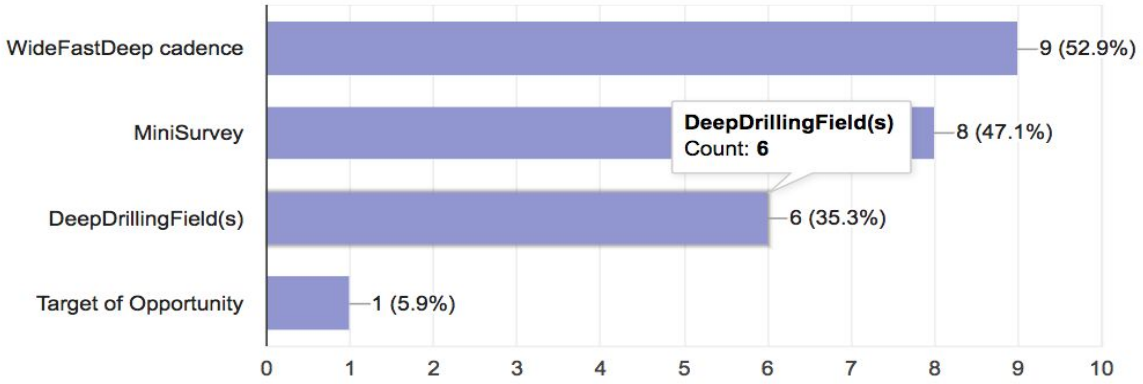
LSST - Large Synoptic Survey Telescope - Special Programs Workshop

TVS Cadence White Paper Letter of Intent

please provide details on the White Paper you intend to submit in response to the LSST Cadence White Paper call https://www.lsst.org/call-whitepaper-2018 by August 15th 2018. Submissions will be reviewed and individuals will be contacted about overlaps and synergy with other papers in preparation by September 1st.

Kind of cadence proposed

17 responses



Code of Conduct, Charter, Publication Policy

QUESTIONS RESPONSES 207

LSST TVS Code of Conduct and Charter

Please read carefully the
LSST Transient and Variable Stars Science Collaboration Charter
https://docs.google.com/document/d/1kQFIU5fTasdaJ2L3F47U6G1Pvt94zuVE9FWgjGthdhQ/edit?usp=sharing
and Code of Conduct
https://docs.google.com/document/d/1qPdo-bK7LHmd6_7iZh1oTDfVi0nJAVa7qFx2GKMlsis/edit?usp=sharing .

By filling this form you are acknowledging and committing to comply to the rules and guidelines described in these documents. Specifically, by filling this form you acknowledge the current TVS Charter and commit to comply to the TVS Code of Conduct in all your future interactions within TVS.
Your acknowledgement and commitment are a *required condition to remain a member of LSST TVS*. Your membership will be suspended, which in practical terms means you will be suspended from mailing list, slack channel, and all other official TVS means of communication until we can contact you and secure your acknowledgement.

73% (196/269) members signed the TVS SC CoC/Charter

Code of Conduct, Charter, Publication Policy

The LSST Transients and Variable Stars Science Collaboration Code of Conduct

Guiding Principles:

All members participate and contribute on equal terms.

The social climate within which all research, collaboration and interactions are conducted will be respectful and professional.

All members can expect that their contributions will receive fair and appropriate credit in all forums.

The default expectation is that research will be conducted openly and be accessible in a timely manner to all members. Exceptions should be rare and well justified.

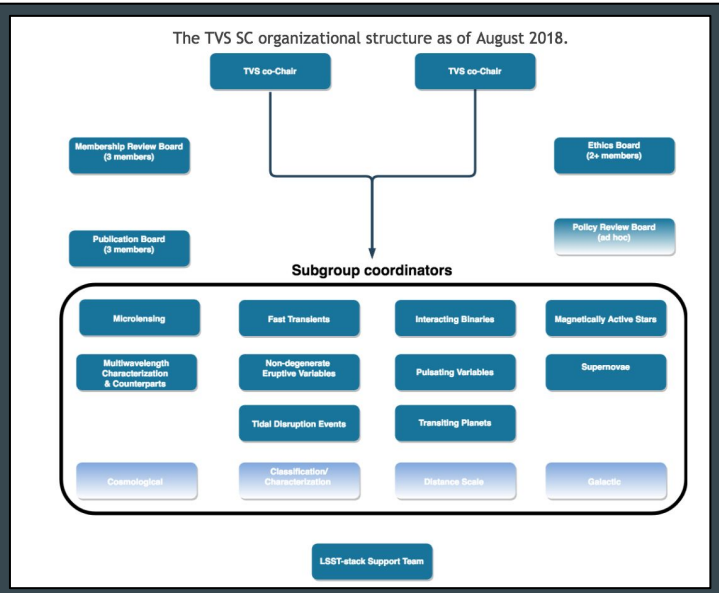
Reading and agreeing to this policy *is a condition for membership* to the LSST Transients and Variable Stars Science Collaboration.

Code of Conduct, Charter, Publication Policy

The LSST Transient and Variable Stars Science Collaboration Charter

Version information: v 0.1 prepared by Federica Bianco (TVS co-Chair) in June 2018 edited by Rachel Street (TVS co-Chair) July 2018

This document describes the governing and managing structure of the Large Synoptic Survey Telescope (LSST) Transients and Variable Stars Science Collaboration (TVS SC, also referred to here as "the Collaboration").



Code of Conduct, Charter, Publication Policy

The LSST Transient and Variable Stars Collaboration Science Collaboration
Publication Policy

Reading and agreeing to this policy *is a condition for membership* to the LSST Transients and Variable Stars Science Collaboration.

Version information: v 0.1 prepared by Federica Bianco (TVS co-Chair) in June 2018

s and Variable Stars Science
llaboration" and TVS)
o all papers produced by TVS
TVS research environment.
line meetings, to any
erwise academically connected
ient and variable Universe and

There are two primary goals for this policy:

• To protect the intellectual property of TVS members and provide a trusted, supportive environment in which they can share ideas and expertise, and.
• To maximize the quality and ensure the validity of TVS publications by taking full advantage of the scientific and technical expertise within the collaboration.

Reading and agreeing to the TVS Publication Policy is a condition for membership and the Publication Policy should be reviewed by all applying for membership before submitting their application.

This publication policy covers

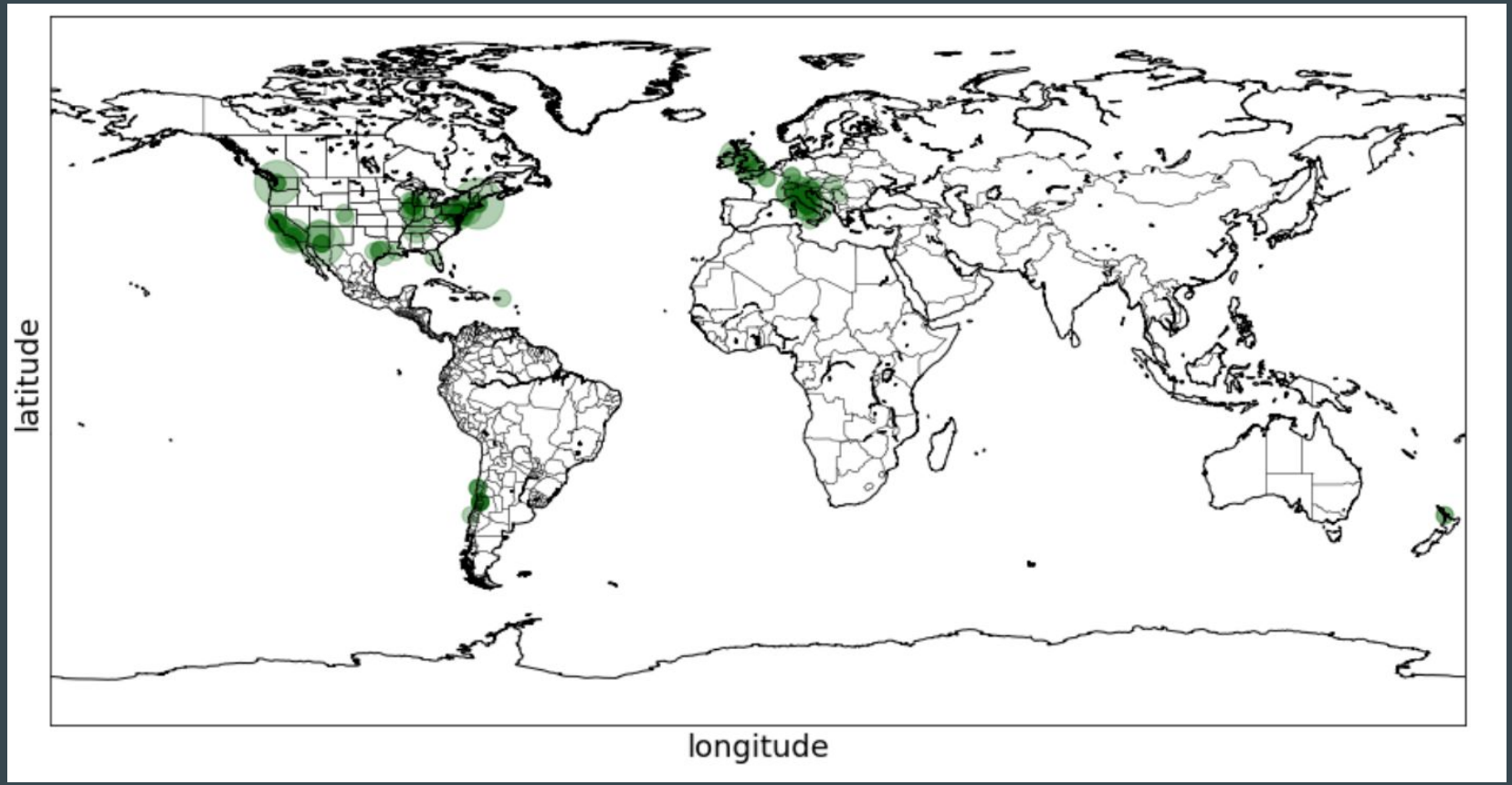
- peer-reviewed publications (journal articles),
- white papers,
- conference contributions (oral and posters),
- theses, dissertations, projects,
- data releases,
- software tools, and
- documentation relating to TVS data products and software.

Matthew Penny
12:20 PM Aug 13
Add header

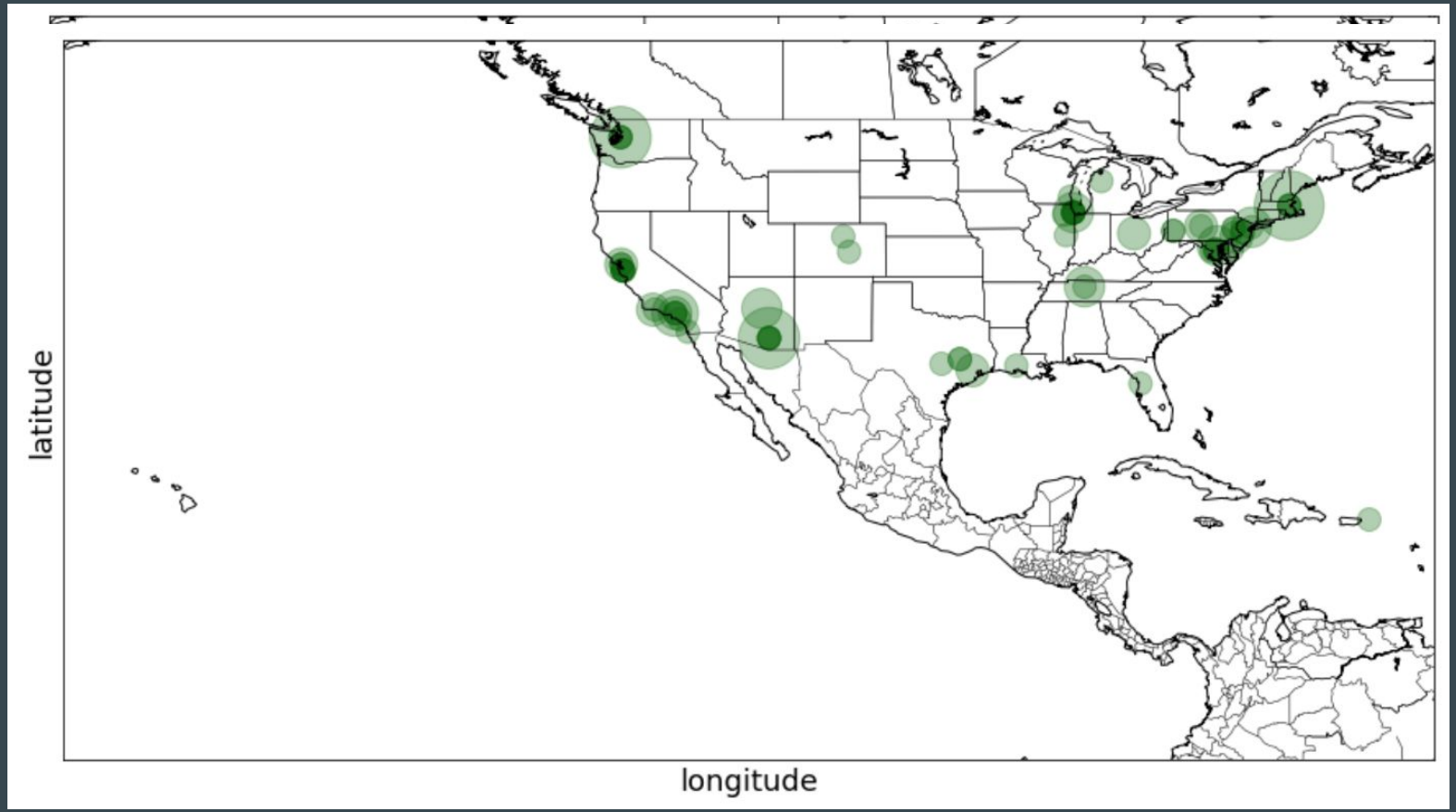
3:01 PM Aug 8
Resolve
Science

Giacomo Vianel...
2:20 PM Jul 19
Resolve
Is there going to be a formal policy for advertising projects before they reach the paper stage? Failing to do so might result in multiple people working on the same thing within the TVS group, and discovering it only very late in the process

Current Membership (199, 128 affiliations)



Current Membership (199, 128 affiliations)



Current Membership (199, 128 affiliations)