LSST and the Solar System Workshop

DPS 2017 - Provo, UT
Thursday October 19, 2017
4:30-6:30pm

Open to All DPS Registrants

Large Synoptic Survey Telescope

Solar System Science Collaboration

LSST and the Solar System Workshop

LSST & Solar System Science Collaboration (SSSC) Update: Where is the SSSC Headed in 2018?
Meg Schwamb (Gemini Observatory) & David Trilling (NAU)

The LSST Observing Strategy: Upcoming Opsim Simulations, Small Body Metrics, and White Papers
Lynne Jones (University of Washington/LSST)

LSST Solar System Data Products and Moving Object Processing System (MOPS) Status
Mario Jurić (University of Washington/LSST)

The Minor Planet Center: Status and Plans
Matt Holman (Harvard CfA/MPC)

Community Feedback on the Planned LSST Solar System Database Schema

Large Synoptic Survey Telescope
Solar System Science Collaboration

LSST Solar System Science Collaboration (SSSC)

Large Synoptic Survey Telescope

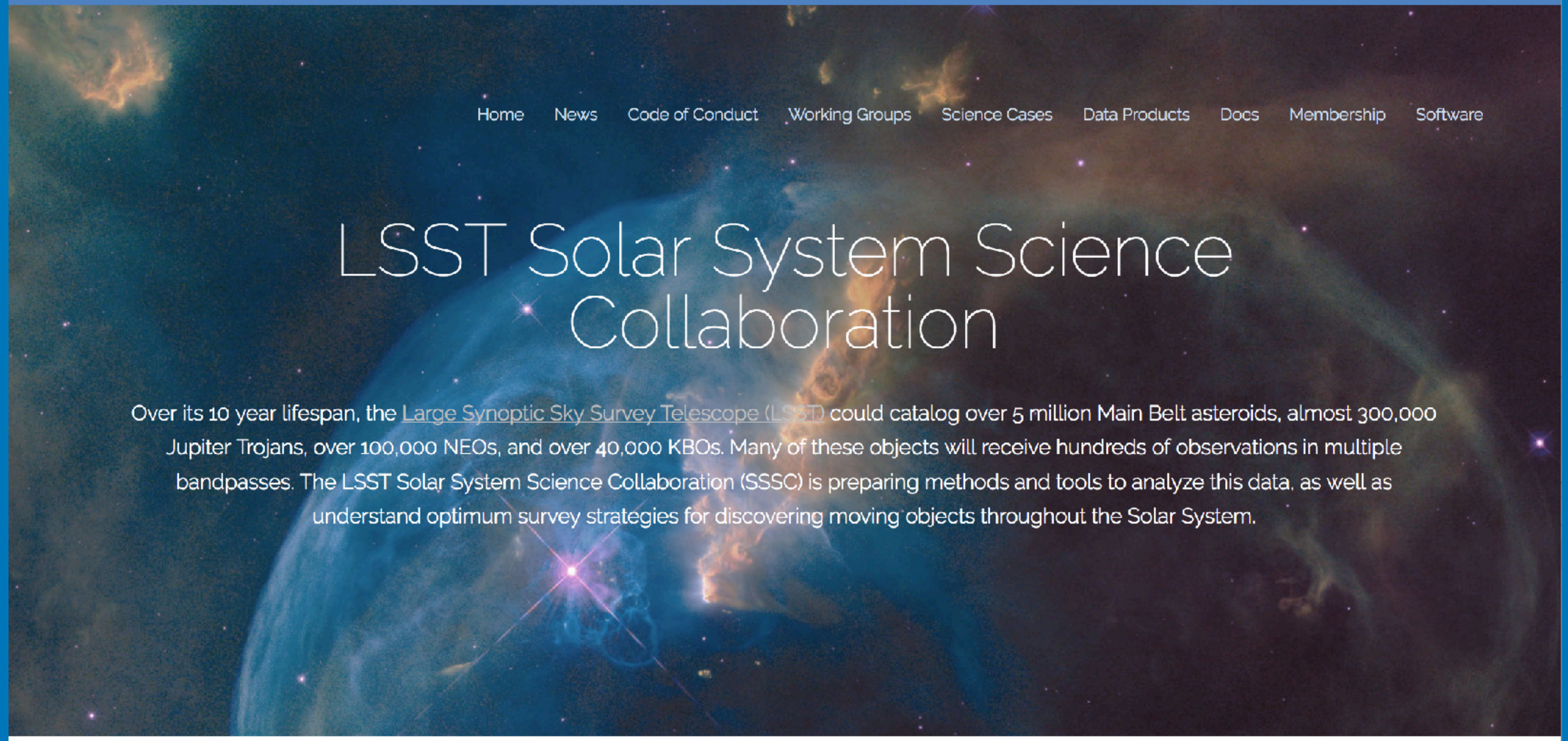
Solar System Science Collaboration

David Trilling & Meg Schwamb
SSSC Co-Chairs

Lynne Jones - Former SSSC Co-Chair

- 1 of 8 active LSST science collaborations
- Comprised of 87 members
- ~1/3 of the membership has signed up for working groups
- Membership is focused on community building
- New members need to have data access rights to join (consistent with other science collaborations)
- If you have questions about data access rights - Best contact is Beth Willman (LSST Deputy Director) or Federica Bianco (LSST Science Collaboration Coordinator)

Launched New Collaboration Website



http://www.lsstsssc.org

News | Working Groups | Membership

It’s really coming! The summit is actually starting to look like the artist rendition!

Image Credit: LSST

Revised Data Delivery Schedule

Data Production Milestone	Start Date
First calibration data from Auxiliary Telescope	November 2018
First on-sky and calibration images with ComCam	May 2020
Images from Camera re-verification at Summit Facility	July 2020
Sustained observing with ComCam	August 2020
First on-sky and calibration data from Camera+Telescope	February 2021
Sustained scheduler driven observing with Camera+Telescope	April 2021
Start Science Verification mini-Surveys	June 2021

Slide Credit: Chuck F Claver

Working Groups

Active objects: broadly consisting of all categories of activity in the minor planet populations: short period comets, long period comets, main belt comets, impact- or rotationally-generated active asteroids,etc
Lead: Alan Fitzsimmons

Community software/infrastructure development: broadly consisting of people interested in helping build databases, software packages, etc to be used by the Solar System community on LSST data
Lead: Henry Hsieh

Inner Solar System: broadly consisting of the main belt, Jupiter Trojans, and Jupiter irregular satellites
Lead: Cristina Thomas

NEOs (Near Earth Objects): broadly consisting of objects on orbits inward of or diffusing inward from the main belt
Lead: Steve Chesley

Outer Solar System: broadly consisting of KBOS, Centaurs, Oort cloud, Saturn/Neptune/Uranus Trojans, and Saturn/Neptune/Uranus irregular satellites
Lead: Darin Ragozzine and Matt Holman

Adopted a Code of Conduct in September

The LSST SSSC is made up of members from around the globe with a diverse set of skills, personalities, perspectives, backgrounds, and experiences. We value the participation and contributions of every member of the SSSC, and we have a shared responsibility in maintaining the SSSC as a positive, inclusive, supportive, and successful community. Accordingly, all SSSC members are expected to abide by the Code of Conduct.

http://lsst-sssc.github.io/codeofconduct.html

LSST: UK

Slide Credit: Wes Fraser

Wes Fraser
SSSC LSST:UK Point of Contact

Interests

(those who signed up or expressed interest so far)

- Comets (Alan Fitzsimmons, Colin Snodgrass)
- Kuiper Belt objects (Wes Fraser, Pedro Lacerda, Michele Bannister)
- Asteroids (Alan Fitzsimmons and Michele Bannister)
- gas-giants (Patrick Irwin)

On-going (funded) UK Dev Work

- Moving source shift'n stack (faint activity)
  Filter dependent lightcurves

  ➡ Alan Fitzsimmons and David Young
- Sparse light curve period determination

  ➡ Wes Fraser
- Trailed photometry

  ➡ Wes Fraser
- Local MAF simulations to assess damage done by rolling cadence

  ➡ Bob Mann is helping to set this up. Efforts ramping up.

UK Data Centre

- Located in Edinburgh
- to contain full detection lists + all sky pixel stack
- fold in other surveys
  - eg. Euclid, 4MOST (VISTA), WEAVE (WHT)
- custom alert stream + brokers
  - emphasis for spectroscopic “marshalls” like used with PS1 supernova survey

Slide Credit: Wes Fraser

Science Roadmap (examples of science priorities) : NEOs Working Group

- Obtain an NEO catalog with high completeness and adequate orbit quality
- Obtain color measurements and broad phase coverage of cataloged NEOs
- Derive debiased orbit, abs. mag. and taxonomy distributions from the catalog
  - Including orbit-taxonomy correlations
- Obtain rotation states and shape modeling from sparse light curves
- Quantify the long term impact flux of smaller NEOs
- Timely notice of near-term close approaches or potential impacts
  - Facilitates external characterization efforts (radar, spectra, light curves)
  - May involve reporting of trailed detections outside of the normal MOPS protocol

Science Roadmap (examples of science priorities) : Inner Solar System Working Group

- Discovery-- includes all populations.
- Population studies--includes complete catalog for completeness and to quickly distinguish from newly discovered objects, orbit population models, astrometry to improve ephemerides for occultations.
- Lightcurves & shape models-- includes rotational periods and lightcurve inversion for shape.
- Colors & Composition-- includes colors of many things such as Trojans, irregular satellites, etc.
- Physical Properties & Ongoing Processes-- includes repeated detection of objects, not lightcurves-- such as improved phase curves, mass estimation from mutual gravitational interactions, non gravitational perturbations, binaries to derive mass.

Science Roadmap (examples of science priorities) : Outer Solar System Working Group

- Discovery and orbital classificiation of large numbers (10,000s) of outer solar system objects over a wide range of sizes (H>9) and orbits in support of many objectives, especially characterization of the size-frequency-orbit distribution of KBOs with implications for understanding the formation and evolution of the outer solar system (e.g., comet/Centaur pathways, collisional evolution, Neptune migration, etc.).

- Determination of rotational light curves for large numbers of objects from different dynamical classes -- with mimimal confusion from color and phase curves -- to study physical properties of KBOs including spin angular momentum distribution and binary frequency.

- Discovery and orbital classification of objects on unusual orbits inexplicable by the current planets, especially Inner Oort Cloud Objects (aka Sednoids) with high perihelia (q > 40) and objects with very high inclination (i > 40 deg), to place constraints on models for these objects (e.g., the putative Planet 9/X).

- Discovery, accurate/precise astrometry, and rapid delivery of calibrated image "postage stamps" to aid in stellar occultation predictions.

Science Roadmap (examples of science priorities) : Active Objects Working Group

- Main-belt comet discoveries and discovery of cometary activity in NEOS; addresses the presence of water ice in the asteroid belt and NEA population, and the collisional evolution of asteroids.

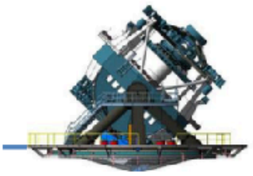
- Determination of activity levels for a large number of short period comets (including Main Belt comets) over the period of their entire orbit, to model and understand the onset and termination of cometary activity on these objects. This includes colors for the objects while both active and inactive, with minimal confusion from phase angles and varying activity levels

- Detection and follow-up of anomalous outbursts and rapid brightening events above the expected brightness evolution of objects already known to be active

- Parameterization of non-gravitational evolution of orbits of comets and active asteroids.

- Discovery and orbital characterization of large numbers of long period comets to properly understand, define, and potentially redefine the dynamical classification of these objects,

- Detection of coma among the most distant objects (Centaurs most likely). To answer the question, what primitive materials drive very distant outgassing and how common is this activity?



Solar System Data Products (Thurs 11am)

Aim: Discuss what measurements and values are currently planned to be outputted from the Moving Object Pipeline System in the SSObject and DIASource scheme. Is this sufficient for the needs of planetary astronomers? What other values would be useful or are critical?

Summary:

Identified new key values to propose to add to SSObject and DIASource including barycentric distance, heliocentric distance, phase angle, other orbital angles

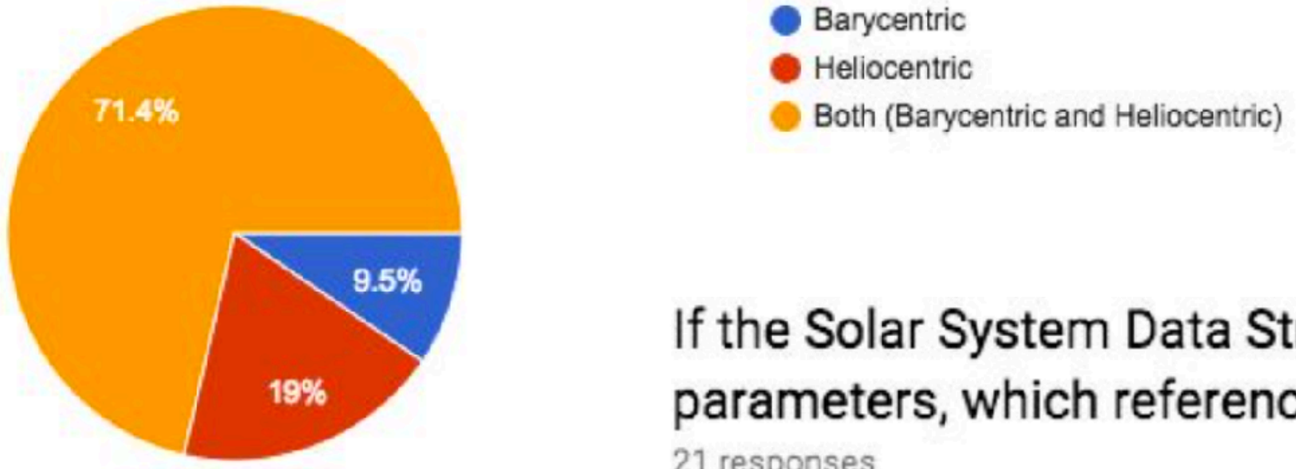
Discussion of how to label previously known objects rediscovered by MOPS in the SSObject schema

Identified questions for the Solar System Science Collaboration: should barycentric or heliocentric orbital parameters or both be outputted by MOPS?

Action Items: Organize a discussion at DPS in October to brainstorm more, SSSC co-chairs to seek and collate input on barycentric versus heliocentric orbital parameters

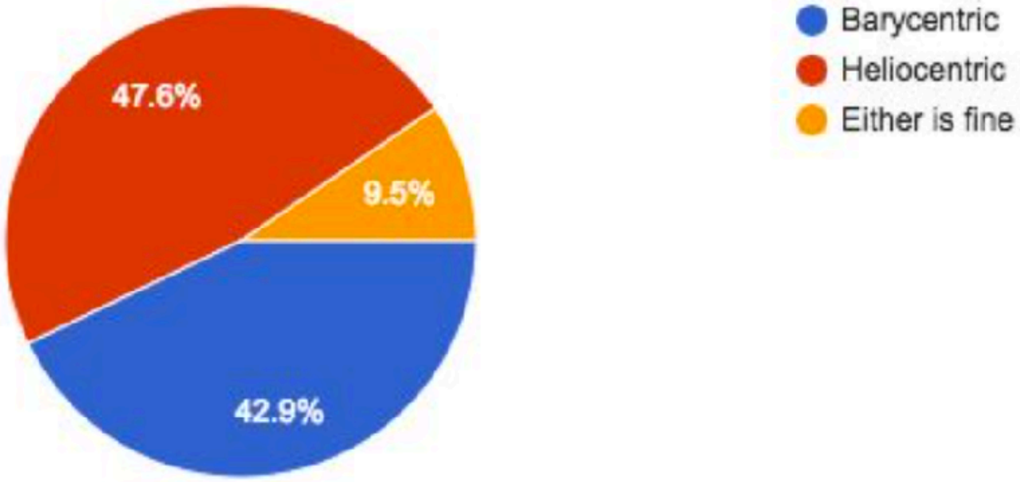
Which reference frame should the Solar System Data Structure store orbital parameters:

21 responses



If the Solar System Data Structure can have only one set of orbital parameters, which reference frame do you prefer

21 responses



If your preferred reference frame is not offered, how would you go about converting the orbital elements to it?
hopefully we can have a standard package so people aren't rolling their own every time
Using the planetary ephemerides at the time of object discovery/orbit calculation to convert to a barycentric set.
I strongly encourage that orbital elements are stored in the Heliocentric frame. In case it is feasible, there is nothing wrong with making orbits available in the Barycentric frame too. But in my opinion that should be seen as ancillary information rather than the baseline product.
n/a
I would add the conversion capability to OpenOrb, download the orbit catalogue, and convert it locally.
NA
Rewriting small parts of the code(s).
I'd either have to rely on their being a software package to make it easy to convert for LSST discoveries, or write my own, or fit the ephemeris to get barycentric
Astropy?
Use NASA/NAIF SPICE routines
Write my own code
Not sure yet.
I'd ask Mario to write me a piece of code :)
Wait for someone to get the object into Horizons
I'd re-fit the original observations.

SSSC Plans for 2018

- Finish Science Roadmap
  - Finalize science priorities for Science Roadmap
  - Develop metrics for our key science priorities to later code into the MAF (Metrics Analysis Framework) for testing success within the cadence simulations
- Give input and finalize with Data Management the Solar System Database Schema
- Plan and organize community response to Deep Drilling Field and Mini-Survey White Paper Calls
- Begin added-value product software development (possible tools for conversion to barycentric coordinates, simulated test datasets, etc)

LSSTC 2018 Enabling Science Call for Proposals

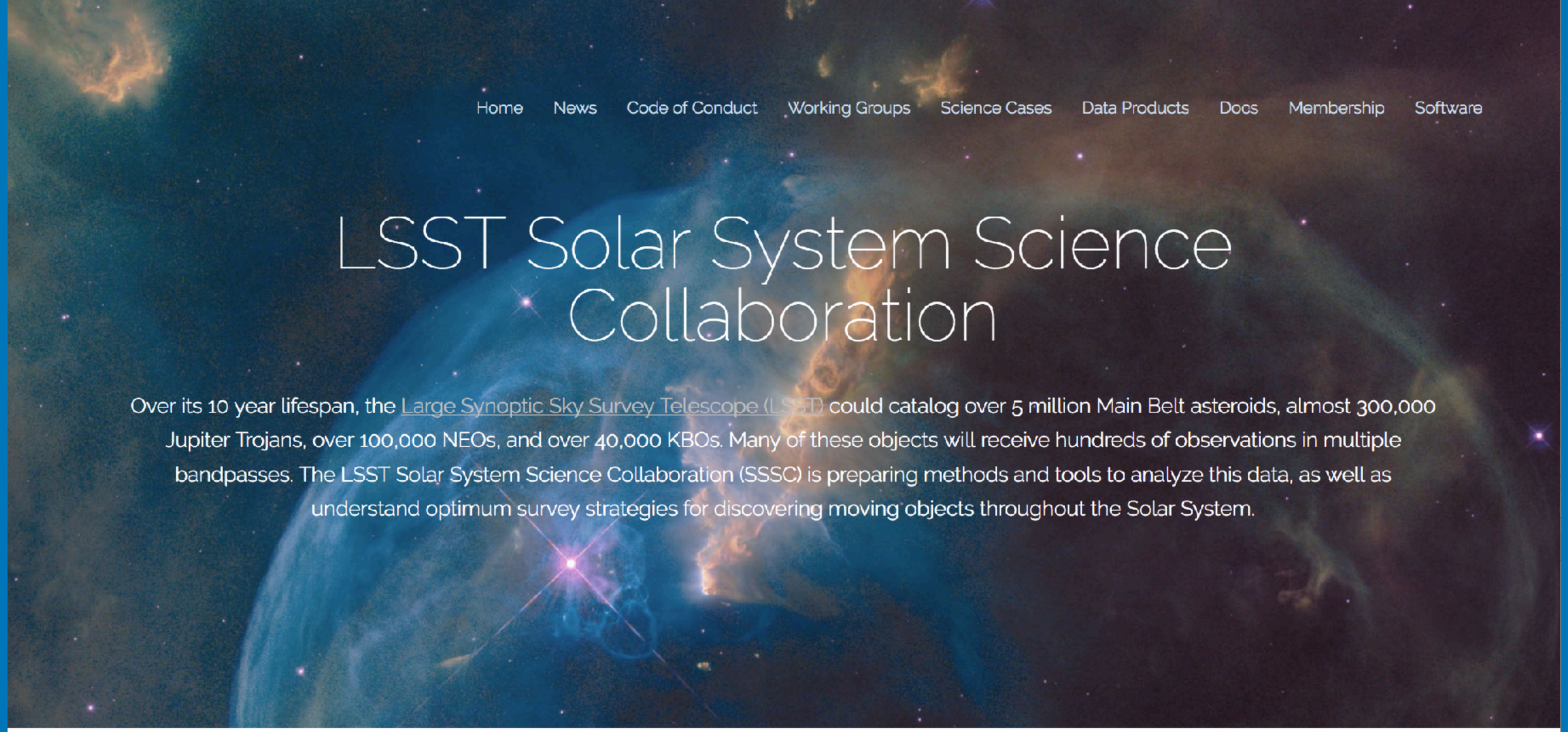
due by 11:59PM Monday, December 18, 2017 (PST)

- can support workshops, summer schools, etc. Up to $150,000 is available for this component of the Call.

SSSC leadership will be submitting a proposal for a workshop/hack days at University of Washington. Stay tuned!

- separate funding to support Undergraduate Internships (doesn't just have to restricted to the summer months). Up to $150,000 is available for this component of the Call.

https://www.lsstcorporation.org/2018-Call-for-Proposals



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SSSC Co-Chair emails: david.Trilling@nau.edu, mschwamb.astro@gmail.com

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