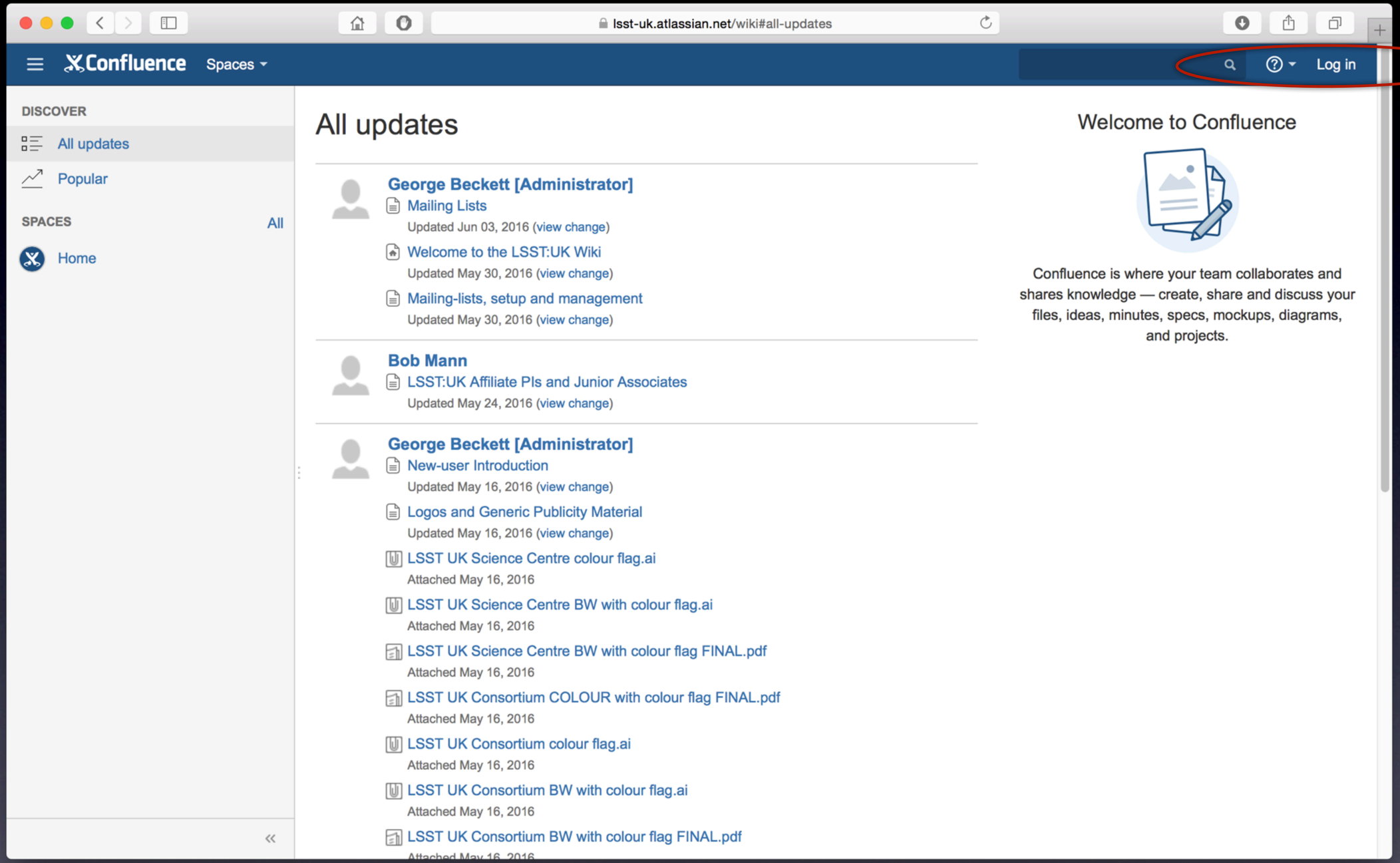
Current status of UK transient work for LSST

Ken W. Smith

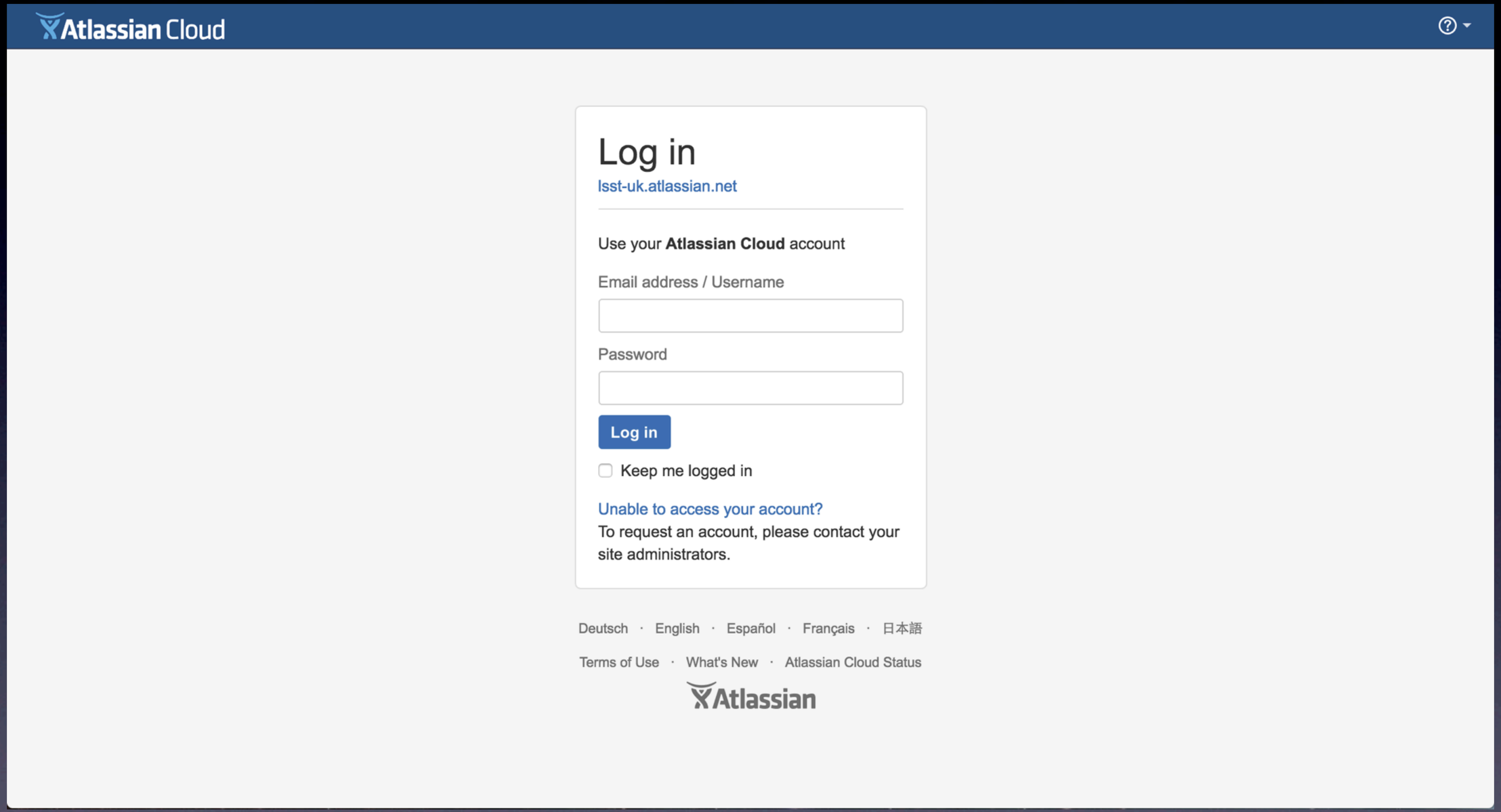
Overview

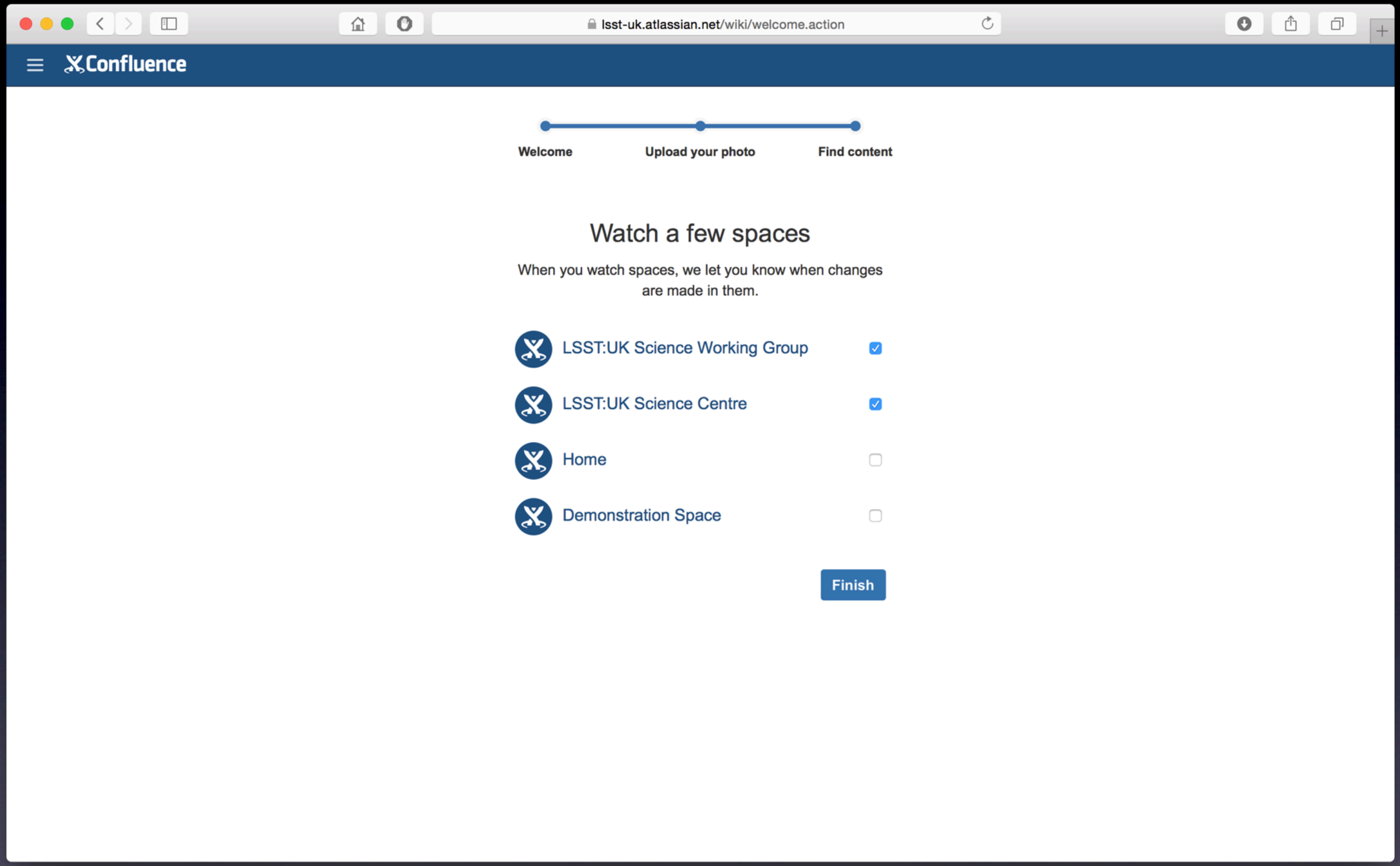
- Sign up to the LSST:UK Transients & Variable Stars Wiki
- March Kick-off meeting with Edinburgh
- Pan-STARRS and ATLAS transient data streams
- What next?

Our UK Wiki: https://lsst-uk.atlassian.net/



Contact your local Principal Investigator for an account




lsst-uk.atlassian.net/wiki/welcome.action
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LSST:UK Science Working Group
LSST:UK Science Centre
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MY SPACES All
- LSST:UK Science Working Gro…
- LSST:UK Science Centre

All updates

George Beckett [Administrator]
20160613_dac_monthly_meeting.txt
Attached yesterday at 4:52 PM

Aprajita Verma
Strong Lensing Working/Analysis Group of the DESC & the Strong Lensing Scienc…
Updated Jun 16, 2016 (view change)

Graham P. Smith
LSST:UK Clusters White Paper 2016
Updated Jun 16, 2016 (view change)
Galaxy Clusters (LSST:UK Clusters)
Updated Jun 16, 2016 (view change)
Birmingham, June 7, 2016
Updated Jun 16, 2016 (view change)

George Beckett [Administrator]
20160527_dac_monthly_meeting.txt
Attached Jun 12, 2016

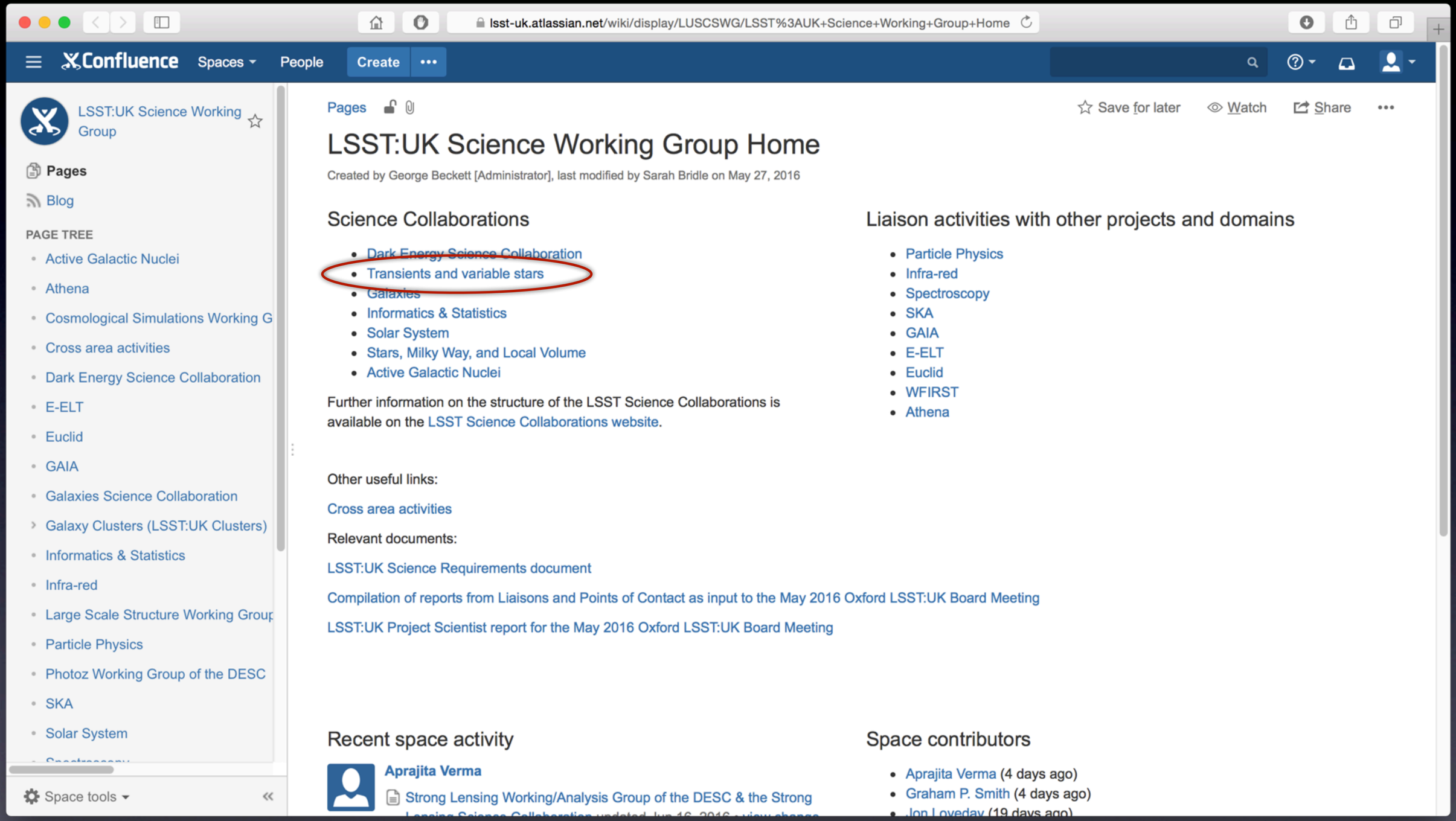
Anonymous
Lay out your page (step 6 of 9)
Created Jun 09, 2016
Get serious with a table (step 5 of 9)
Created Jun 09, 2016
Tell people what you think in a comment (step 8 of 9)
Created Jun 09, 2016
What is Confluence? (step 1 of 9)
Created Jun 09, 2016
Welcome to Confluence
Created Jun 09, 2016

Create Space

Welcome to Confluence

Confluence is where your team collaborates and shares knowledge — create, share and discuss your files, ideas, minutes, specs, mockups, diagrams, and projects.

https://lsst-uk.atlassian.net/wiki/display/LUSCSWG



https://lsst-uk.atlassian.net/wiki/display/LUSCSWG/Transients+and+variable+stars

- E-ELT
- Euclid
- GAIA
- Galaxies Science Collaboration
- Galaxy Clusters (LSST:UK Clusters)
- Informatics & Statistics
- Infra-red
- Large Scale Structure Working Group
- Particle Physics
- Photoz Working Group of the DESC
- SKA
- Solar System
- Spectroscopy
- Stars, Milky Way, and Local Volume
- Strong Lensing Working/Analysis Grc
- Supernova Working Group of the DE
- Theory and Joint Probes Working Gr
- Time-domain Follow-up
- **Transients and variable stars**
- Variable Stars Working Group of the
- Weak Lensing Working Group of the
- WFIRST

Open #app-switcher on this page in a new tab

Transients and variable stars

Created by George Beckett [Administrator], last modified by Stephen Smartt on May 12, 2016

Consortium Information	
UK Point of Contact	@Stephen Smartt (primary PoC for Science Collaboration, specialising in Transients), Aleks Scholz (Variable stars)
UK Mailing-list address	lusc-var@jiscmail.ac.uk
LSST Project Site	https://tvs.science.lsst.org/

Joining the LSST Science Collaboration

The US LSST project description of this Science Collaboration is as follows : *"The LSST Transients and Variable Stars collaboration focuses on the transient sky, including a large and diverse range of phenomena: variable events, periodic or not, explosive and eruptive transients, and geometric transients (e.g. eclipsing binaries and planets). Variability is a tell tale of the nature of the object observed, but it also enables galactic studies (the mapping of the galactic structure), extragalactic studies (the characterization of the intracluster medium), and cosmological studies. Because of their physical and phenomenological diversity, the object we study span a wide range of timescales, and present themselves in a range of brightnesses, and colors. LSST also holds great potential for discovery of new transient phenomena, especially at the very short and very long time scales."*

In the UK we view the nature of the science requirements and exploitation for "Transients" and "Variable stars" to be different, with some overlap areas. Therefore we have two points of contact for this Science Collaboration (S. Smartt and A. Scholz, with contact details above).

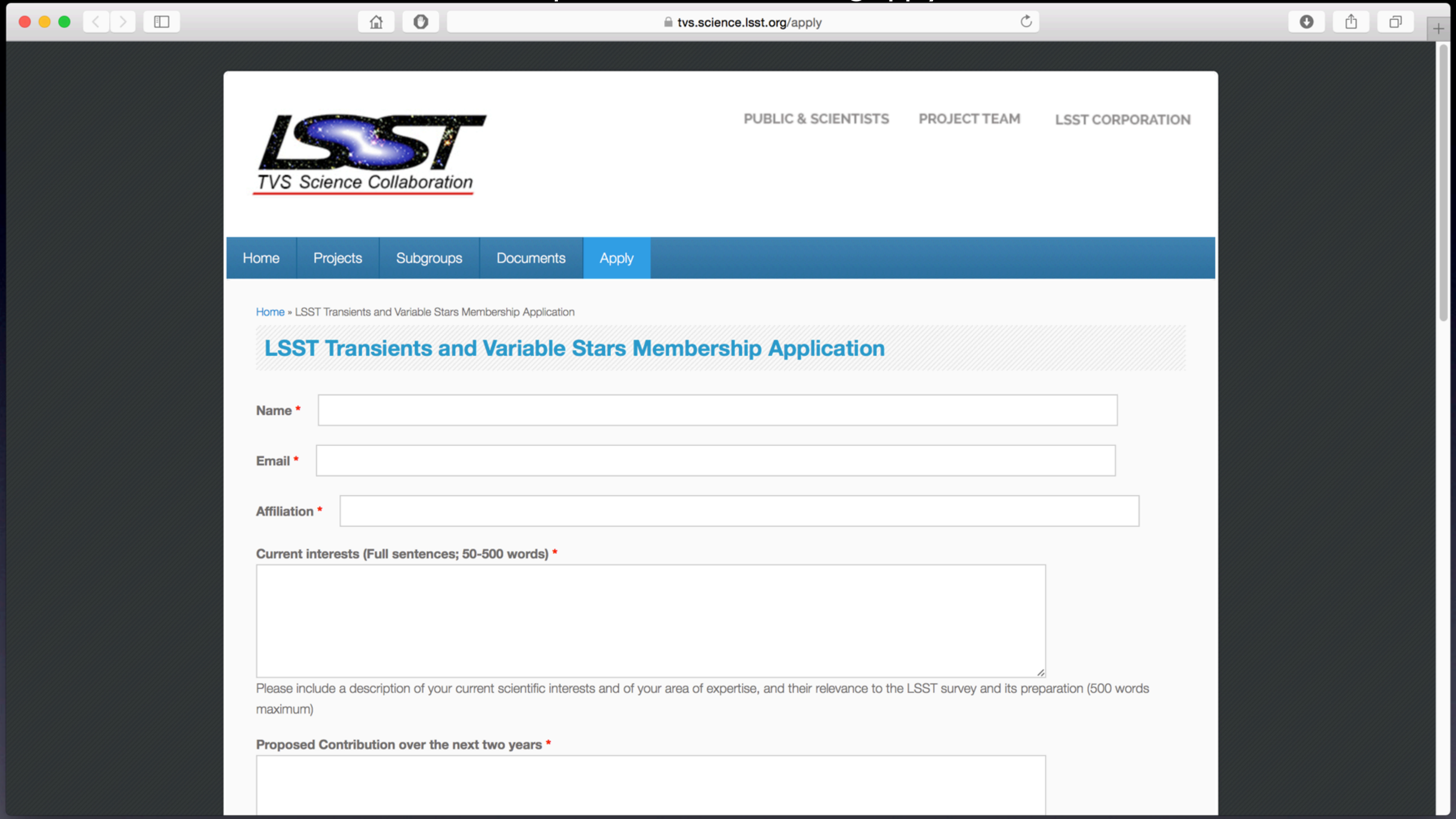
Those of you who are LSST:UK PIs (as joint affiliates) or Junior Associates, can apply to join the US collaboration. Apply here : https://tvs.science.lsst.org/apply

S. Smartt has applied, and was approved, although the process took a long time and formal notification was not obvious. We would encourage all approved LSST:UK scientists to go through this procedure. If and when you do, please add your name to the list at the bottom of this page. Note that the following is an incomplete, example list of people in the UK who expressed interest in this area. This list is illustrative and is not used as a project definition list, or email list, or anything else like that. So don't panic if you are not on it. Add your name, and apply on the above US based project site.

LSST:UK focused work

Some recent activity :

https://tvs.science.lsst.org/apply



https://lsst-uk.atlassian.net/wiki/display/LUSCSWG

lsst-uk.atlassian.net/wiki/display/LUSCSWG/LSST%3AUK+Science+Working+Group+Home

Confluence Spaces People Create

LSST:UK Science Working Group

Pages

Blog

PAGE TREE

- Active Galactic Nuclei
- Athena
- Cosmological Simulations Working G
- Cross area activities
- Dark Energy Science Collaboration
- E-ELT
- Euclid
- GAIA
- Galaxies Science Collaboration
- Galaxy Clusters (LSST:UK Clusters)
- Informatics & Statistics
- Infra-red
- Large Scale Structure Working Group
- Particle Physics
- Photoz Working Group of the DESC
- SKA
- Solar System

Space tools

Pages

Save for later Watch Share

LSST:UK Science Working Group Home

Created by George Beckett [Administrator], last modified by Sarah Bridle on May 27, 2016

Science Collaborations

- Dark Energy Science Collaboration
- Transients and variable stars
- Galaxies
- Informatics & Statistics
- Solar System
- Stars, Milky Way, and Local Volume
- Active Galactic Nuclei

Further information on the structure of the LSST Science Collaborations is available on the LSST Science Collaborations website.

Liaison activities with other projects and domains

- Particle Physics
- Infra-red
- Spectroscopy
- SKA
- GAIA
- E-ELT
- Euclid
- WFIRST
- Athena

Other useful links:

Cross area activities

Relevant documents:

LSST:UK Science Requirements document

Compilation of reports from Liaisons and Points of Contact as input to the May 2016 Oxford LSST:UK Board Meeting

LSST:UK Project Scientist report for the May 2016 Oxford LSST:UK Board Meeting

Recent space activity

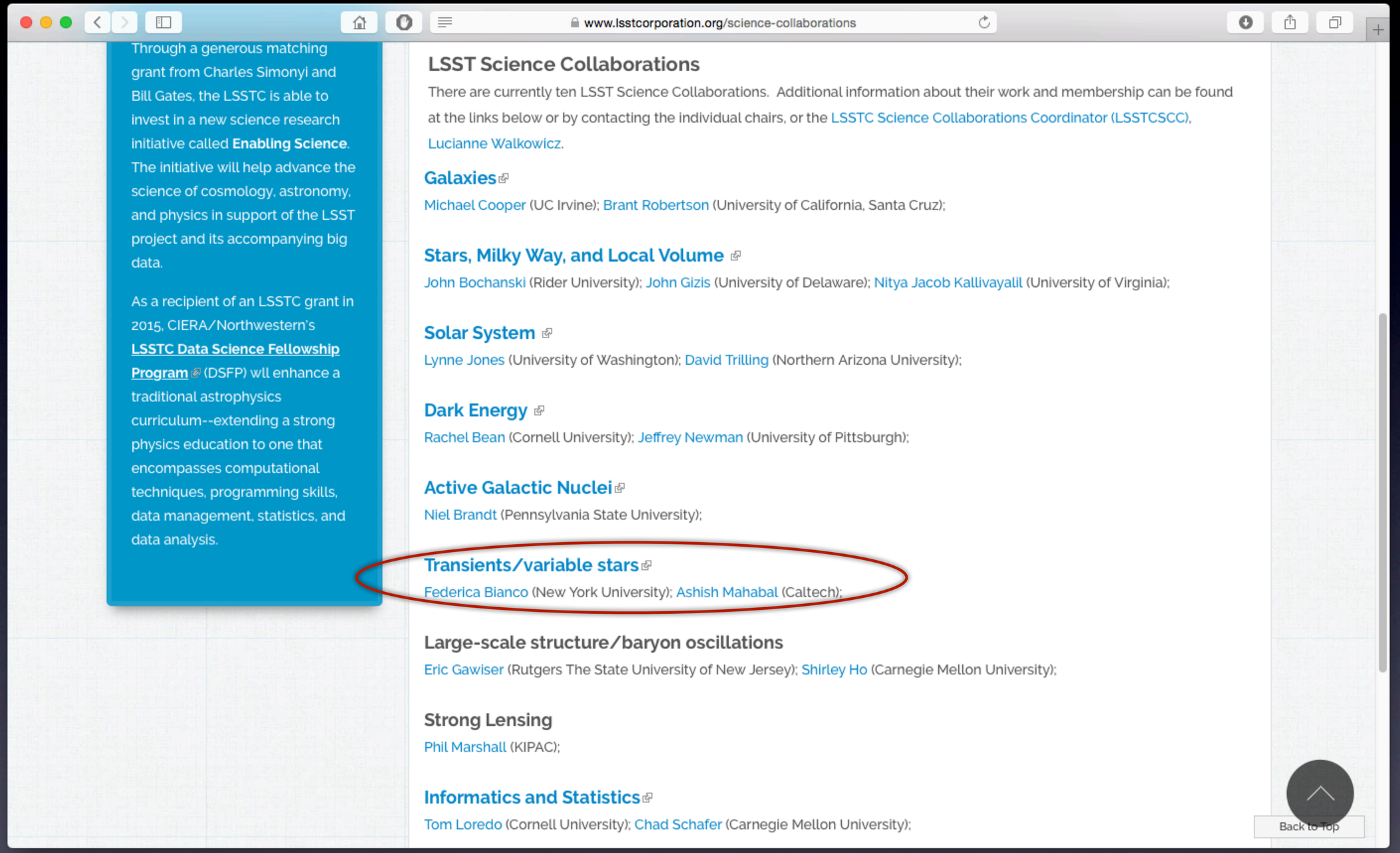
Aprajita Verma

Strong Lensing Working/Analysis Group of the DESC & the Strong

Space contributors

- Aprajita Verma (4 days ago)
- Graham P. Smith (4 days ago)
- Jon Loveday (19 days ago)

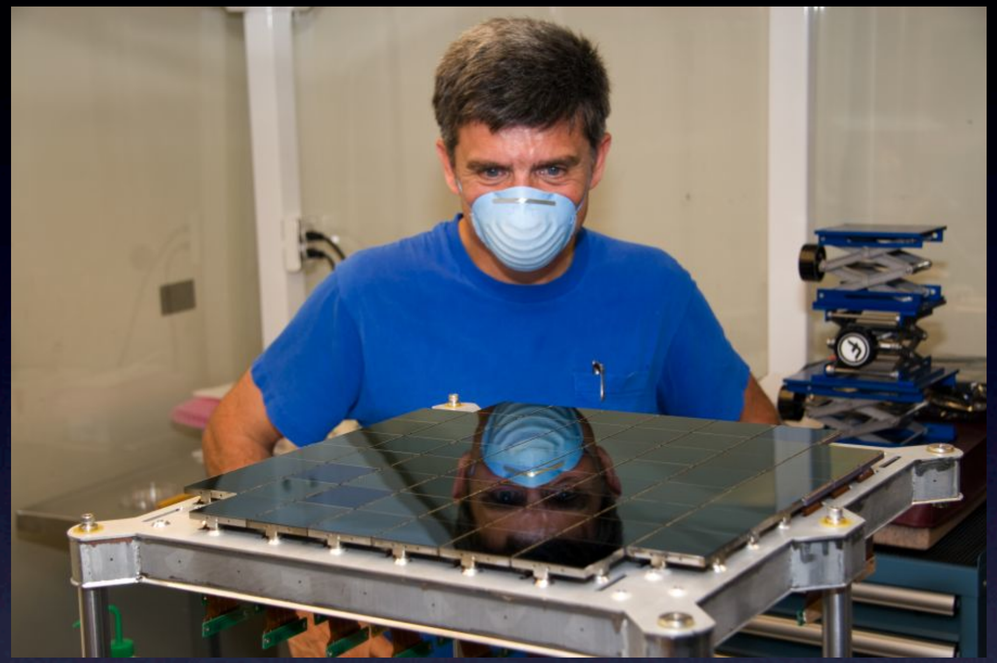
https://www.lsstcorporation.org/science-collaborations

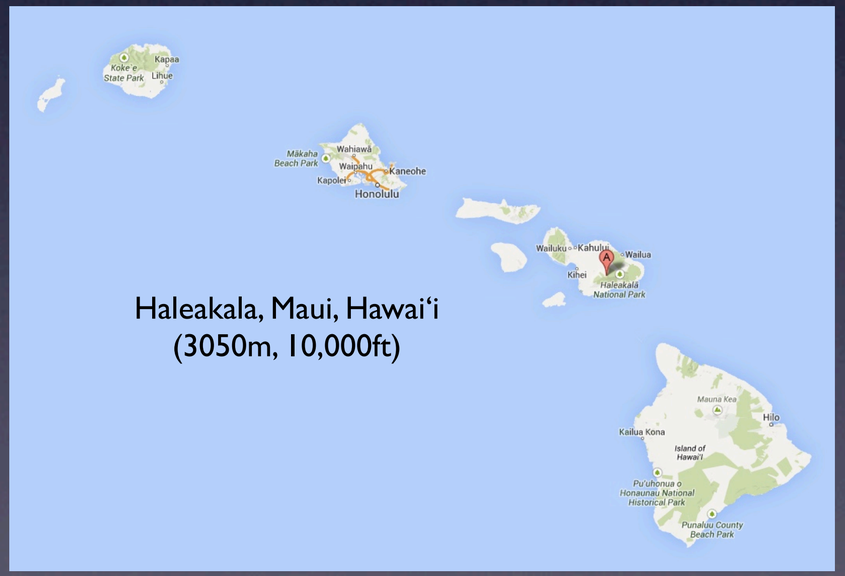


LSST QUB March Meeting

- Overview of Data Access Centre
- Overview of science objectives / applications for LSST
- Pan-STARRS (& ATLAS) applications developed and running at QUB
- Object context classification
- Machine learning applied to massive data sets
- PESSTO marshall software (prioritisation of spectroscopic followup)
- 'qServ' evaluation (LSST database)
- LoDEn / CoDEn development platform + feedback from QUB
- LUSC collaborative tools

Data Stream #1: Panoramic Survey Telescope and Rapid Response System





Haleakala, Maui, Hawai'i
(3050m, 10,000ft)

PS1 & PS2 80 x 4800 x 4800 pixel chips (0.259"/pixel)
= 1.4 gigapixels

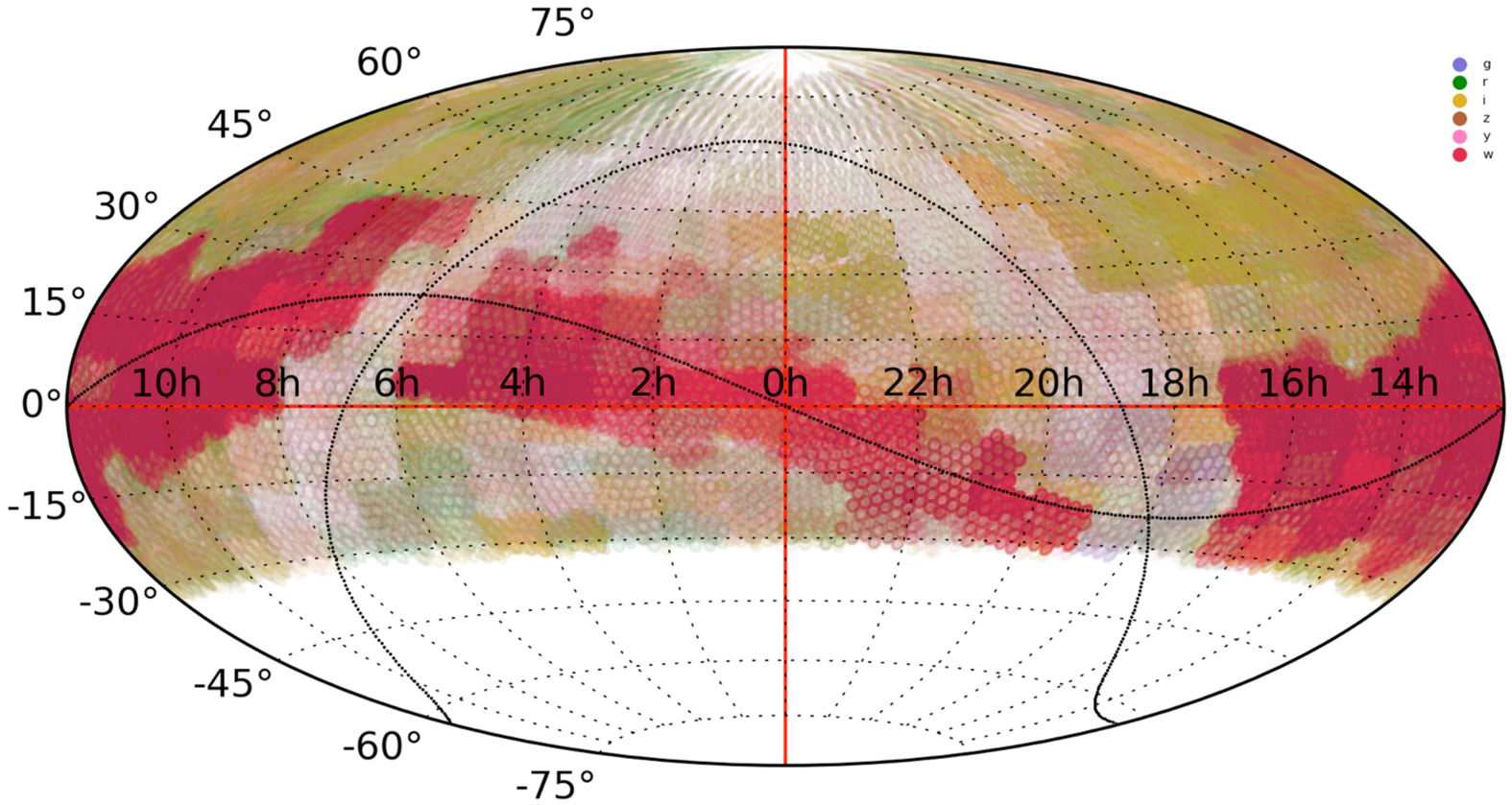
7 square degrees field of view

2 Telescopes located together on Haleakala
PS2 is undergoing commissioning

Difference Detections ingested since June 1st 2013 (with some operational gaps)

PSST Exposures Processed (DB = 1.2 TB, stamps = 2.5TB)

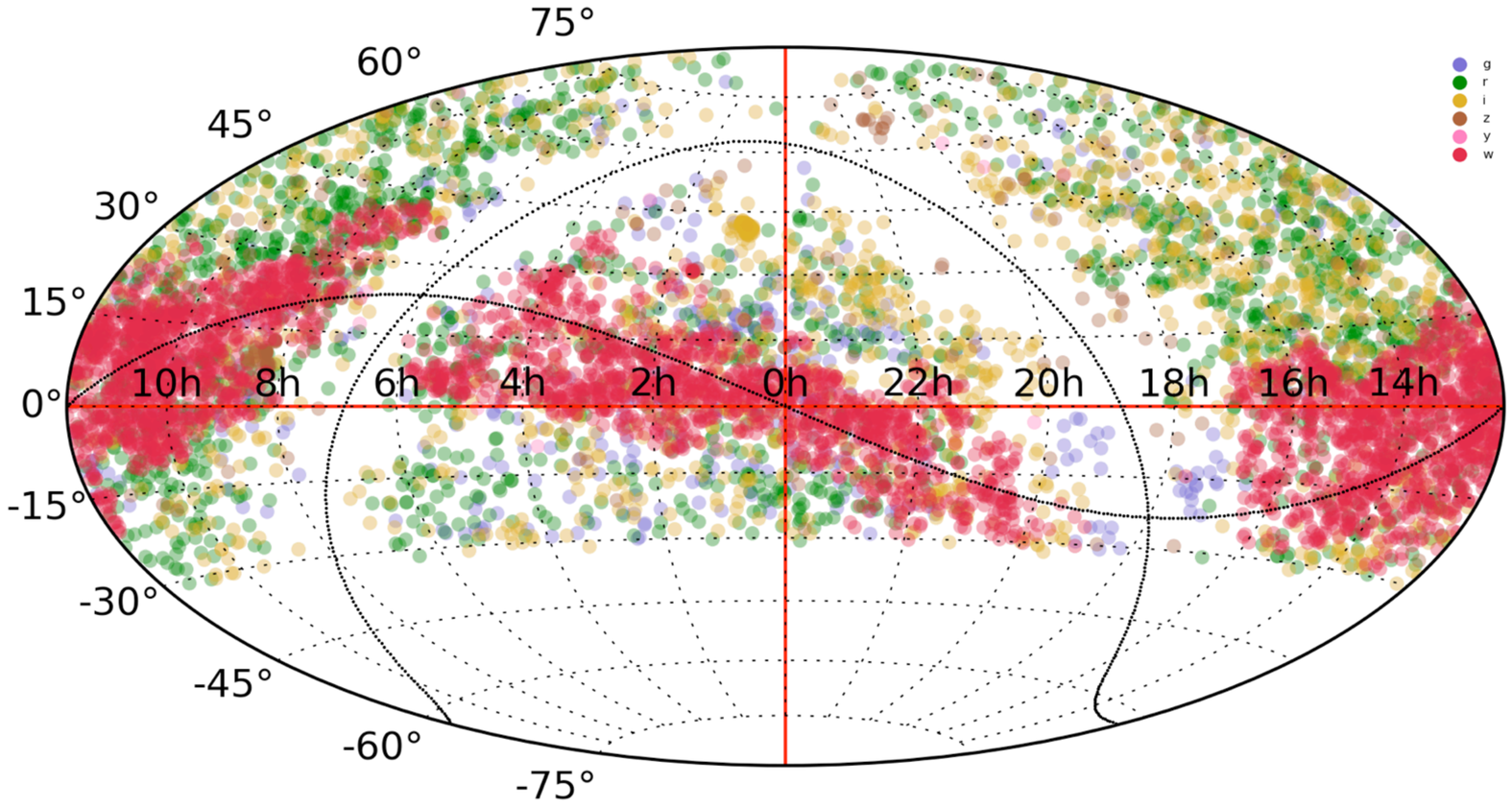
1 billion objects, 2.2 billion detections



The Pan-STARRS Survey for Transients (PSST) - first announcement and public release, M. Huber et. al., ATel #7153

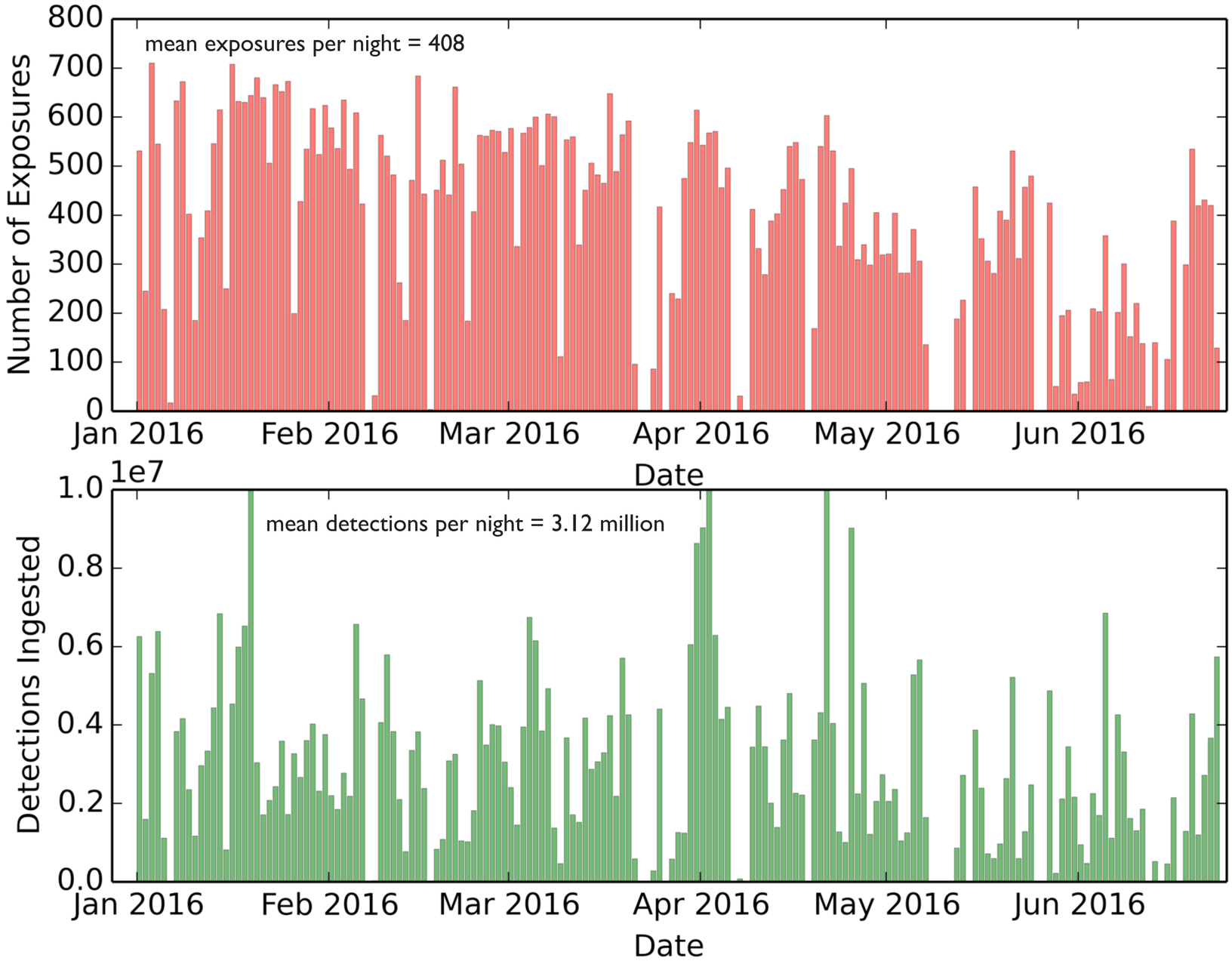
PSST Exposures Processed (DB = 1.2 TB, images = 2.5TB)

7,136 Objects Promoted



The Pan-STARRS Survey for Transients (PSST) - first announcement and public release, M. Huber et. al., ATel #7153

Diff Detections ingested from PS1



PS16ha

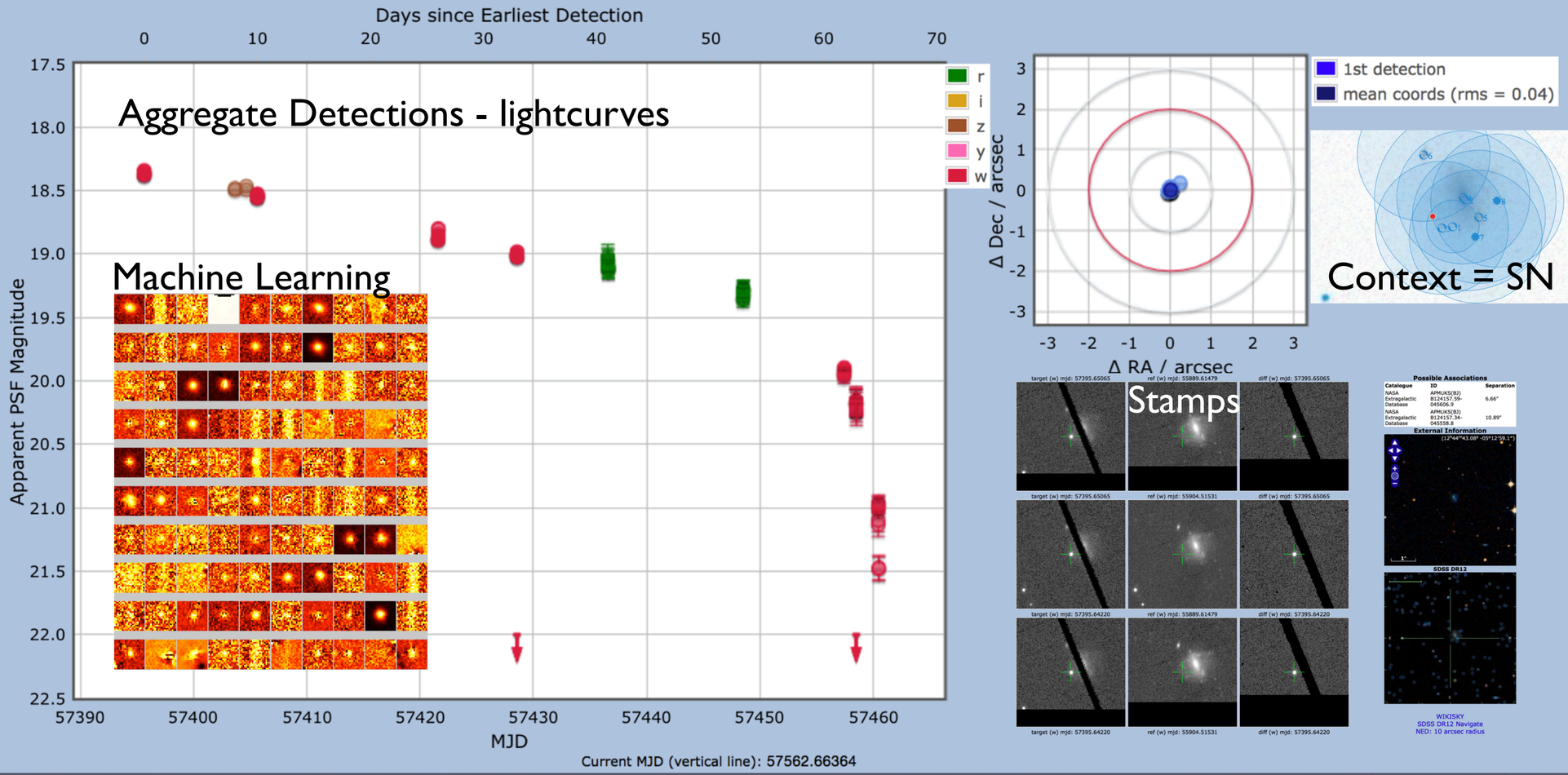
12:44:32.86 -05:12:28.3

See also: MLS151217-124433-051228

Local Name: 6A3Phaa
Flag Date: Jan. 9, 2016
Survey: RING
Processing Flags: targetfinders reffinders stamps locationmap eph ghost brightstar

PS1 Name: PS16ha
Number of Detections: 76
Object List: good
Spectral Type:

Internal Followup ID: 4883013
Internal ID: 1124432860051228300
Contextual Classification: sn



Data Stream #2: Asteroid Terrestrial impact Last-Alert System

John Tonry / Larry Denneau

Larry Denneau

ATLAS Haleakala
(3050m, 10,000ft)

ATLAS Mauna Loa
(3397m, 11145ft)

ATLAS STA 10500 x 10500 pixel single chip (1.86”/pixel)
= 110 megapixels

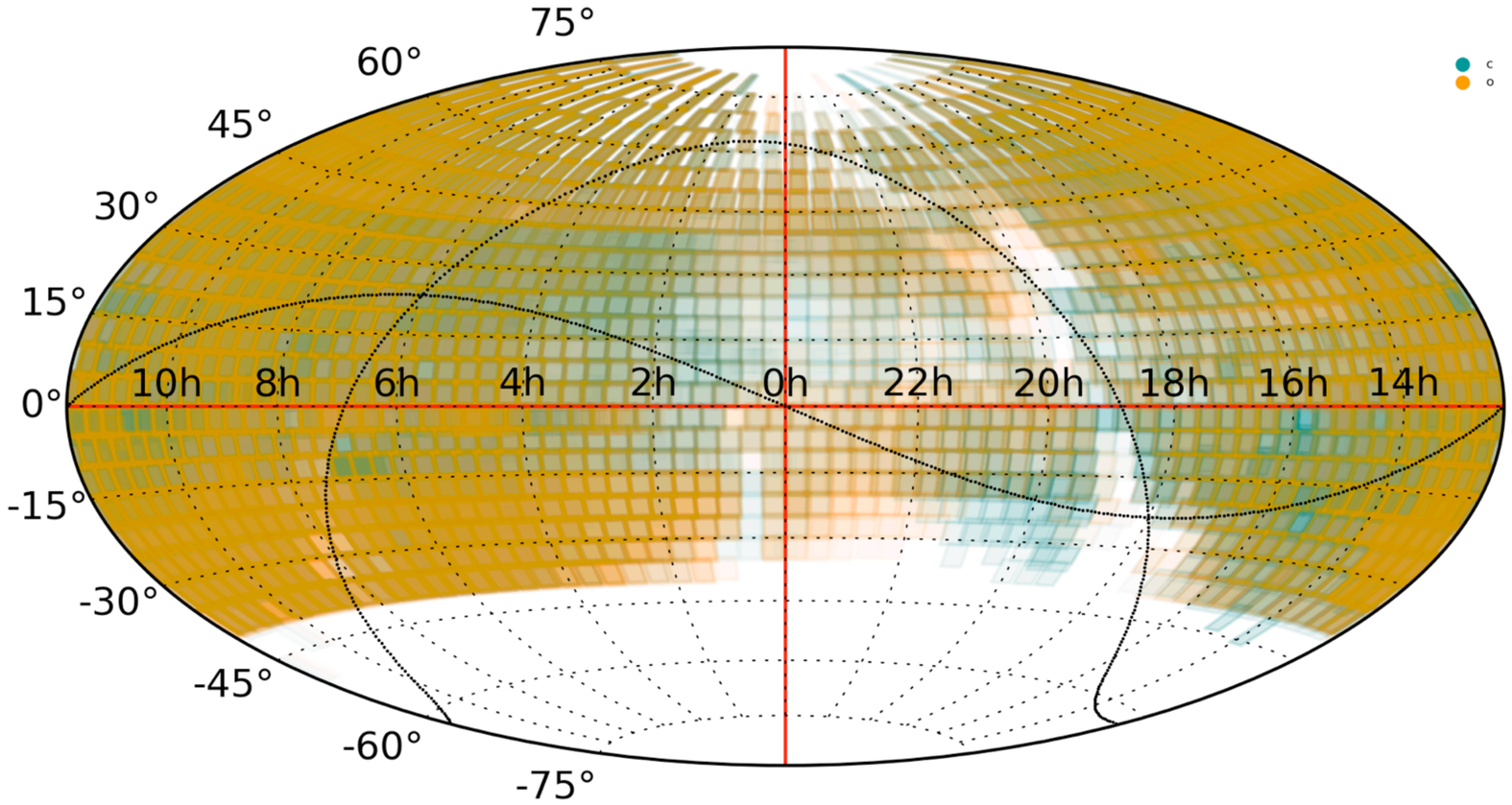
29.4 square degrees field of view

2 Telescopes on Haleakala and Mauna Loa
(MLO not yet fully operational)

Difference Detections ingested since December 21st 2015

ATLAS (Haleakala) Exposures Processed (DB = 245GB, stamps = 500GB)

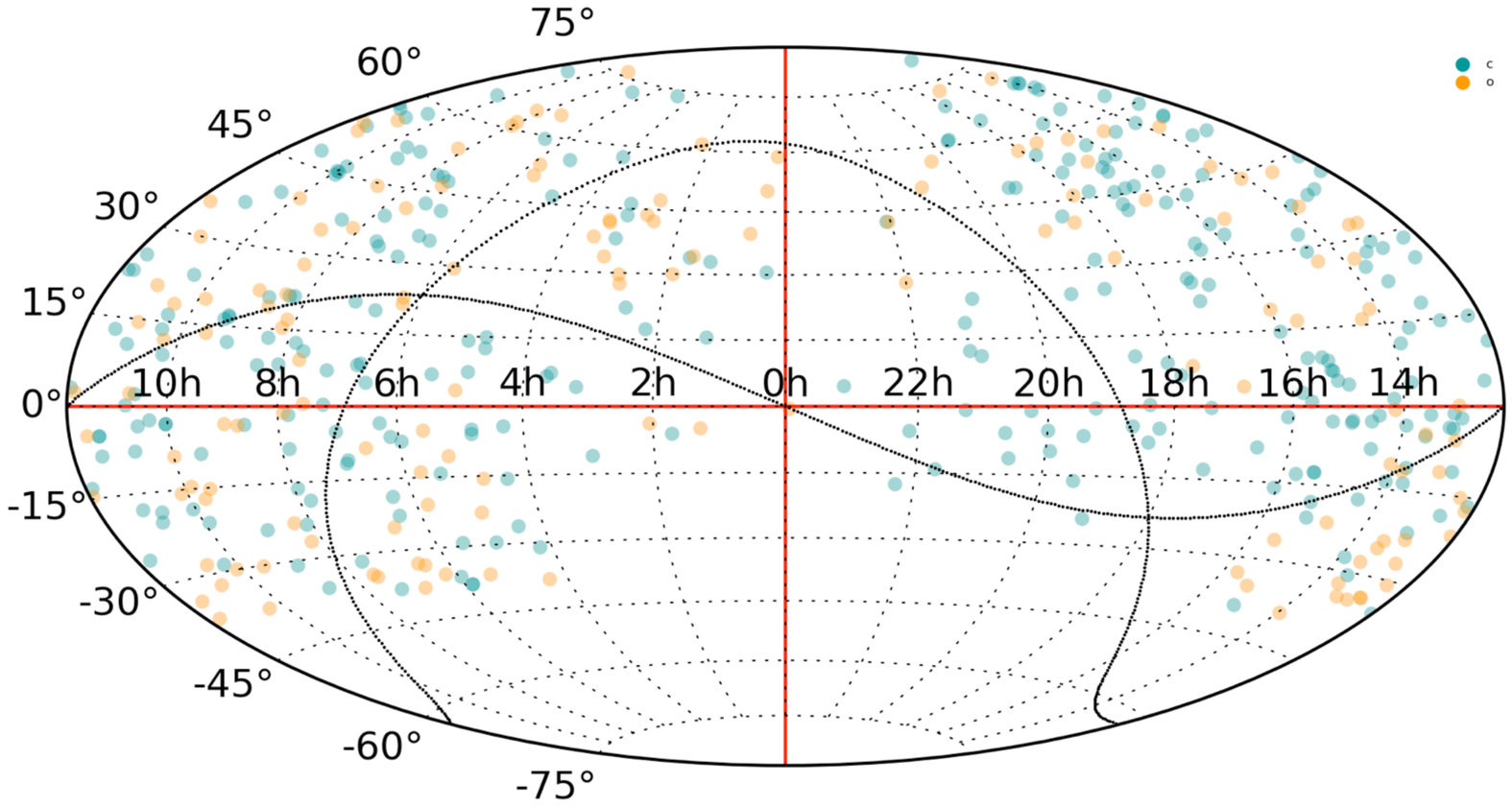
300 million objects, 500 million detections



Discovery and Classification of 3 Type Supernovae by ATLAS, J. Tonry et. al., ATel #8680

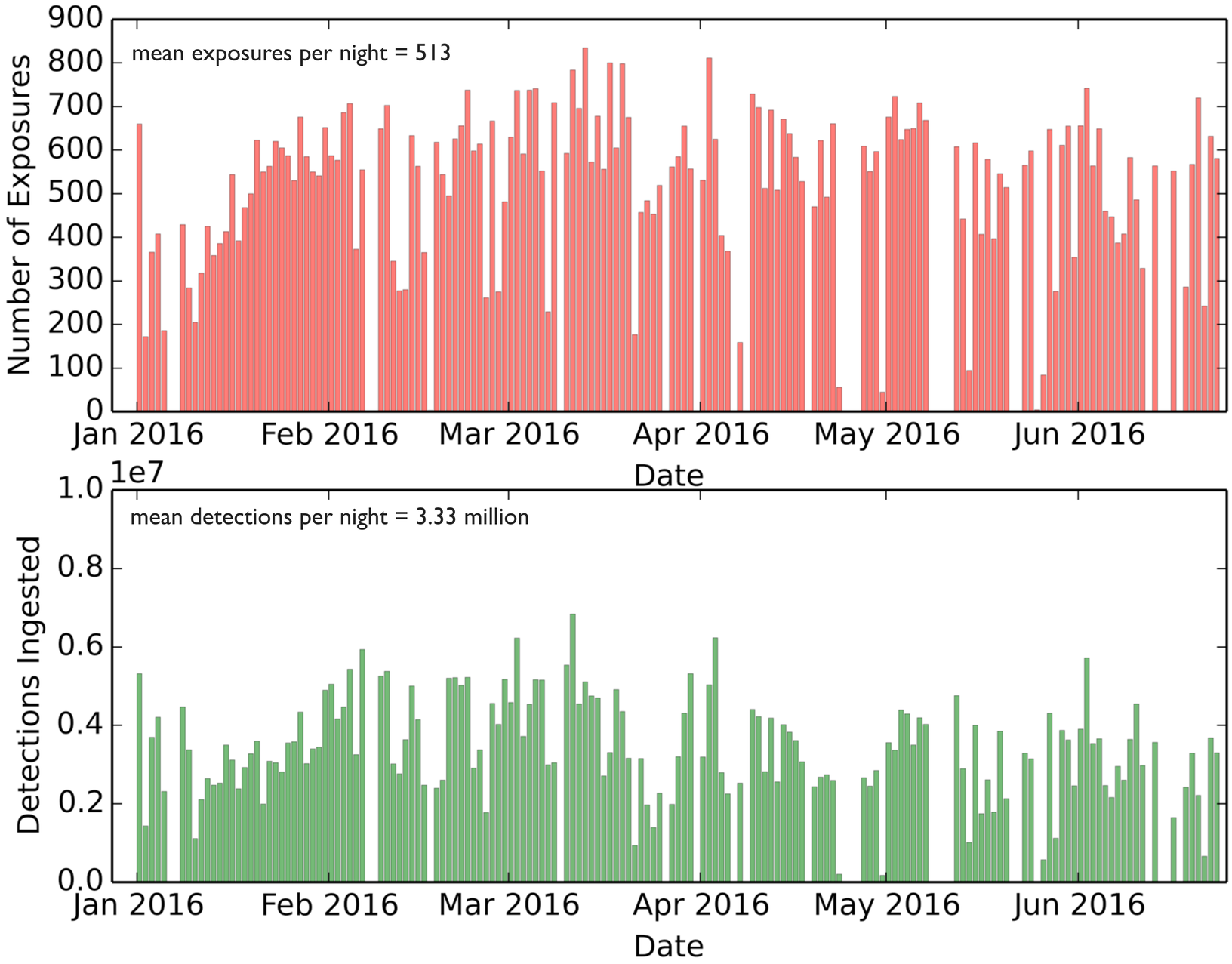
ATLAS Exposures Processed (DB = 245GB, images = 500GB)

429 Objects Promoted
(Still tuning the filtering algorithms + Machine Learning)



Discovery and Classification of 3 Type Supernovae by ATLAS, J. Tonry et. al., ATel #8680

Diff Detections ingested from ATLAS



ATLAS16avw

12:02:51.71 +44:15:27.7
(180.71548 +44.25770)

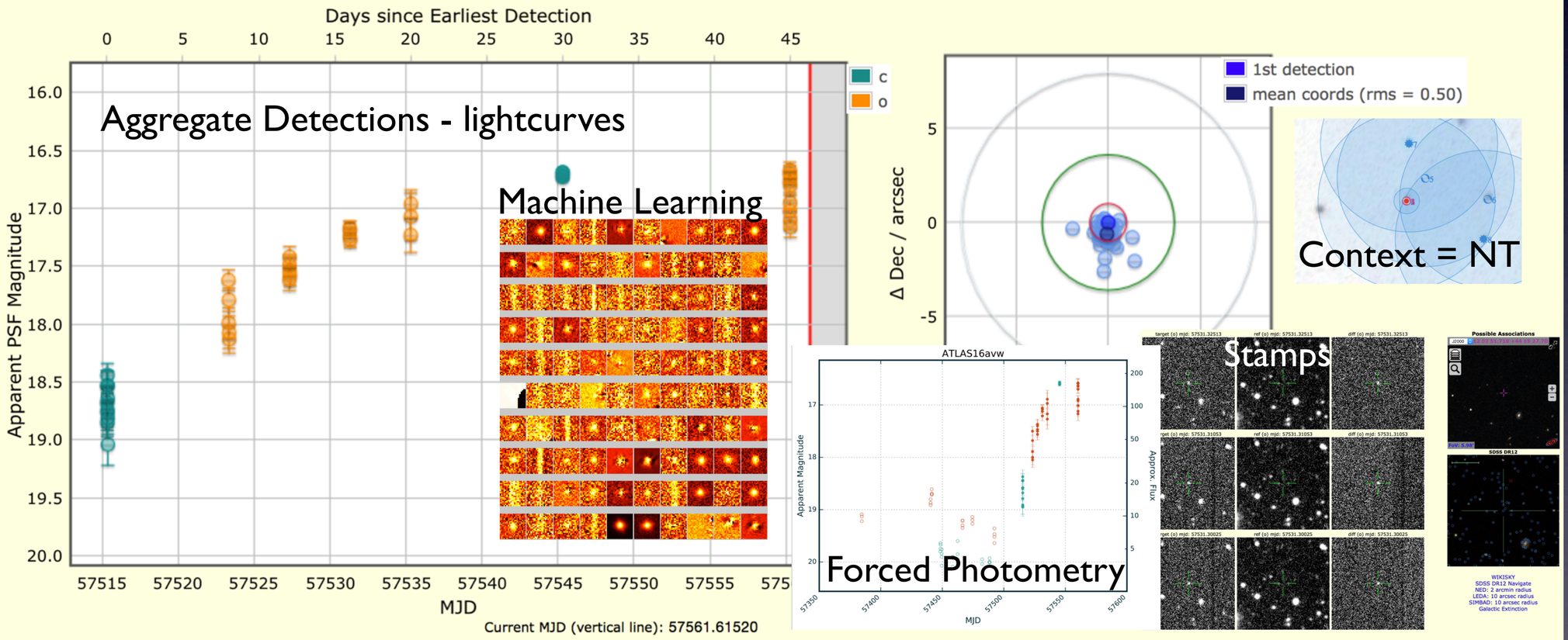
See also: Gaia16apd

Local Name:
Flag Date: May 19, 2016
Survey:
Processing Flags:

Internal Name: ATLAS16avw
Number of Detections: 41
Object List: good
Spectral Type: SLSN-I

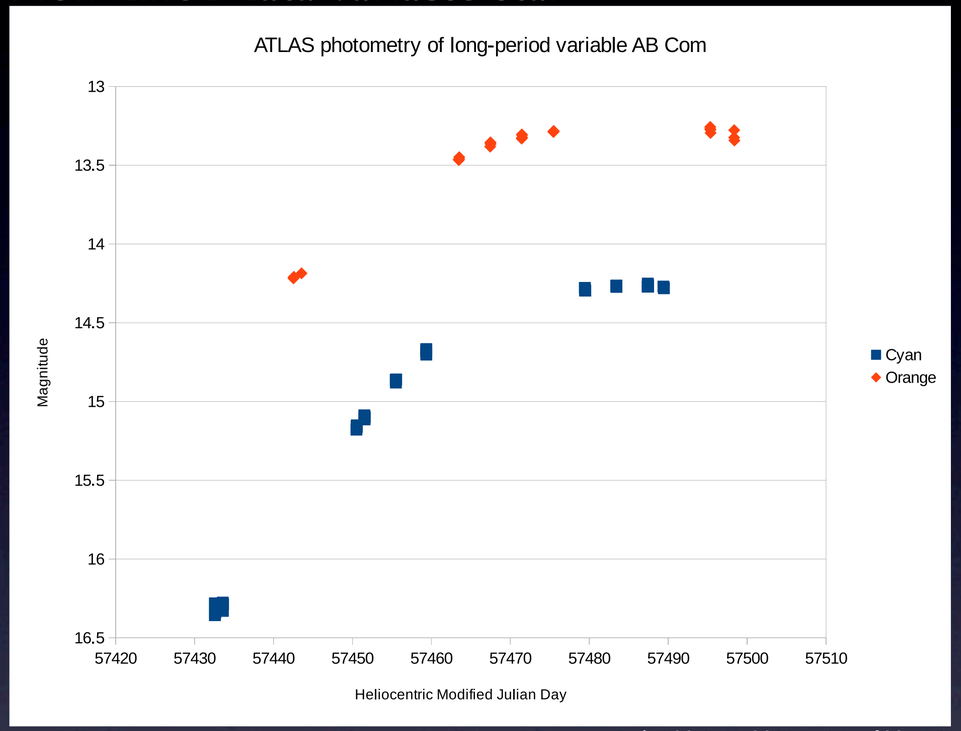
Internal Followup ID: 815370
Internal ID: 1120251721441527100
Contextual Classification: nt
Galactic (l,b): (149.45875,70.28422)

Comments: Good, but known Gaia object: SLSN type I, z=0.1



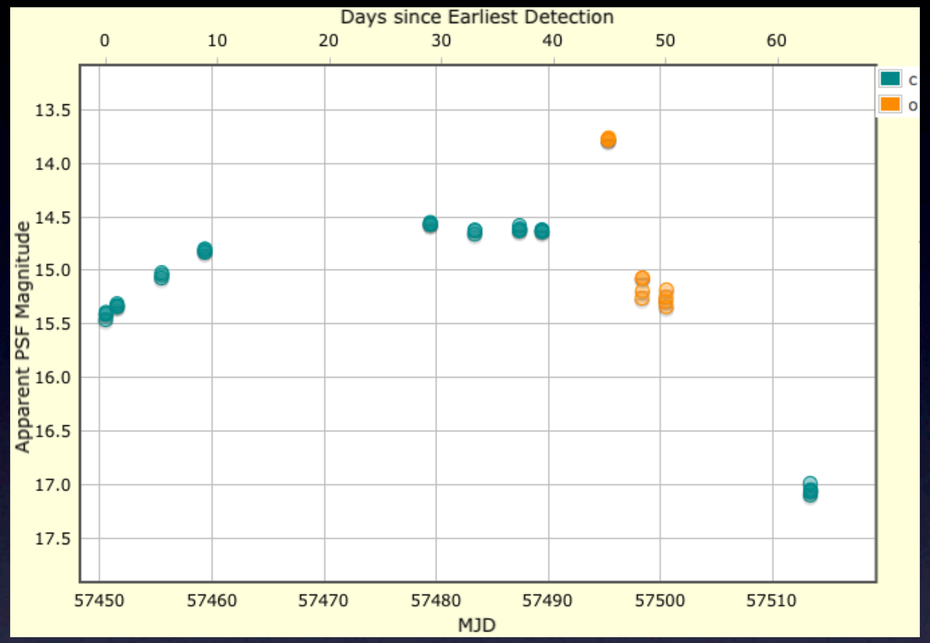
Datastream #2a: ATLAS Billion Stars

Non-diffed data variable star

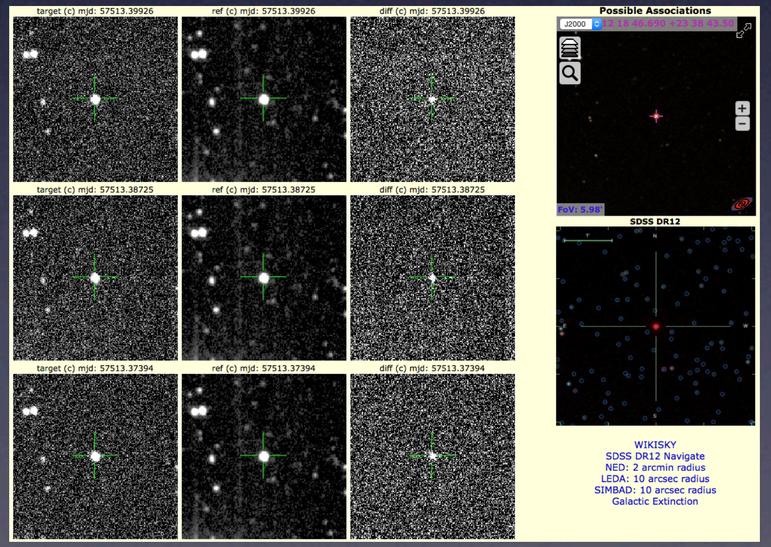


Ari Heinze, University of Hawaii

Same star in diff data



(orange data missing because star was brighter when reference image created)



ATLAS will produce 1 Billion Star + 1000 point lightcurve data based on non-diff data required.

Conservative estimate of database size = at least 100TB per year database, assuming 100 bytes per detection, plus insertion rate of 64K detections / sec.

Good test data for LSST qServ?

What Next?

- Understand how to subscribe to LSST Transients
- Find out how to get stamps around transients
- Apply filters + machine learning to catalogues and stamps
- Apply context classification
- Disseminate the transients data to the community

- Complete/Tune ATLAS diff detection pipeline - including context classification
- Train the machine learning classifiers (both catalogue and pixel)
- Add Mauna Loa telescope data stream

- Test Ingest of ATLAS Difference Detections into qServ
- Test Ingest Variable Star Detections into qServ
- Start using collaborative tools & development environment in anger