

LSST Informatics and Statistics Science Collaboration (ISSC)

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*Mullard Space Science Laboratory (MSSL)
University College London (UCL)*

National Astronomy Meeting (NAM), University of Nottingham, June 2016

LSST Informatics and Statistics Science Collaboration (ISSC)

US (<https://issc.science.lsst.org/>)

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LSST Informatics & Statistics Science Collaboration

Welcome to the web site for the LSST Informatics and Statistics Science Collaboration (ISSC).

The ISSC consists of over [40 data scientists](#) devoted to developing tools for use with large astronomical surveys. Our team includes astronomers, statisticians, computer scientists, and machine learning researchers, with a shared objective of addressing the inference challenges facing LSST as it works to meet its scientific goals.

The ISSC is led by a core team consisting of the following members:

Jogesh Babu

Tamas Budavari

Eric Feigelson

Tom Loredo, co-chair

Chad Schafer, co-chair

Sam Schmidt

Robert Wolpert

LSST Informatics and Statistics Science Collaboration (ISSC)

Joining (<https://issc.science.lsst.org/apply>)

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LSST Informatics & Statistics Membership Application

Prospective members from U.S.-based institutions, please use the application below.

Researchers affiliated with Chilean institutions are also welcome to join the ISSC, but there is a separate application process. Please contact [Sebastian Lopez](#) for more information.

If you have questions regarding membership, please contact Chad Schafer at cschafer@cmu.edu.

First Name *

Last Name *

LSST Informatics and Statistics Science Collaboration (ISSC)

LUSC-ISSC mailing list (LUSC-ISSC@jiscmail.ac.uk)

Subscribe by sending an email to listserv@jiscmail.ac.uk, with the following details:

Subject: <BLANK>

Message: SUBSCRIBE LUSC-ISSC <Firstname> <Lastname>

This mailing list will be used to keep everyone abreast of ISSC related activities.

*Although ISSC is a distinct science collaboration, there will be **close interaction with the activities of DESC and other science collaborations** to ensure informatics and statistics developments are closely related to the science goals of LSST.*

All list members can post messages so feel free to make use of this list for general discussions of interest to members and don't hesitate if you have any questions about ISSC!

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Conferences, meetings and visitor programmes

- Statistical Challenges in 21st Century Cosmology, Chania, 24-27 May 2016
<http://cosmo21.cosmostat.org/>
- Statistical Challenges in Modern Astronomy, Carnegie Mellon University, 6-10 June 2016
<http://scma6.org/>
- LSST@Europe 2, Belgrade, 20-24 June 2016
<https://project.lsst.org/meetings/lsst-europe-2016/>
- DESC collaboration meeting, Oxford, 18-22 July 2016
<http://www.lsst.ac.uk/news/2016/oxford-welcomes-desc-2016-16-01-12>
- SAMSI opening workshop on Statistical, Mathematical and Computational Methods for Astronomy, North Carolina, 22-26 August 2016
<https://www.samsi.info/programs-and-activities/research-workshops/2016-17-astro-opening-workshop-august-22-26-2016/>
- SAMSI visitor programme, North Carolina
<https://www.samsi.info/programs-and-activities/year-long-research-programs/2016-17-program-on-statistical-mathematical-and-computational-methods-for-astronomy-astro/>

Conferences, meetings and visitor programmes

- Biomedical and Astronomical Signal Processing (BASP) Frontiers workshop**
 Villars, Switzerland, 29 January - 3 February 2017
 Dedicated LSST informatics and statistics session
<http://www.baspfrontiers.org/>




International BASP Frontiers workshop 2017
January 29 - February 3, 2017 - Villars-sur-Ollon, Switzerland

[General](#)
[Programme](#)
[Venue and resort](#)
[Contributions](#)
[Registration](#)



IMPORTANT DATES

01.06.2016 Session proposal deadline
 01.09.2016 Abstract submission opening
 01.10.2016 Abstract submission deadline

About the workshop

The **International Biomedical and Astronomical Signal Processing (BASP) Frontiers workshop** was created to promote synergies between selected topics in astronomy and biomedical sciences, around common challenges for signal processing.

Building on the success of the first workshops (2011, 2013 and 2015), BASP Frontiers 2017 will gather around 100 participants and open its floor to many interesting hot topics in theoretical, astrophysical, and biomedical signal processing, with a particular focus on imaging.

Ski and full board philosophy: Following our tradition, BASP Frontiers 2017 will take



Photometric supernova classification

Machine learning

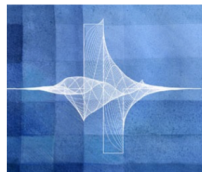
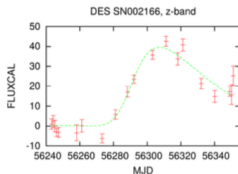
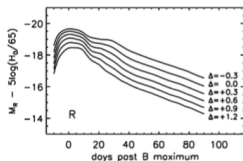
- Spectroscopic follow-up not possible for majority of sample.
- Photometric supernova classification to determine **SN type** by **machine learning** (Lochner, McEwen, Peiris, Lahav & Winter 2016; [arXiv:1603.00882](https://arxiv.org/abs/1603.00882)).
- Go beyond single techniques to **study classes**.
- Understand **physical requirements** (e.g. representative training, redshift).



Michelle
Lochner

Photometric supernova classification

Feature selection



Template Fitting

SALT2 templates
fitted with SNCosmo
+MultiNest

General parameterisations

Karpenka et al (2014)
Newling et al. (2010)
fitted with MultiNest

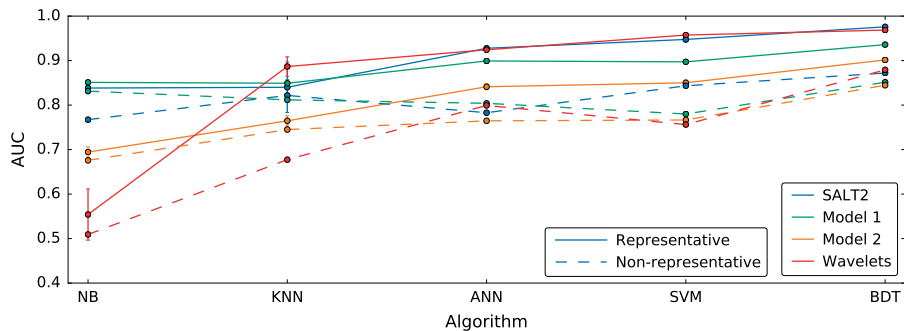
Wavelets

Gaussian Process fit to
light curves; wavelet
decomposition; PCA

Model Independence

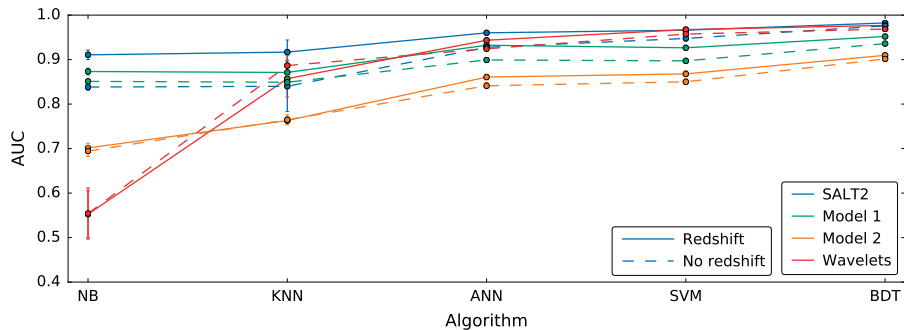
Photometric supernova classification

Importance of representative training data



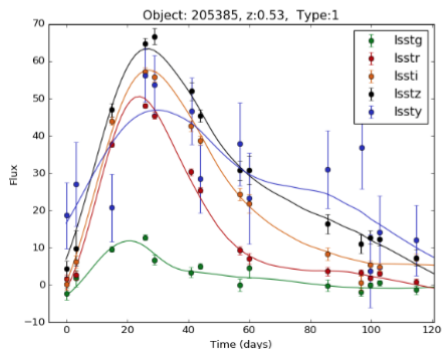
Photometric supernova classification

Importance of redshift

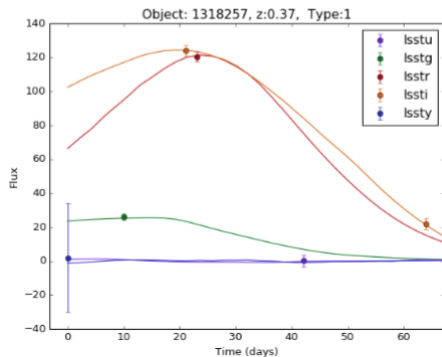


Photometric supernova classification

Applying to LSST cadence simulations

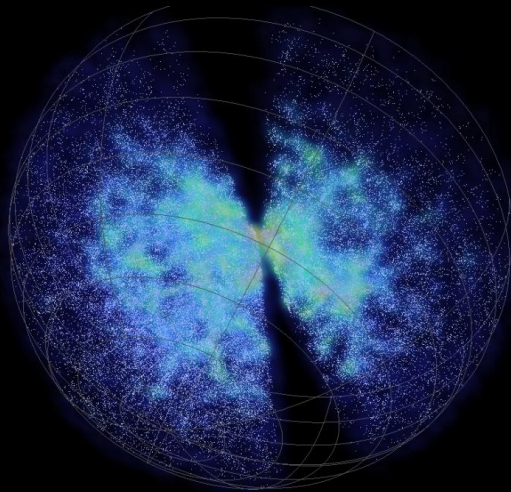


*Wavelets,
Deep Drilling Fields*



*Wavelets,
Wide-Fast-Deep*

LSST 3D data compression (3DDC) taskforce



Credit: SDSS

LSST 3D data compression (3DDC) taskforce

3DDC taskforce wiki page:

<https://confluence.slac.stanford.edu/pages/viewpage.action?pageId=195857648>

3DDC taskforce Slack team:

<https://lsst3ddc.slack.com>

Contributors: Franz Elsner, Jean-Eric Campagne, Benjamin Joachimi, Thomas Kitching, Francois Lanusse, Boris Leistedt, Jason McEwen, Hiranya Peiris, Layne Price, Anze Slosar, Edo van Uitert, ...

- Why 3D?

- Extract more information
- Filter non-linear scales
- Deal with covariances

- Challenges

- Fast transforms for data and theory
- 3D pixelisations
- Mask, selection effects, covariances, systematics

LSST 3D data compression (3DDC) taskforce

Identified existing codes for 2D/3D transforms

Add yours!

CosmicPy	C++, Py	Theory Fourier-Bessel
MRS3D	C++	Fourier-Bessel + wavelets
3DEX	F90 (!)	Fourier-Bessel transform
HEALPIX	C, F90, Py, IDL	2D Spherical harmonics
SSHT	C, Matlab	2D Spherical harmonics
FLAG(LET)	C, Py, Matlab	3D Fourier-Laguerre + wavelets
LagSHT	C++	3D Fourier-Laguerre + Bessel
3DFast	C	Flat-sky Fourier-Bessel

Plan to start **Uber 3D code**™

Get in touch if you'd like to contribute!



LSST 3D data compression (3DDC) taskforce



Uber 3D code™

<https://github.com/astro-informatics/uber3d>



- **Data:** survey => 3D clustering+shear power spectra
 - **Theory:** interfaced with cosmology library
- Supports all existing transforms and pixelizations
- **Extras:** likelihoods, systematics mitigation, etc



LSST 3D data compression (3DDC) taskforce

```

77%] Building CXX object src/Healpix_cxx/CMakeFiles/healpix.dir/moc_query.cc.o
79%] Building CXX object src/Healpix_cxx/CMakeFiles/healpix.dir/alm_fitsio.cc.o
81%] Building CXX object src/Healpix_cxx/CMakeFiles/healpix.dir/powspec_fitsio.cc.o
83%] Building CXX object src/Healpix_cxx/CMakeFiles/healpix.dir/healpix_data_io.cc.o
84%] Building CXX object src/Healpix_cxx/CMakeFiles/healpix.dir/healpix_map_fitsio.cc.o
86%] Building CXX object src/Healpix_cxx/CMakeFiles/healpix.dir/moc_fitsio.cc.o
88%] Linking CXX shared library libhealpix.so
88%] Built target healpix
90%] Building CXX object src/uber3d/CMakeFiles/uber3d.dir/almn_cln_tools.cpp.o
92%] Building CXX object src/uber3d/CMakeFiles/uber3d.dir/almn_fitsio.cpp.o
94%] Building CXX object src/uber3d/CMakeFiles/uber3d.dir/cln_fitsio.cpp.o
96%] Linking CXX shared library libuber3d.so
96%] Built target uber3d
98%] Building CXX object src/dsbt/CMakeFiles/dsbt.dir/fastDSBT.cpp.o
100%] Linking CXX shared library libdsbt.so
100%] Built target dsbt
francois@Procyon build]$
    
```

Uber3D Trello Board after hack day,
March DESC Collaboration Meeting @SLAC

Uber 3D Private

To Do

- Review Fourier-Bessel equations
- Add discussion of sampling and quadrature to doc
- Set up data structures
- Read/write data structures to fits files
- Forward Fourier-Bessel transform on separable sampling
- Inverse Fourier-Bessel transform on separable sampling
- Create a template documented function
- Radial construction (linear, log, quadrature)
- Add a card...

Queued

- Set up test framework for code
- Set up doxygen
- Add a card...

Doing

- Class for Radial Sampling
- Class for Angular Sampling + SHT and Healpix children
- Add a card...

Done

- Add text surrounding equations
- Inverse spherical Bessel transform
- Compute zeros of spherical Bessel functions
- Forward spherical Bessel transforms
- Enter overview equations of interest into doc
- All get code framework running locally
- Brainstorm expressions for transforms on whiteboard
- Add a card...

Menu

- Change Background
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- Activity
 - Jason McEwen moved [All get code framework running locally](#) from Doing to Done 5 minutes ago
 - Jason McEwen moved [Add text surrounding equations](#) from Doing to Done an hour ago
 - Francois Lanusse moved [Inverse spherical Bessel transform](#) from Doing to Done an hour ago
 - Francois Lanusse moved [Compute zeros of spherical Bessel functions](#) from Doing to Done an hour ago
 - Francois Lanusse moved [Forward spherical Bessel transforms](#) from Doing to Done an hour ago