# Boris Leistedt — Curriculum Vitae

NASA Einstein Fellow, Center for Cosmology & Particle Physics, New York University
Contact: boris.leistedt@nyu.edu    Homepage: http://www.ixkael.com    Software: github.com/ixkael

## Research Interests

**Fundamental physics:** tests of early universe and high-energy physics using cosmological data sets.[23,25]

**Analysis of galaxy surveys:** photometric redshifts, galaxy & quasar clustering, cross-correlations, using novel statistical estimators [24,7] and Bayesian inference methods [6,4] including robust systematics mitigation.[10,27]

Statistics and dynamics of Milky Way stars. [3,1] Cosmic Microwave Background component separation [26,28,22] Connections between (deep) machine learning, (hierarchical) Bayesian statistics, and compressive sensing.

*The numbers in brackets refer to selected first- or second-author journal publications, see list below.*

## Current and past positions

**NYU – New York University (USA)**, Center for Cosmology & Particle Physics.    since 2015
Postdoctoral researcher. Advisor: David Hogg.

**UCL – University College London (UK)**, Department of Physics & Astronomy.    2014 – 2015
Postdoctoral researcher. Advisor: Hiranya Peiris.

## Education

**UCL – University College London (UK)**    2011 – 2014

Doctor of Philosophy (PhD) in Physics and Astronomy, awarded 10/2014.
Thesis: *Accurate cosmology with galaxy and quasar surveys*. Advisor: Hiranya Peiris.

**UMons – University of Mons (Belgium)** and    2006 – 2011
**Supélec – École Supérieure d'Électricité (France)**

Joint Diplôme d'Ingénieur (dual MSc Electrical Engineering / Computer Science).
Thesis: *Optimal learning sets for preference modeling and decision making*.
Advisors: Marc Pirlot (UMons) and Vincent Mousseau (École Centrale Paris).

**Paris 11 – Orsay Paris-Sud University (France)**    2008 – 2011

Master de Physique Fondamentale (MSc Physics, joint with engineering degree)

## Awards

| | |
|---|---|
| NASA Einstein Research Fellowship (3-year national physics fellowship) | 2016 – 2019 |
| Simons Foundation Research Fellowship (3-year interdisciplinary fellowship) | 2015 – 2016 |
| UCL Jon Darius Memorial Prize (outstanding PhD research in astrophysics) | 2015 |
| RAS Michael Penston Prize (runner-up, best UK PhD thesis in astrophysics) | 2014 |
| ORBEL award finalist (best MSc thesis in operational research in Belgium) | 2011 |
| High Octane award (top of MSc class), Faculty of Engineering, University of Mons | 2011 |
| T.I.M.E. scholarship held at UMons/Supélec/Paris 11 ( exchange program between top European engineering universities leading to a joint MSc degree) | 2008 – 2011 |

## ORGANISATION OF WORKSHOPS AND SEMINARS

Organiser of interdisciplinary weekly group meetings (Stars & Milky Way, and Cosmology and Statistics) at the Flatiron Institute Center for Computational Astronomy     since 2016

Co-organiser of the interdisciplinary *Biomedical and Astronomical Signal Processing (BASP) Frontiers workshops* (2013, 2015, 2017)     since 2013

Co-organiser of the *Cross-correlating cosmic probes* conference in UCL     June 2014

## TEACHING

Lecturer (10 hours, astrostatistics and cosmology) at the CosmoAndes School (Chile).     Jan 2018

Lecturer (5 hours, astrostatistics and cosmology) at the TIARA Summer school (Taiwan)     Sept 2017

## ACADEMIC SERVICE AND OTHER AFFILIATIONS

Regular visitor, Center for Inference & Cosmology, Imperial College London.     since 2017

Regular visitor, Department of Physics & Astronomy, University College London.     since 2015

Full member of the LSST Dark Energy Science Collaboration.     since 2016

Member of the Dark Energy Survey (with full individual data-rights).     since 2014

Referee for ApJ, JCAP, MNRAS, RSPA, JOSA     since 2014

## PUBLIC CODES (main author only, see github.com/ixkael for full list)

| | |
|---|---|
| Starlight | Joint inference of stellar colors and distances via hierarchical models. |
| Delight | Photo-$z$'s and latent galaxy SEDs from deep photometry via Gaussian Processes. |
| PZ tools | Tools for photometric redshift (photo-$z$) estimation and mock generation. |
| QuickSip | Quickly weight & project galaxy Survey Image Properties (e.g. seeing) into sky maps. |
| So3 | Sampling theorem and Wigner transforms on the 3D ring torus. |
| S2let | 2D spherical spin directional wavelets, curvelets, and ridgelets on the sphere. |
| Flag (let) | 3D Fourier-Laguerre sampling theorem, harmonic transforms and 3D wavelets. |

## OUTREACH AND PUBLIC ENGAGEMENT

Since 2013 I have been tweeting about astronomy and careers in STEM with the username @ixkael.

In addition to outreach talks at specific events (a few per year), I was involved in the following activities:

| | |
|---|---|
| Seminar organiser for the UCL *Certificate in Astronomy* course. | 2013 – 2015 |
| Animator for the Your Universe outreach festival, UCL (high-school students). | 2013 – 2015 |
| Consultant for the Dash theatre company (trailer of the project). | 2012 |

## REFERENCES

### Hiranya Peiris

Director, Oskar Klein Centre for Cosmoparticle Physics, Stockholm, Sweden
Professor, Dept of Physics & Astronomy, University College London, UK
Contact: h.peiris@ucl.ac.uk

### David Hogg

Professor, Center for Cosmology and Particle Physics, New York University, USA
Contact: david.hogg@nyu.edu

### Alan Heavens

Director, Imperial Centre for Inference and Cosmology, Imperial College London, UK
Chair in Astrostatistics, Department of Physics, Imperial College London, UK
Contact: a.heavens@imperial.ac.uk

### Licia Verde

Professor, Institute of Cosmos Sciences, University of Barcelona, Spain
Contact: liciaverde@icc.ub.edu

## COMPUTING SKILLS

Proficient in C, C++, Fortran, IDL, Matlab, Python.  Notions of Java, R, Scala, SQL, XML.
High Performance Computing on heterogeneous Systems (OpenMP, MPI, OpenCL, GP-GPU)
Bayesian and machine learning toolkits: Skikit-Learn, Stan, TensorFlow.

## SELECTED PRESENTATIONS

Meeting names are in italic. Inter-disciplinary talks and meetings are highlighted with *.
Talks at bi-annual DES and LSST DESC collaboration meetings are not included.

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|---|---|
| Jan 2017 * | *BASP Frontiers Workshop 2017*, Villars, Switzerland (**invited**) |
| Nov 2016 | Department of Astrophysical Sciences, Princeton University, USA (**invited**) |
| Oct 2016 | Department of Physics, University of Oxford, UK (**invited**) |
| Oct 2016 | Department of Physics, Yale University, USA (**invited**) |
| Sept 2016 | Department of Physics & Astronomy, Rutgers University, USA (**invited**) |
| May 2016 | Department of Physics & Astronomy, University of Delaware, USA (**invited**) |
| May 2016 * | *Statistical Challenges in 21st Century Cosmology*, Chania, Greece. |
| Apr 2016 * | Center for Data Science, New York University, USA (**invited**) |
| Apr 2016 | American Physical Society (APS), Salt Lake City, USA (**invited**) |
| Apr 2016 | McWilliams Center for Cosmology, Carnegie Mellon University, USA (**invited**) |
| Mar 2016 | Kavli Institute for Particle Astrophysics and Cosmology, Stanford University, USA |
| Feb 2016 | *SphereX Community Workshop*, California Institute of Technology, USA |
| Jan 2016 * | *Sampling & non-sampling methods in cosmology*, University of California, Berkeley, USA |
| Dec 2015 | Dept of Physics & Astronomy, Imperial College London, UK (**invited**) |
| Mar 2015 | Dept of Physics & Astronomy, University College London, UK |
| Jan 2015 * | *BASP Frontiers Workshop 2015*, Villars, Switzerland (**best presentation prize**) |
| Nov 2014 | Lawrence Berkeley Laboratory, Berkeley, USA (**invited**) |
| Nov 2014 | Perimeter Institute, Waterloo, Canada (**invited**) |
| Nov 2014 | Institute of Astronomy & DAMPT, University of Cambridge, UK (**invited**) |
| Sept 2014 | Department of Astrophysical Sciences, Princeton University, USA |
| Sept 2014 | Institute for Strings, Cosmology & Astroparticle Physics, Columbia University, USA |
| Sept 2014 | Institute for Theory and Computation, Harvard University, USA |
| Sept 2014 | Center for Cosmology and AstroParticle Physics, Ohio State University, USA |
| Aug 2014 | COSMO 2014, Kavli Institute for Cosmological Physics, University of Chicago, USA |
| July 2014 | Laboratorio Interinstitucional de e-Astronomia, Rio de J., Brazil (webminar, **invited**) |
| July 2014 * | *Science on the Sphere, Royal Society Seminar*, Chicheley Hall, UK (**invited**) |
| Jun 2014 * | *Astronomy and Biomedical Imaging Workshop*, UCL Crick Institute, UK |
| Apr 2014 * | *Statistical Challenges in 21st Century Cosmology*, Lisbon, Portugal |
| Apr 2014 | *Progress on Old and New Themes in Cosmology*, Avignon, France |
| Mar 2014 | *49th Rencontres de Moriond*, La Thuile, Italy |
| Dec 2013 | London Cosmology Discussion Meeting (LCDM), UK |
| Nov 2013 | Department of Physics, University of Oxford, UK (**invited**) |
| Oct 2013 | Institute of Cosmological Sciences, University of Barcelona, Spain |
| Aug 2013 * | *Wavelet and Sparsity XV, SPIE 2013*, San Diego, USA (**invited**) |
| July 2013 | *Challenges for Next Gen. LSS Surveys*, Ascona, Switzerland (**best presentation prize**) |

## PUBLICATIONS

PRE-PRINTS:

1. *Red clump stars and Gaia: Calibration of the Standard Candle*.
   K. Hawkins, **B. Leistedt**, J. Bovy, D. W. Hogg, submitted to MNRAS.

2. *Mapping dark matter on the celestial sphere with weak gravitational lensing*.
   C. G. R. Wallis, J. D. McEwen, T. D. Kitching, **B. Leistedt**, A. Plouviez, submitted to MNRAS.

3. *Hierarchical inference of the color-magnitude diagram and shrinkage of stellar distance uncertainties*.
   **B. Leistedt**, D. W. Hogg, ApJ, in press.

REFEREED JOURNAL ARTICLES:

4. *Data-driven, interpretable photometric redshifts trained on heterogeneous and unrepresentative data*.
   **B. Leistedt**, D. W. Hogg, ApJ, 838, 1, 2017.

5. *Wavelet reconstruction of pure E and B modes for CMB polarisation and cosmic shear analyses*.
   **B. Leistedt**, J. D. McEwen, M. Büttner, H. V. Peiris, MNRAS, 466 (3): 3728-3740, 2017.

6. *Hierarchical Bayesian inference of galaxy redshift distributions from photometric surveys*.
   **B. Leistedt**, D. J. Mortlock, H. V. Peiris, MNRAS, 460(4): 4258-4267, 2016.

7. *Unbiased pseudo-Cl power spectrum estimation with mode projection*
   F. Elsner, **B. Leistedt**, H. V. Peiris, MNRAS, 465(2), 1847-1855, 2017.

8. *Spin-SILC: CMB polarisation component separation with spin wavelets.*
   K. Rogers, H. V. Peiris, **B. Leistedt**, J. D. McEwen, A. Pontzen, MNRAS, 463(3), 2310-2322, 2016.

9. *Second-generation curvelets on the sphere*.
   J. Y. H. Chan, **B. Leistedt**, T. Kitching, J. D. McEwen, IEEE TSP, 65, 5-14.

10. *Mapping and simulating systematics due to spatially-varying observing conditions in DES SV data.*
    **B. Leistedt**, H. V. Peiris, F. Elsner *et al* (DES collaboration), ApJS, 226, 2, 2016.

11. *Redshift distributions of galaxies in the DES SV shear catalogue and implications for weak lensing*.
    C. Bonnett *et al.* (DES collaboration, including **B. Leistedt**), PRD, 94, 042005, 2016.

12. *Cosmology from Cosmic Shear with DES Science Verification Data*.
    DES collaboration (including **B. Leistedt**), PRD, 94, 022001, 2016.

13. *Cosmic Shear Measurements with DES Science Verification Data*.
    M. Becker *et al.* (DES collaboration, including **B. Leistedt**), PRD, 94, 022002, 2016.

14. *redMaGiC: Selecting Luminous Red Galaxies from the DES Science Verification Data*.
    E. Rozo *et al.* (DES collaboration, including **B. Leistedt**), MNRAS, 461(2), 1431-1450, 2016.

15. *SILC: a new Planck Internal Linear Combination CMB temperature map using directional wavelets.*
    K. Rogers, H. V. Peiris, **B. Leistedt**, J. D. McEwen, A. Pontzen, MNRAS, 460(3), 3014-3028, 2016.

16. *No galaxy left behind: Accurate clustering for incomplete galaxy samples in the Dark Energy Survey*.
    E. Suchyta, E. Huff *et al.* (DES collaboration, including **B. Leistedt**), MNRAS, 457(1): 786-808, 2016.

17. *Debiasing systematics mitigation methods in galaxy angular clustering estimators.*
    F. Elsner, **B. Leistedt**, H. V. Peiris, MNRAS, 456(2): 2095-2104, 2016.

18. *CMB lensing tomography with the DES Science Verification galaxies*.
    T. Giannantonio *et al.* (DES collaboration, including **B. Leistedt**), MNRAS, 456(3), 3213-3244, 2016.

19.  *Galaxy clustering, photometric redshifts & diagnosis of systematics in the DES Science Verification data*.
     M. Crocce *et al.* (DES collaboration, including **B. Leistedt**), MNRAS, 455(4): 4301-4324, 2016.

20.  *A novel sampling theorem on the rotation group*.
     J. D. McEwen, M. Büttner, **B. Leistedt**, H. V. Peiris, Y. Wiaux, IEEE Sig Proc Letters, 22, 12, 2015.

21.  *Modelling the Transfer Function for the Dark Energy Survey*.
     C. Chang *et al.* (DES collaboration, including **B. Leistedt**), ApJ, 801, 73, 2015.

22.  *3D weak lensing with spin wavelets on the ball*.
     **B. Leistedt**, J. D. McEwen, T. Kitching, H. V. Peiris, PRD, 92, 123010, 2015.

23.  *Constraints on primordial non-Gaussianity from 800,000 photometric quasars*.
     **B. Leistedt**, H. V. Peiris, N. Roth, 2014, PRL, 113, 221301, 2014.

24.  *Exploiting the full potential of photometric quasar surveys: Optimal power spectra through blind mitigation of systematics*.
     **B. Leistedt**, H. V. Peiris, MNRAS, 444(1): 2-14, 2014.

25.  *No new cosmological concordance with massive sterile neutrinos*.
     **B. Leistedt**, H. V. Peiris, L. Verde, PRL, 113, 041301, 2014.

26.  *S2LET: a code to perform fast wavelet analysis on the sphere*.
     **B. Leistedt**, J. D. McEwen, P. Vandergheynst, Y. Wiaux, A&A, 558, A128, 2013.

27.  *Estimating the large-scale angular power spectrum in the presence of systematics: a case study of Sloan Digital Sky Survey quasars*.
     **B. Leistedt**, H. V. Peiris, D. Mortlock, A. Benoit-Lvy, A. Pontzen, MNRAS, 435(3): 1857-73, 2013.

28.  *Exact Wavelets on the Ball*.
     **B. Leistedt**, J. D. McEwen, IEEE TSP, 60, 6257-6269, 2012.

29.  *3DEX: a code for Fast Fourier-Bessel Decomposition of All-Sky 3D Surveys*.
     **B. Leistedt**, A. Rassat, J-L Starck, A. Refregier, A&A, 540, A60, 2011.