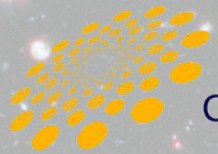


BERKELEY CENTER *for*
COSMOLOGICAL PHYSICS

Member Introduction

August 31 2021, 1:10 PM PT (1 slide 1 minute / person)

Started at the Lab in Jan. 2020

Anthony Kremin

DESI Postdoc at LBNL
akremin@lbl.gov

- Research Interests:
  - Galaxy Clusters / Cluster Dynamics
  - DESI Peculiar Velocity Survey
  - Machine Learning
- Other Roles in DESI:
  - Spectroscopic Pipeline Operations Lead
  - Early Career Scientist Committee Member
- Other Interests:
  - Public Outreach
  - Hiking

Antón Baleato Lizancos
New postdoc at BCCP and LBL

CMB lensing, delensing and synergies between probes

Active projects:

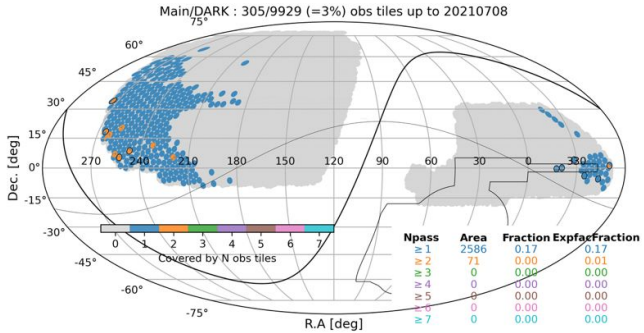
- Modeling biases to CMB lensing reconstructions from extragalactic foregrounds (tSZ, CIB...)
- Delensing SO B-modes to look for tensor modes: how to robustly incorporate multiple tracers, foregrounds, etc.?
- Finding an apartment in the Bay Area (most challenging).

Looking forward to meeting everyone in person from mid-October (visa-permitting!)
Until then, find me on Slack or ab2368@cam.ac.uk

Anand RAICHOOR — DESI project scientist

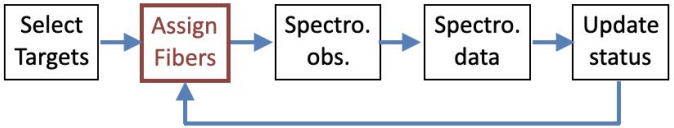
My Background

- *galaxy evolution, galaxy clusters*
- *Large-Scale Structures (LSS): SDSS/eBOSS*



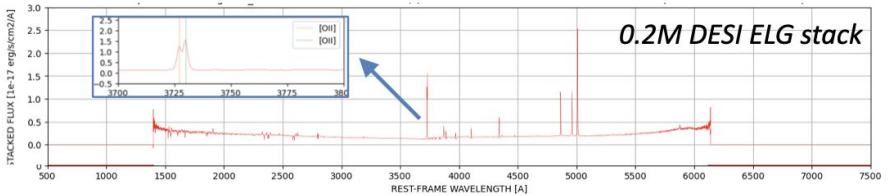
DESI operations

- *fiber assignment*
- *ensure reproducibility for LSS analysis*



DESI science

- *Emission Line Galaxies (ELG)*
- *Target Selection*
- *LSS analysis*



Dark Energy Spectroscopic Instrument
U.S. Department of Energy Office of Science
Lawrence Berkeley National Laboratory

araichoor@lbl.gov

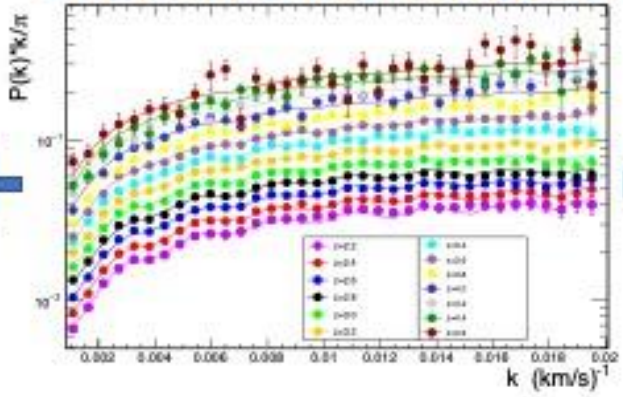
Personal research:
Full DESI !

- Target selection (esp. Quasars)
- Take advantage of small-scales measurable in Lyman-alpha data to constrain neutrino mass and warm DM

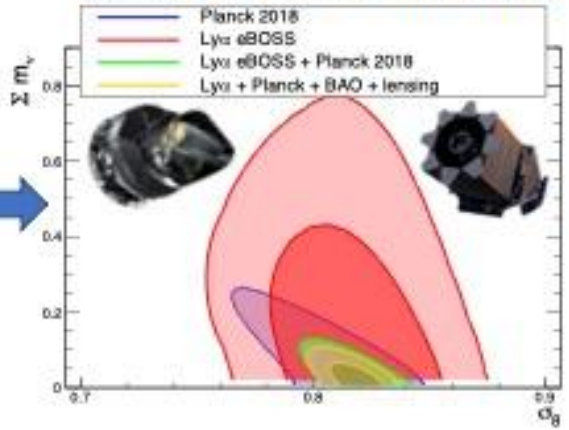
Nathalie Palanque-Delabrouille
Incoming Physics Division director
Co-spokesperson for DESI

Hydro simulations

Lya transmitted flux power spectrum



Constrains on neutrino mass



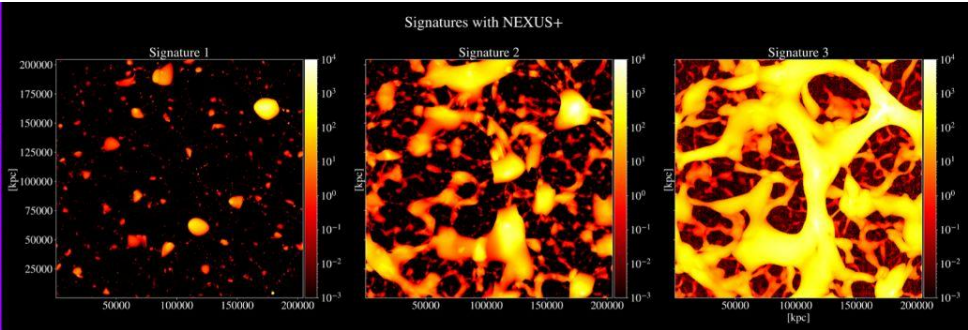
James Sunseri

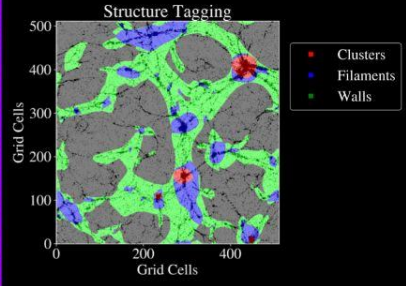
4th year undergrad

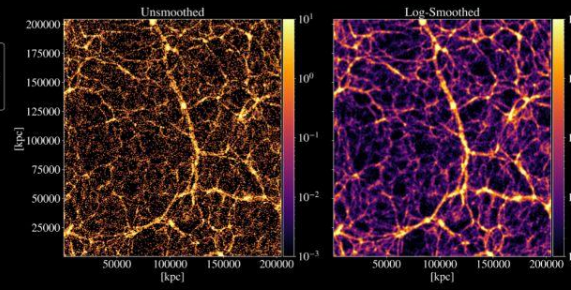
Research Projects:

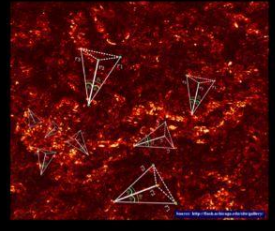
- The Effects of Baryons Beyond the Galactic Halo (multiscale morphological analysis of cosmo simulations)
- Fast Four Point Statistics of (Interstellar Medium, surveys, and simulations)

Personal website: www.jamessunseri.com

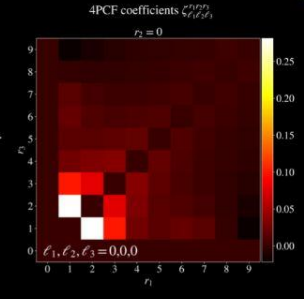








$$4PCF = \sum \left[\text{Radial Coefficients}\right] \times \left[\text{Isotropic Basis}\right]$$



Eric Linder

BERKELEY CENTER for COSMOLOGICAL PHYSICS

Cosmic Probes – all of them!

Strong lenses, Supernovae, Strong lensing of supernovae
(haven't yet figured out supernovae of strong lenses...)

Cosmic redshift drift – theory + Snowmass interferometry

Model independent cosmology analysis

Expansion vs growth vs gravity cosmic history

Inflationary freedom – effect on late time cosmology fits

Gravity beyond GR – theory + phenomenology

Dynamical Casimir effect + black hole radiation/information

Coauthored with 1 graduate student and 4 postdocs on 8 articles with ≤ 4 authors in the last year

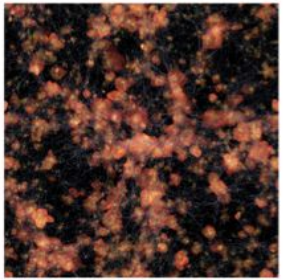
evlinder@lbl.gov

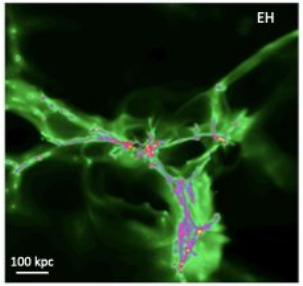
Solène Chabanier

LBL postdoc Data Division
schabanier@lbl.gov

Research:

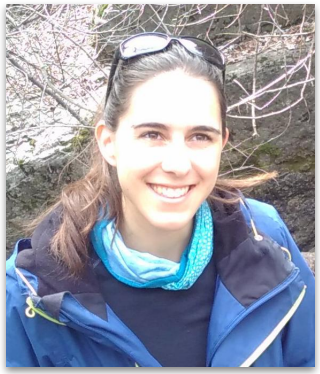
- Cosmology with the Lya forest: DESI-Lya WG co-chair
  - Neutrino masses, dark matter models
  - 1D power spectrum data analysis (eBOSS and DESI)
  - Theoretical modeling with hydro sims (Nyx, HACC, Ramses), member of ECP
  - Statistical methods for inference process with hydro sims
  - Baryonic effects on cosmological probes
- Galaxy formation and evolution models





Other interests:

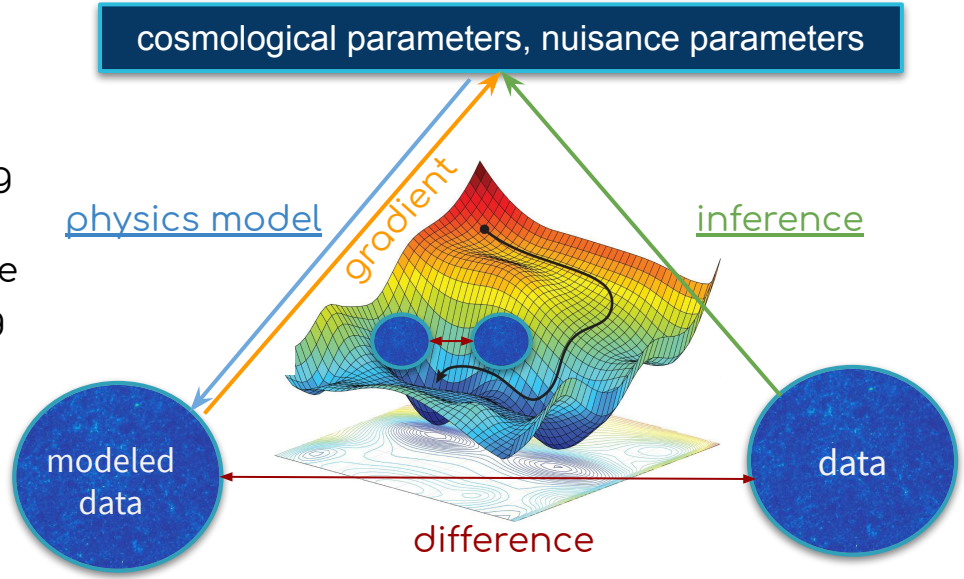
Outreach and mentoring, avid hiker, sailing, music..



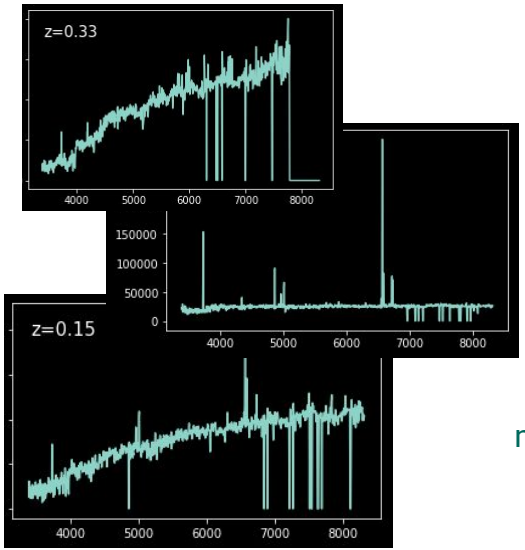
Vanessa Boehm

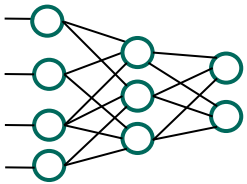
Postdoc

- ❏ Weak Gravitational Lensing
- ❏ Differentiable Simulations
- ❏ High dimensional Inference
- ❏ (Robust) Machine Learning

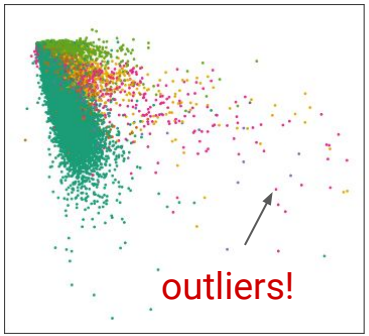


galaxy spectra





machine learning model



1. STARFORMING BROADLINE
2. STARFORMING
3. STARBURST BROADLINE
4. STARBURST
5. BROADLINE
6. AGN BROADLINE
7. AGN
8. NO LABEL

Stephen Chen

5th Year Grad Student with Martin White

Interests:

– Perturbation Theory: velocileptors™, Lagrangian vs Eulerian, galaxy bias, redshift-space distortions, velocities, reconstruction, synergies with simulations, Lyman alpha forest

– Redshift Surveys like DESI … and other observables

– Other things I've worked on: Asymptotic expansions in LSS, imprint of inflationary features on LSS, dark-matter/baryon relative perturbations, 21 cm, high redshift absorption lines

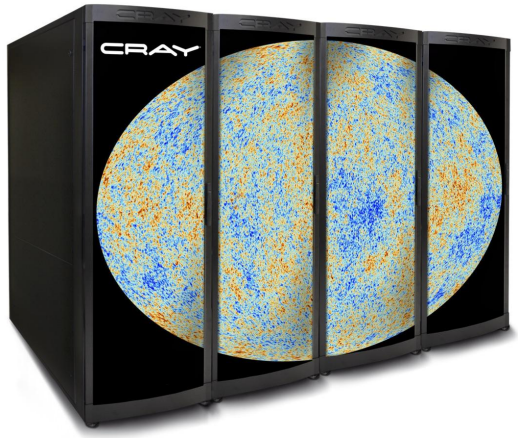
– Something else? Come chat!

Julian Borrill

Computational Cosmology Center, LBL & Space Sciences Laboratory, UCB

Cosmic Microwave Background

- Data Management
  - Planck
  - Simons Observatory
  - CMB-S4
  - High Performance Computing (NERSC)
- Project Management
  - CMB-S4 Collaboration Co-Spokesperson
  - CMB-S4 Project Data Scientist



Martin White (faculty; theory+data)

Too many individual projects to try to list, so ...

Short term

Science with DESI … modeling P(k,μ), BAO reconstruction, x-correlation with CMB, scoping out 21cm landscape w/ x-correlation & LyαF. [DESI]

Medium term

More DESI, prep for DESI-II. What can be learned by combining DESI+LSST+SO? What framework should we use to model and interpret these data? [DESI, LSST, SO, DESI-II, S4]

Long term

Cosmology “before noon”, i.e. large-scale structure above z~2ish. What can we learn from it, how do we map it and how do we analyze it. [MegaMapper, PUMA, SO/S4].

Jamie Sullivan (grad student, 307D)

4th-year in Astro (w. Uroš)
LSS models+analysis
Current Projects:

- Small-scale 2pt modeling (HZPT)
- Bayesian optimization (and sampling)
- Bolt.jl ⚡(diff. Boltzmann code)

Interests:

- Nonlinear modeling
- Computational methods

astrobites
THE ASTRO-PH READER'S DIGEST | SUPPORTED BY THE AAS

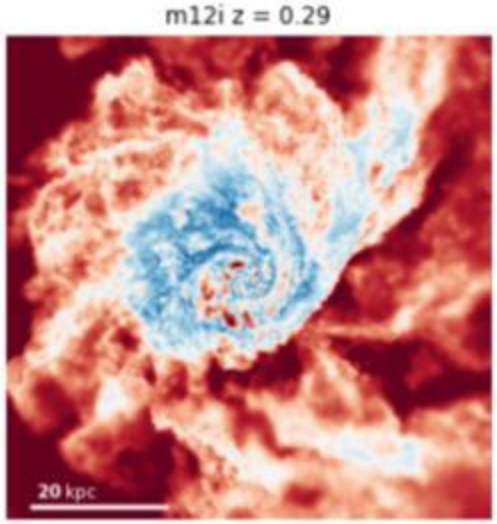
Lindsey Byrne

lbyrne@lbl.gov

4th-year PhD student

Northwestern University (w/ Claude-André Faucher-Giguère)

DOE CSGF fellow, at LBL until November

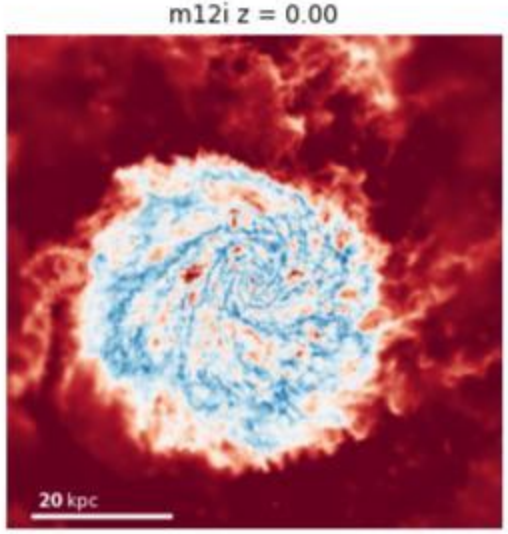


Research interests

- Galaxy formation
- Cosmological hydrodynamical simulations (FIRE, Nyx)
- AGN feedback/galaxy-BH co-evolution

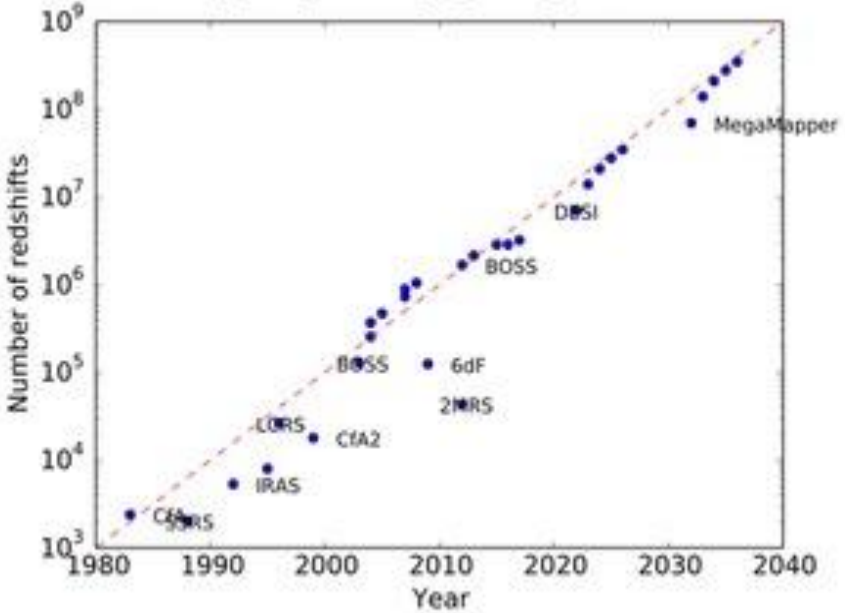
Other

- Northwestern P&A grad student council Equity & Inclusion committee chair



David Schlegel, LBL senior scientist

Project scientist for the Dark Energy Spectroscopic Instrument (DESI)
Working towards mapping every galaxy before I die



More near-term student projects:

— DESI secondary project — spectra of the ~1M weirdest-color things
— Fiber Robot Lab — testing MegaMapper fiber robots
— Machine learning — construct "ImageNet" for astronomy data sets

Christian Hellum Bye (graduate student)

chb@berkeley.edu

21-cm cosmology (global signal)

Simulating sky observations for the **Mapper of the IGM Spin Temperature** (http://www.physics.mcgill.ca/mist/): informs choice of antenna design, orientation, location, integration time … (in progress)

Machine learning: emulating the global signal with **21cmVAE** (arXiv: 2107.05581)

Joanne Cohn (Research Staff)

Broadly: Large scale structure and structures

just finished project on the web and clusters

Topics I am interested in now include:

- finding new projects :)
- perturbation theory applications & methods
- what can be learned at moderate/high z
  - galaxy evolution
  - structures and their relations to other z
- reionization

Methods/tools I tend to use:

- Simulation data
- Analytic approaches
- Machine learning sometimes

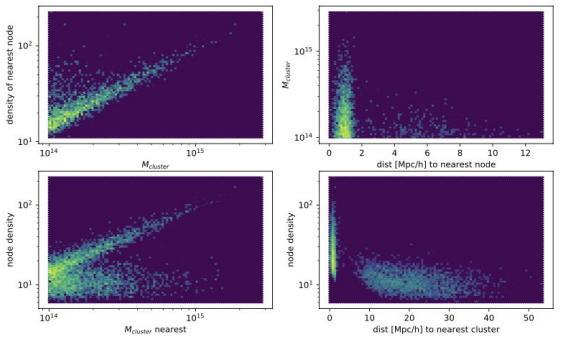
Some older topics:

- Simplified models of galaxy formation
- Galaxy clusters
  - especially mass measurement systematics
- Mock catalogue validation (DES/LSST)

node/cluster mass correlations

cluster mass

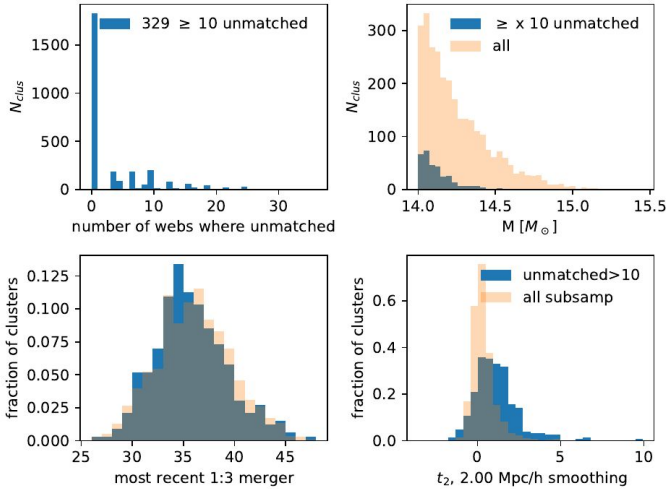
node mass



clusters & cosmic web nodes

distance to nearest cluster or node

often unmatched clusters (to nodes)



Joe DeRose

Chamberlain Fellow, LBNL
jderose@lbl.gov

Research: cosmology

- How to optimally combine/model lensing and clustering data to probe gravity?
- Galaxy surveys: DES, DESI, LSST
- Recent forays into CMB lensing/SZ

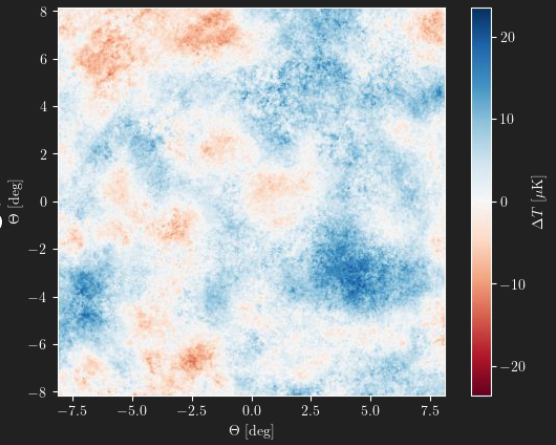
Techniques: Simulations, Statistics and Machine Learning, HPC, Theory

Non-Physics interests: Cycling, Backpacking, Basketball, Bay area sports teams

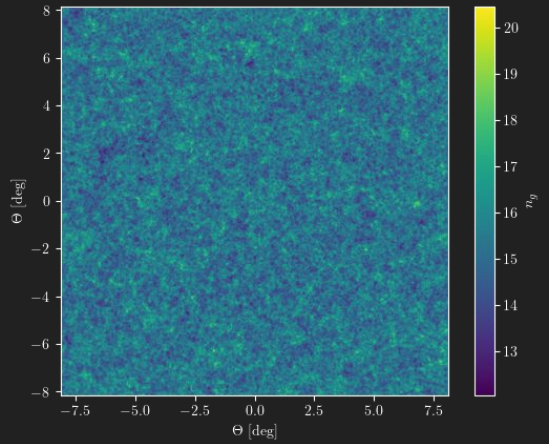
Paul La Plante (postdoc)

- Reionization
  - 21cm (HERA) and CMB (SO)
- Cross-correlation (21cm + kSZ + galaxies)
- Machine learning
  - (Bayesian) Neural Networks
- Real-time Data Analysis + Software Pipelines

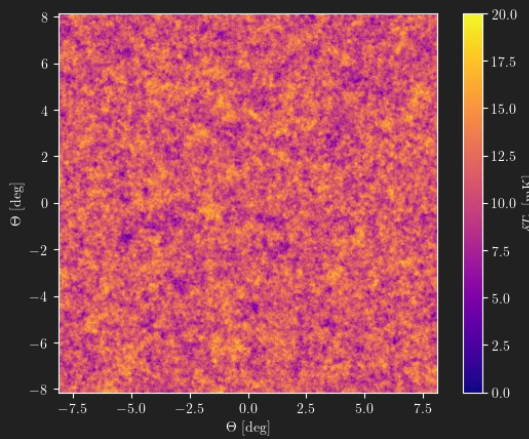
kSZ



galaxies

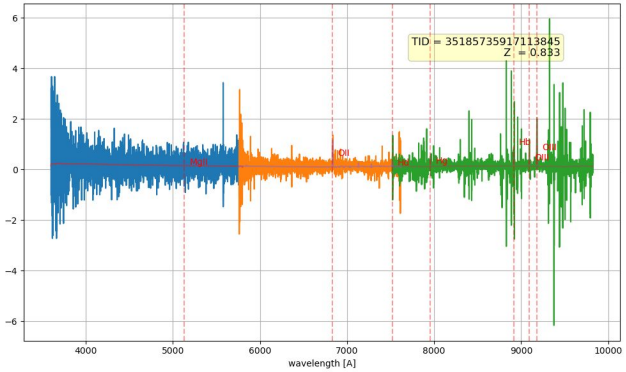


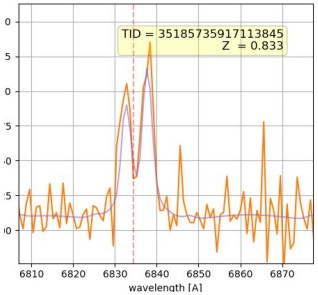
21cm



Julien Guy
Staff scientist LBL
Co-project scientist for DESI

One Emission Line Galaxy DESI spectrum





DESI instrumentation and data processing

- spectrographs calibration
- spectroscopic pipeline
- calibration of positioners on the DESI focal plane
- survey requirements / margin

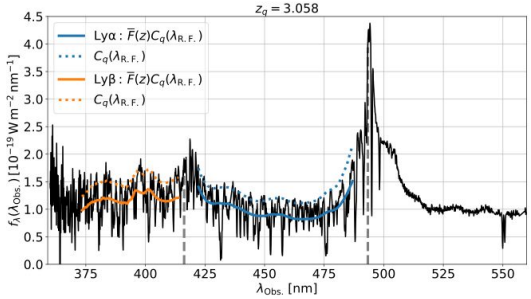
DESI science

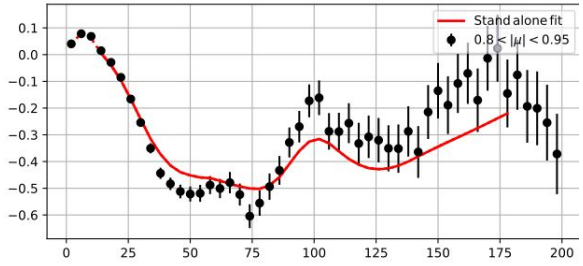
- **Lyman-alpha BAO analysis**
- Clustering: instrumental effects (spectroscopic efficiency)

→

Next generation spectroscopic survey

- Survey design
- Hardware R&D (positioners / layout / fiber handling, connectors?)





(figures from du Mas des Bourboux et al. 2019)

Byeonghee Yu
(grad student w/ Uroš)

Interests:

- Statistical analysis of LSS clustering
- Bayesian data analysis/ML

- RSD analysis using perturbation theory/emulator
- Constructing hybrid covariance combining analytic and data-driven pieces
- Cosmological parameter inference with Bayesian statistics
- Physical origin of m_ν and w constraints from CMB-S4 x LSST

Zarija Lukić, Research Scientist at LBL

Computational Cosmology Center
Building 50B, 4th floor, office 4218B
zarija@lbl.gov

Cosmological simulations

All aspects: physical models, algorithms, deployment on HPC platforms
https://amrex-astro.github.io/Nyx/

Large-scale structure

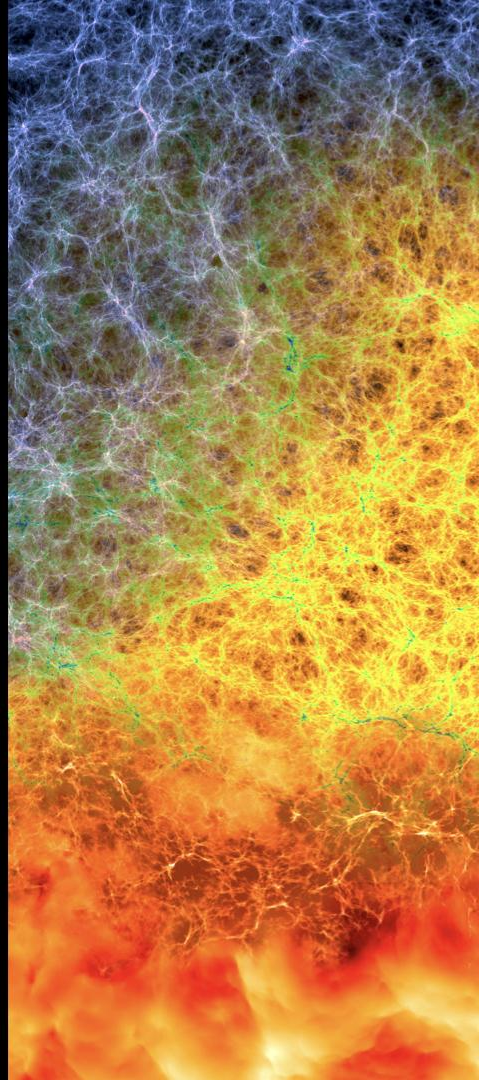
Mostly intergalactic medium and Lyman α forest

Inference from simulations and data

Building reliable predictions with minimal number of simulations

Machine learning for cosmology

Surrogate models in simulations, representations of astronomical images

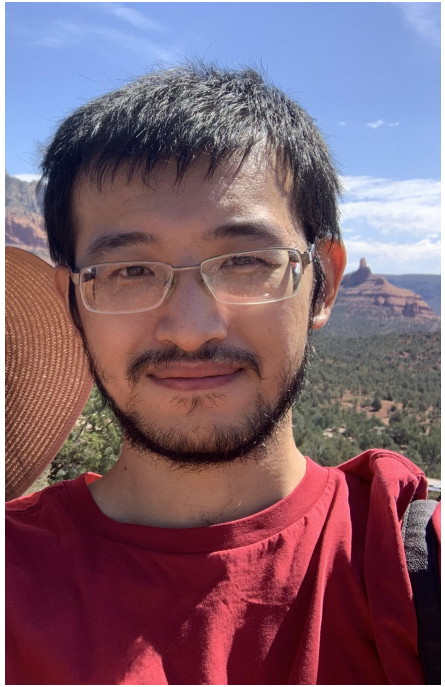


Rongpu Zhou

DESI postdoc at LBL

- DESI imaging surveys and target selections
- DESI cross-correlations with other datasets, e.g., with CMB lensing maps
- Forward modeling imaging systematics of galaxy surveys
- Photometric redshifts for next-generation surveys

Xiao Fang (postdoc)



Large-Scale Structure:

- Perturbation theory and computational methods for galaxy surveys (e.g. FAST-PT)
- Cross correlations, covariances, and multi-probe analysis
- Have worked on DES, LSST, Roman

Recent Interest:

What can we learn by combining data from LSS and CMB experiments, e.g. LSST/DESI + SO?

Dynamics:

- Hierarchical stellar systems, Lidov-Kozai
- GW source progenitors

Recent Interest:

How can we distinguish various formation scenarios of LIGO BHs?

Broad interest in astrophysics problems

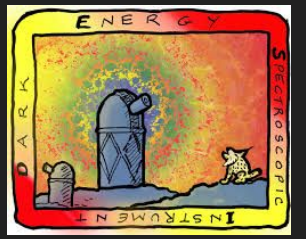
Have worked on primordial black hole observational constraints

xfang@berkeley.edu
https://xfangcosmo.github.io

I'm arriving in October and looking forward to working with all of you!

Satya Gontcho A Gontcho

DESI project scientist (since January 2021)



DESI Science:

Main interest: **Intergalactic-medium based Cosmology**

- Lyman-alpha BAO analysis
- CIV forest cross-correlations (QSOs, ELGs, ...)
- IGM tomography (*voids & other real-space features, cosmic web...*)

DESI Operations:

Lead Observing Scientist

Reobservation strategy for quasars

Other interests:

Cosmology from Stage-IV surveys combined, DESI-II / Future Surveys
Outreach and Mentoring

Get in touch with me satyagontcho@lbl.gov

Noah Sailer
(3rd year physics student)

CMB (SO) and Large Scale Structure (DESI)
working with Martin, Simone and Emmanuel

Current/past projects:

- CMB lensing
  - “optimal” estimator for SO?
  - reducing bias from extragalactic foregrounds
- Forecasting for future high-z (2<z<6) surveys

Some other stuff that I find interesting (future projects?):

- CMB lensing+DESI cross-correlations
- DESI-II
- constraints on IDM, primordial features, …? (still exploring)

Always happy to chat! (nsailer@berkeley.edu)

Alex Kim, LBNL, Staff Scientist

Research Interests

Type Ia SN cosmology; peculiar velocities; transient searches, machine learning

Current Projects (and collaborations)

SN Ia spectral-timeseries standardization (SNFactory)

Time-delays with strongly-lensed SNe (DESI, LSST-DESC)

Outlier, transient discovery (DESI, Euclid)

Transient follow-up pipeline/infrastructure, e.g. Marshal, TOM (LSST-DESC)

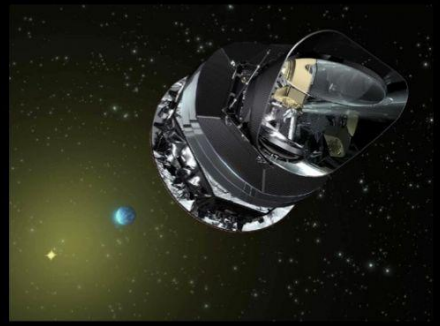
Precision astronomical measurements (with LLNL)

IDEA education and outreach (LBNL, DES)

agkim@lbl.gov

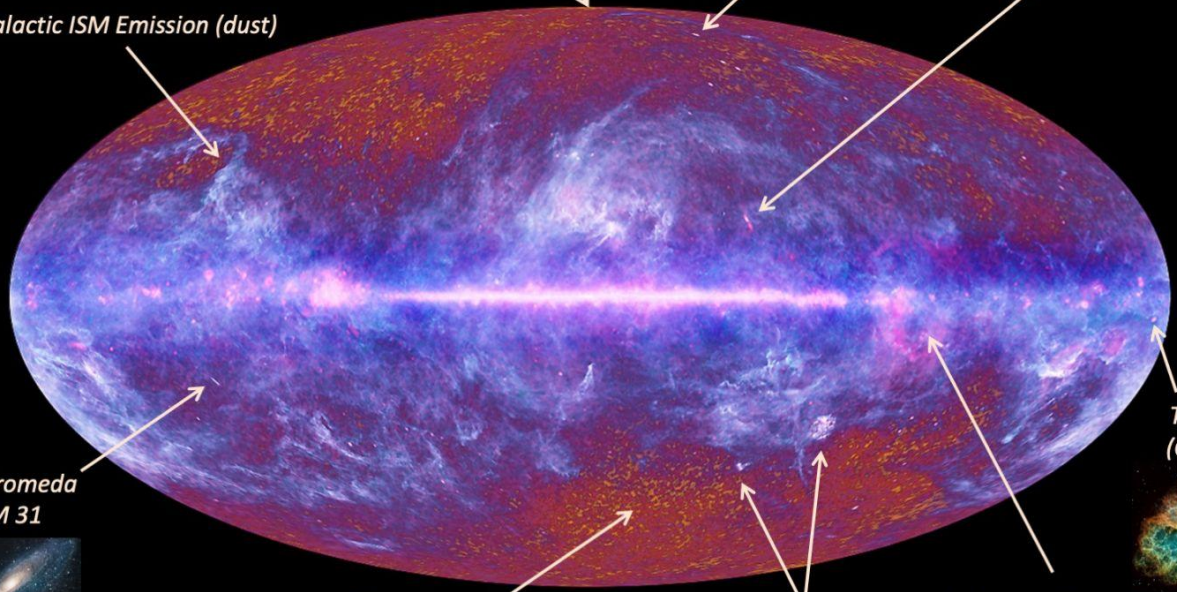
Jacques Delabrouille

Centre Pierre Binétruy (CNRS)



Keywords:

CMB
CMB foregrounds
Planck space mission
Future CMB missions
Simulations
Data processing
CMB-S4



Nicholas Huang
(student)

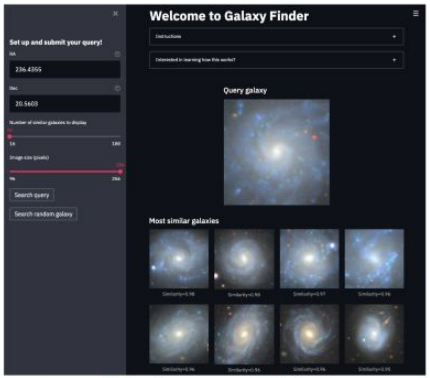
- CMB observation with SPT (with Bill Holzapfel)
- Galaxy cluster search using the SZ effect
- Reionization constraints from high-ell CMB

George Stein BCCP and LBL postdoc - gstein@berkeley.edu

Machine learning for cosmology

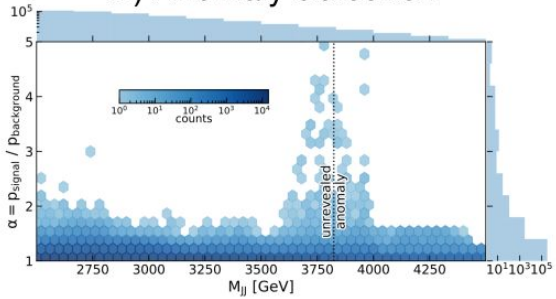
github.com/georgestein/ml-in-cosmology

1.) Data exploration



share.streamlit.io/georgestein/galaxy_search

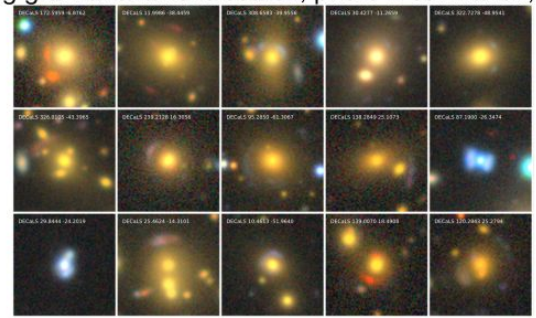
2.) Anomaly detection



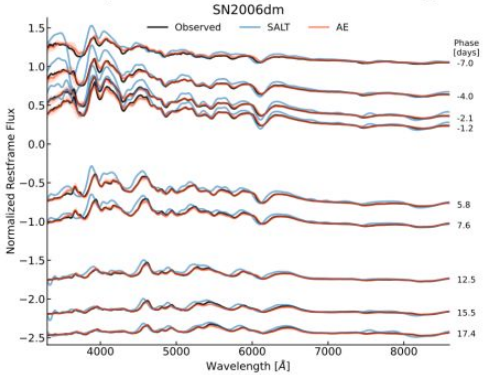
2012.11638

3.) Automated survey tools

(strong gravitational lens search, photo-z estimation, etc.)

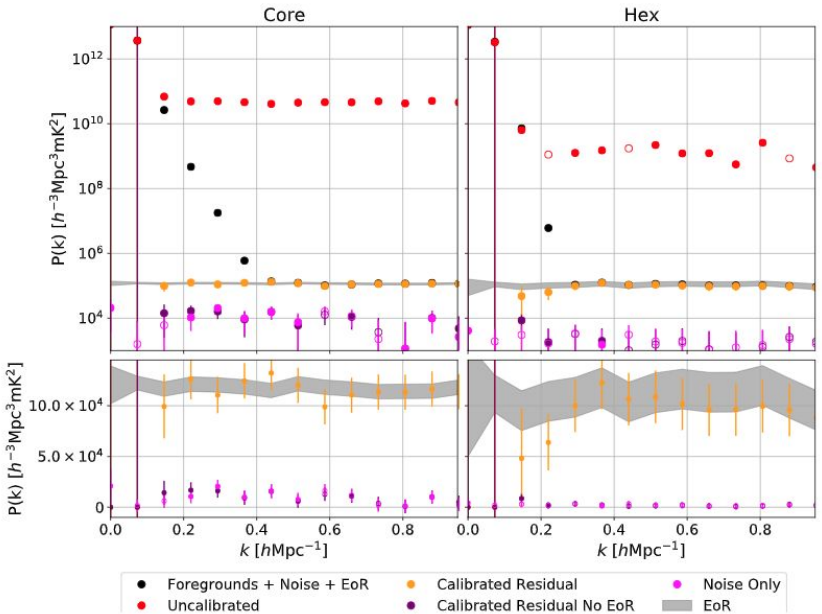


4.) Generative modeling

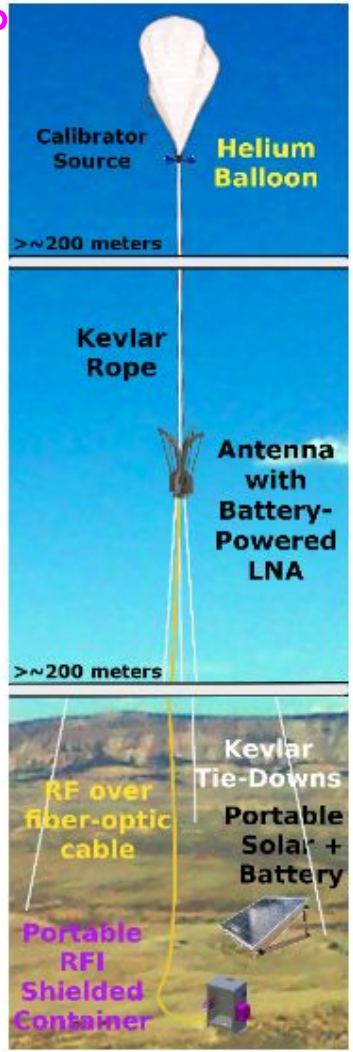


Aaron Ewall-Wice

I create novel instrumentation, calibration and analysis techniques to isolate cosmological signals from data heavily contaminated by noise and systematics.



EIGSEP



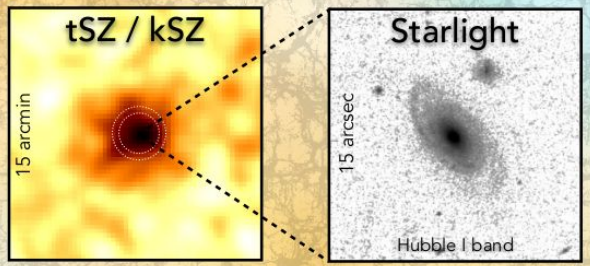
Emmanuel Schaan

Chamberlain fellow at LBL

BERKELEY LAB

Revealing the hidden gas around galaxies with the Sunayev-Zel'dovich effects

Probing velocities and f_{NL} with kSZ



Neutrinos, growth, dark energy

New methods for robust CMB lensing

Calibrating galaxy systematics with the CMB

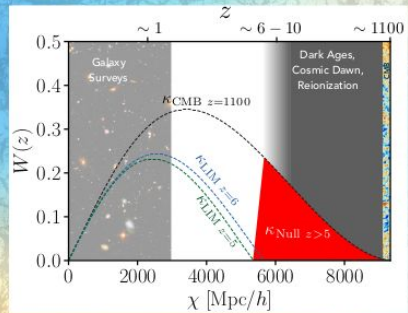
→ ACT, SO x DESI will be unrivaled

Intensity mapping

Extracting cosmology and astrophysics

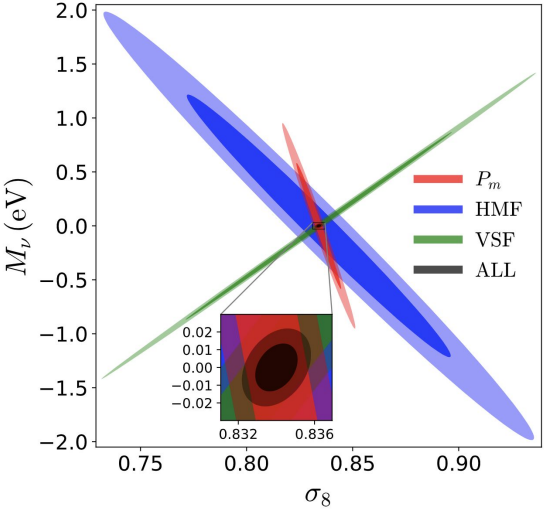
Removing foregrounds

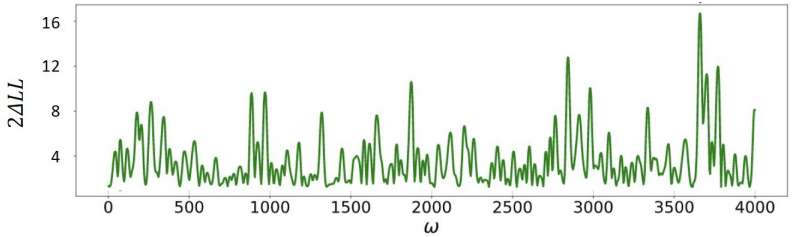
Can the CMB help?



Adrian Bayer
(grad student)

- Neutrino LSS simulations + information content
- Reconstruction: information in redshift space
- Bayesian data analysis:
  - Look-elsewhere effect (exoplanets)
  - Sampling methods
- Still exploring, open to new projects





Noah Weaverdyck

(incoming postdoc, starting 1 Oct.)

Research interests:

- Galaxy clustering
- Mitigating imaging systematics in LSS
- Bayesian stats, model validation and comparison metrics, robust inference
- Machine learning
- Primordial non-Gaussianity with LSS
- DES, new to DESI

Other interests:

- Hiking, live music, organizing around global warming and its impacts

Interested in chatting? Drop me a line!
NWeaverd@umich.edu (any time)
NWeaverdyck@lbl.gov (after Oct.)

Nicole Farias

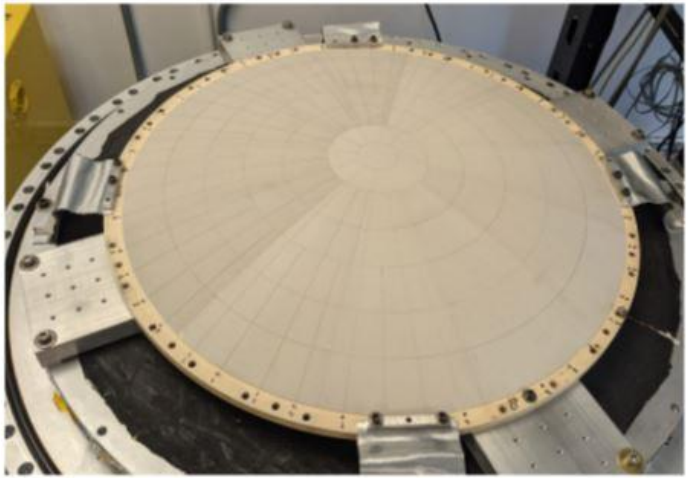
2nd year PhD student

nfarias@berkeley.edu

Working with Adrian Lee

CMB - Simons Array and LiteBIRD

Anti-reflection coatings and readout



Antonella Palmese

Einstein Fellow at UC Berkeley
(From October, currently Fermilab postdoc)

palmese@fnal.gov

Work interests:

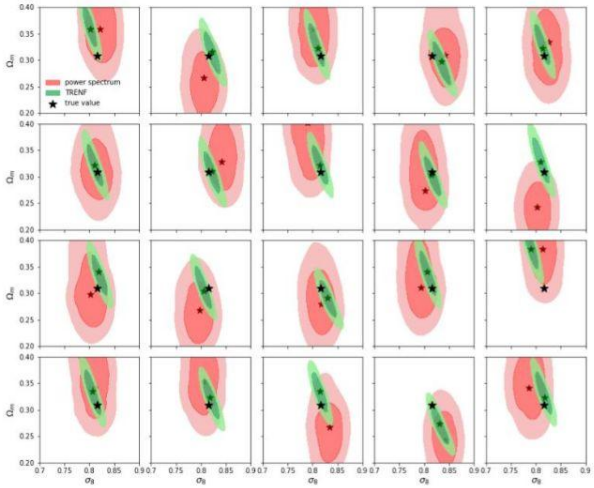
- Optical galaxy surveys: DES and DESI
- Gravitational wave follow-up (optical to NIR)
- Gravitational wave cosmology. In particular: standard siren measurements with binary black hole mergers
- Transients and host galaxies, applications for Supernova cosmology
- Galaxy evolution and large scale structure
- Machine learning

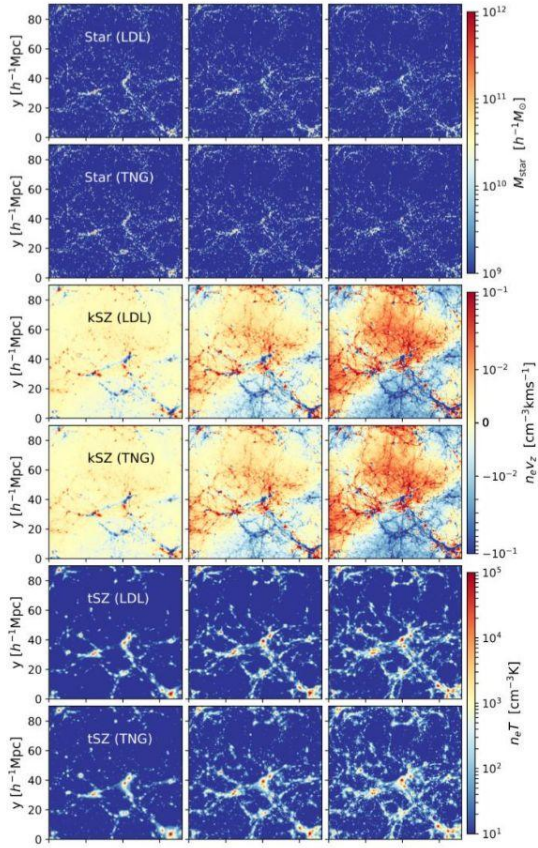
Other interests: sports (beach volleyball and Crossfit), art, theater, travel

Biwei Dai (4th-year grad student)

Machine Learning X Cosmology

- Improve the accuracy of fast simulations
- Generate hydro outputs from DMO simulations
- Optimal cosmological data analysis with normalizing flows
- Fast evaluation of gravitational wave likelihood
- Develop new ML algorithms





Pat McDonald (LBL staff scientist)

Working on DESI galaxy clustering analysis

- Power spectrum estimation
- Window and covariance matrices
- Model fitting
- Model-independent compression

Recently trying to put together existing codes for these things into a usable pipeline in Arnaud de Mattia's "cosmopipe" framework:
https://github.com/adematti/cosmopipe

Developing scripts here:
https://github.com/cosmodesi/GCpipeline

BERKELEY LAB

LAWRENCE BERKELEY NATIONAL LABORATORY

Simone Ferraro

Divisional Fellow, LBNL

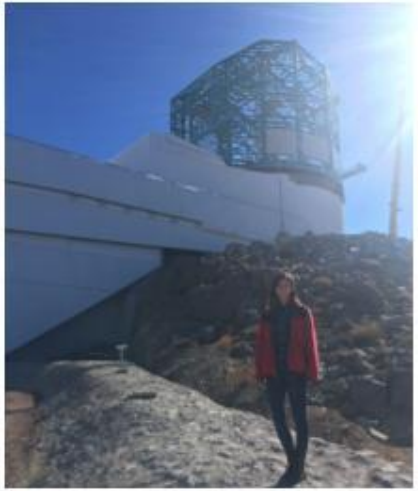
Research: cosmology (theory and data analysis)

- CMB: secondary anisotropies (kSZ, tSZ, …) and lensing
- Inflation: primordial gravitational waves, non-Gaussianity
- Reionization: imprint of the first stars and galaxies
- Galaxy surveys: DESI, LSST
- Statistics and Machine Learning

Berkeley Astro Postdoc (Miller Fellow) → LBNL (tenure track)

Interested in a research project? Contact me at sferraro@lbl.gov

Jackie Blaum



jrblaum@berkeley.edu
2nd year astronomy graduate student
Advisor: Josh Bloom

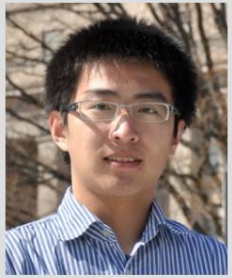
Research interests:

- Machine learning & big data
- Large scale structure
- Time domain

Current/potential projects:

- Finding strong lenses using self-supervised ML with Zarija & George at LBL
- Supernova similarity search
- Likelihood-free inference on eclipsing binaries

Other interests: hiking/backpacking, ballet, lyra, yoga, my dog



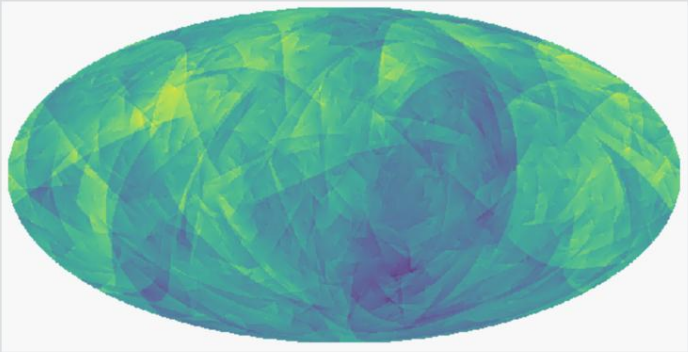
Liang Dai

Assistant Prof.
Department of Physics

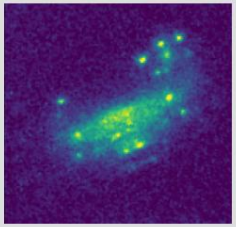
Office: **Campbell 367**
Email: liangdai@berkeley.edu

I work with (under-)graduate students and postdocs;
I teach PHYS 110A, 110B (electrodynamics)

- *Early universe cosmology:*
  Signatures of cosmic strings in CMB
  Constraining ultralight axion-like particles

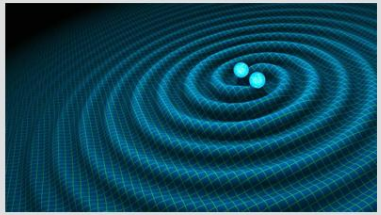


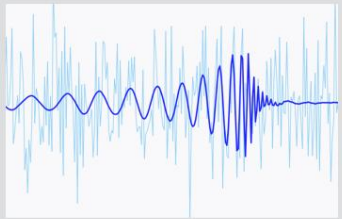
Strong gravitational lensing in galaxy clusters
Extragalactic microlensing (HST, JWST, etc.)

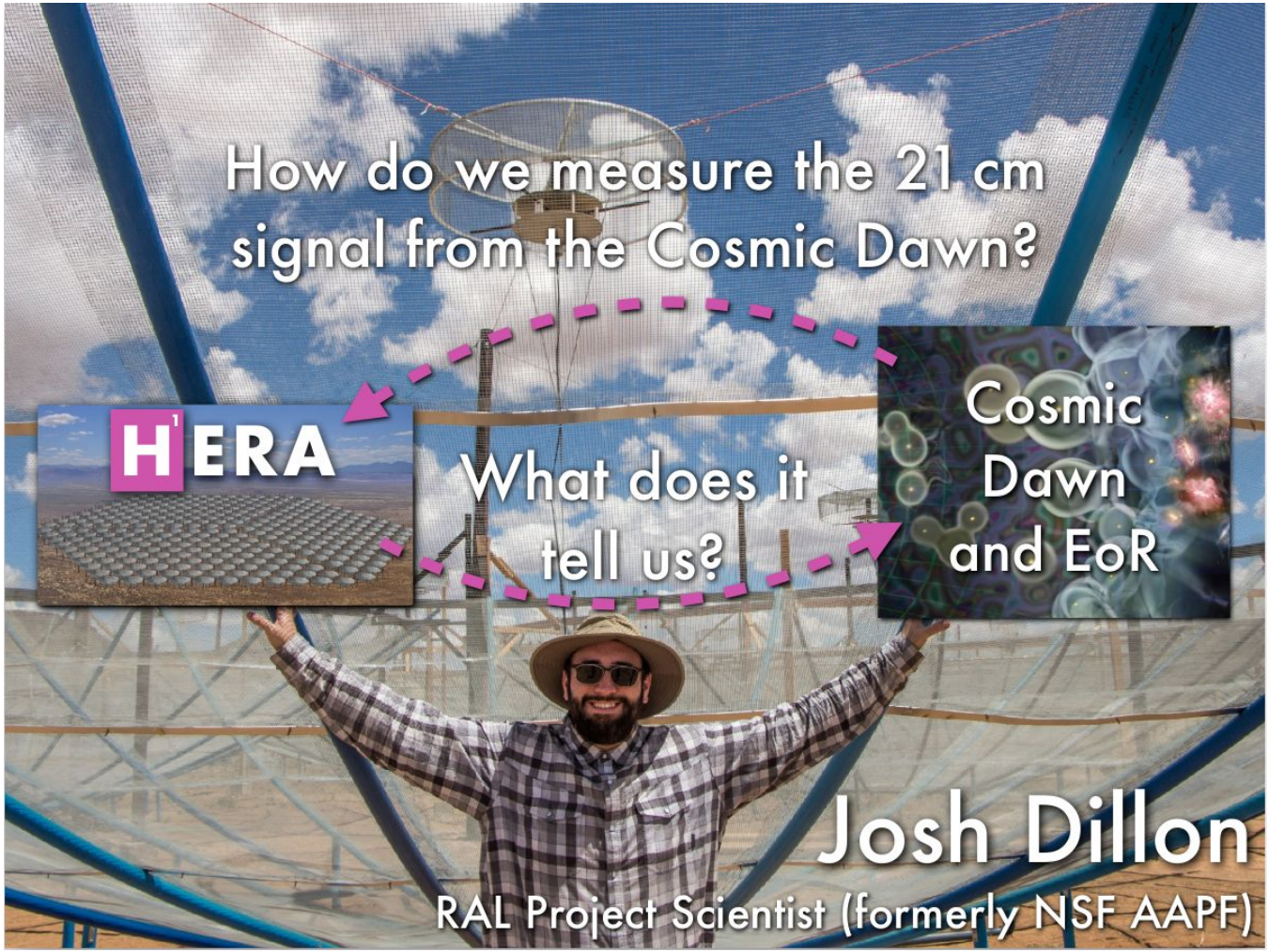


- Caustic crossing galaxies/transients as a probe of small-scale DM structures
- Statistical theory of extragalactic microlensing
- High-z star formation and radiation physics from magnified galaxies (HST, MUSE)

Faster data analysis of gravitational waves
Lensing of gravitational waves (LIGO/Virgo)






How do we measure the 21 cm signal from the Cosmic Dawn?
HERA
What does it tell us?
Cosmic Dawn and EoR
Josh Dillon
RAL Project Scientist (formerly NSF AAPF)