Matthew Kirby

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Research Interests

My primary research interest is to gain a better understanding of the nature of dark energy by measuring cluster abundances supplemented with X-ray and/or mm-wave follow-up data. I am also generally interested in galaxy cluster science including galaxy evolution in cluster environments and cluster lensing.

Education

University of Arizona **Tucson, Arizona**
Ph.D. in Physics *Anticipated Spring 2020*
Advisor: Eduardo Rozo

Rensselaer Polytechnic Institute **Troy, New York**
B.S. in Physics *2013*
Advisor: Gyorgy Korniss

Research Experience

Improving DES Cluster Cosmology via SPT Cluster Observations
Advisor: Eduardo Rozo *2019–2019*
Using the overlapping area of the Dark Energy Survey and South Pole Telescope, I built a complete sample of DES clusters with SPT detections. I then used the sample to constrain the variance in the richness–mass relation and tighten cosmological constraints.

Preprocessing among the Infalling Galaxy Population of EDisCS Clusters
Advisor: Dennis Zaritsky *2016–2018*
Computed redshifts for galaxies in the EDisCS clusters using data taken on a low dispersion spectrograph and then analyzed the colors and clustering properties of confirmed member galaxies.

Improving SDSS Cluster Cosmology via a Modest X-ray Follow-Up Program
Advisor: Eduardo Rozo *2016–2019*
Obtained X-ray mass proxies for the 30 richest galaxy clusters in the Sloan Digital Sky Survey and developed a statistical model that I used to tighten cluster cosmology constraints.

The Morphological Content of the Infall Regions of EDisCS Clusters
Advisor: Dennis Zaritsky *2014–2016*
Identified cluster member galaxies, led a small group that visually classified the morphology of each cluster member, and analyzed the distribution of morphologies.

Measuring Photometric Redshift Bias Due to Unmodeled Dust Reddening
Advisor: Elliot Cheu *2013–2014*
Applied dust absorption models to galaxy spectra to measure the expected photometric redshift bias due to unmodeled galactic dust.

Evolving Opinions on Social Networks with Competing Committed Groups
Advisor: Gyorgy Korniss *2011–2013*
Simulated and tracked the propagation of opinions on several types of connected social networks with static members using the naming game algorithm.

Teaching Experience

Primary Instructor
Algebra-Based Electricity and Magnetism *Summer 2014*
Developed course materials including short lectures, collaborative group work, homework, and exams with an emphasis on active learning for a 4.5 week algebra-based course on electricity and magnetism

Lecturer
Algebra-Based Mechanics *Fall 2014*
Led lectures including active learning components on algebra-based mechanics. My section was selected to take part in a pilot program to test an innovative collaborative learning space.

Graduate Teaching Assistant
Assorted Courses *2013–2017*
Algebra-based mechanics for non-science and biology majors.
Algebra-based electricity and magnetism for non-science and biology majors.
Calculus-based mechanics for science majors and engineers.
Calculus-based electricity and magnetism for science majors and engineers.
Introduction to programming for physics applications.

Awards & Fellowships

Universities Research Association Fermilab Visiting Scholar **2019**

UA Nasa Space Grant Fellowship **2017–2018**

Outstanding Graduate Student Speaking Award **2017**

Outstanding Graduate Student Speaking Award **2016**

Selected to Participate in Collaborative Learning Space Pilot Program **2014**

Service

Cosmology Journal Club @ University of Arizona **2016–2019**

Organized and coordinated a journal club between faculty, postdocs, graduate students and undergraduate students where we discuss recent arXiv submissions relevant to cosmology.

Physics Graduate Student Council @ University of Arizona **2015–2019**

Organized weekly meetings with visiting speakers, graduate student seminars, graduate student invited speakers and acted as a liaison between the graduate student body and the department regarding topics include funding and qualifying exams.

Publications

1. Avestruz, C. et al. (with 22 others include **Kirby, M.**) "CLMM: A Galaxy Cluster Lensing Utility for Cosmology", In Prep.
2. **Kirby, M.** et al. "The Morphological Content of the Infall Regions of EDisCS Clusters", In Prep.
3. **Kirby, M.** et al. "Improved Cosmological Constraints from SDSS redMaPPer Clusters via X-ray Follow-up of a Complete Subsample of Systems", 2019 (arXiv:1910.13548)
4. Just, D., **Kirby, M.**, et al. "Preprocessing among the infalling galaxy population of EDISCS clusters.", 2019 (ApJ, 885, 6)
5. Chisari, N. E. et al. (with 31 others including **Kirby, M.**) "CCL: Core Cosmology Library", 2019 (ASCL, 1901.003)
6. Chisari, N. E. et al. (with 29 others including **Kirby, M.**) "Core Cosmology Library: Precision cosmological predictions for LSST", 2019 (ApJS, 242, 2)
7. Xie, J., Emenheiser, J., **Kirby, M.**, et al. "Evolution of opinions on social networks in the presence of competing committed groups", 2012 (PLoS ONE 2012).

Contributed Conference Talks and Posters

1. **Improved Cosmological Constraints from SDSS redMaPPer Clusters via X-ray Follow-up of a Complete Subsample of Systems**
   June 2019 - Dark Energy Survey Collaboration Meeting
2. **The Scatter in Cluster Scaling Relations with a Complete Cluster Sample**
   March 2018 - SnowCluster 2018 (**Poster**)
3. **Scaling Relations with a Complete Cluster Sample**
   February 2018 - LSST Dark Energy Science Collaboration Meeting
4. **What Can We Learn from Tidal Debris?**
   December 2015 - KASI-Arizona Collaboration Meeting

Other Notable Seminars

1. **Measuring Redshifts to Distant Objects in the Universe**
   March 2018 - University of Arizona Graduate Student Seminar
2. **The Search for Dark Matter**
   September 2017 - University of Arizona Graduate Student Seminar
   Outstanding Graduate Student Speaking Award Winning
3. **Weighing the Most Massive Objects in the Universe**
   April 2017 - University of Arizona Graduate Student Talks
4. **What is an Ultra Diffuse Galaxy and Why do we Care?**
   September 2016 - University of Arizona Graduate Student Seminar

Outstanding Graduate Student Speaking Award Winning

5. **Galactic Ghosts: What Can We Learn From Stellar Streams**
   November 2015 - University of Arizona Graduate Student Seminar
6. **The Evolution of Galaxies**
   May 2015 - University of Arizona Graduate Student Seminar

Travel Grants

1. LSST DESC Workshop Support Program, 2019
2. Dark Energy Survey Early Career Scientist Travel Grant, 2019
3. University of Arizona Department of Physics Fanfare Award, 2018
4. University of Arizona Graduate and Professional Student Association Travel Grant, 2018
5. LSST Dark Energy Science Collaboration Travel Grant, 2018
6. LSST Dark Energy Science Collaboration Travel Grant, 2017

Conferences and Workshops

1. DES Collaboration Meeting, Sussex, November 2019
2. CLMM Workshop, GCCL Bochum, July 2019
3. LSST DESC Collaboration Meeting, APC Paris, July 2019
4. DES Collaboration Meeting, Penn, June 2019
5. LSST DESC Collaboration Meeting, Berkeley, February 2019
6. CLMM Workshop, CMU, July 2018
7. LSST DESC Collaboration Meeting, CMU, July 2018
8. LSST DESC Collaboration Meeting, SLAC, February 2018
9. SLAC Summer Institute: Cosmic Opportunities, SLAC, August 2017
10. LSST DESC Collaboration Meeting, Stony Brook University, July 2017
11. LSST DSFP, Local representative, University of Arizona, April 2017
12. KASI-Arizona Collaboration Meeting, University of Arizona, December 2015
13. Software Carpentry Workshop, University of Arizona, 2015