Seth R. Siegel

Division of Physics, Mathematics, and Astronomy, California Institute of Technology
1200 E California Blvd, MC 367-17, Pasadena, CA 91125
(734) 693-9223 – ssiegel@caltech.edu
http://www.astro.caltech.edu/~ssiegel/

Research Interests

Cosmology and the formation of large scale structure. Galaxy clusters as cosmological probes. Measurements of the Sunyaev-Zel'dovich (SZ) effect. Astronomical instrumentation.

Education

California Institute of Technology 2009 – Present
Ph.D. Candidate in Physics (defending July 2015)

University of Michigan - Ann Arbor 2005 – 2009
B.S. with Highest Distinctions and Highest Honors in Physics
2nd Major: Mathematics GPA: 3.94/4.00

Technical Skills

Programming	C | MATLAB | IDL | SQL | Bash | LaTeX | HTML
Laboratory	Cryogenics | Machining | Microwave/RF Engineering | Automation
Observing	Caltech Submillimeter Observatory, Bolocam and MUSIC 100+ hours collecting deep pointed observations of the SZ effect in galaxy clusters

Fellowships

NASA Earth and Space Science Fellowship in Astrophysics 2011 – Present

Moore Experimental Astrophysics Fellowship 2009 – 2011

Awards

Wirt & Mary Cornwell Prize for Undergraduates 2009
Awarded to one graduating Physics concentrator who has shown promise for original study and creative work.

Phi Beta Kappa 2008

Phi Kappa Phi 2008

Research Experience

Graduate Research Assistant 2009 – Present
California Institute of Technology
Advisor: Sunil Golwala
Thesis: Characterization of a New Instrument for (Sub)mm Astronomy and a Multi-Wavelength Study of the Intra-Cluster Medium

- Tested, commissioned, and observed with the Multiwavelength Sub/millimeter Inductance Camera (MUSIC), a new four-band photometric imaging camera for the Caltech Submillimeter Observatory.
  - Led effort to characterize optical efficiency, spectral response, on-sky loading, and noise properties of over 1000 Microwave Kinetic Inductance Detectors (MKIDs). Designed and implemented SQL database to organize results.
  - Developed MCMC algorithm in MATLAB to fit model based on RF transmission theory and Mattis-Bardeen theory of superconductivity to calibration data to extract reliable estimates of detector optical efficiency and loading.
  - Created algorithm in IDL to remove correlated electronics and atmospheric noise from time ordered data, improving long-timescale stability of the instrument.
  - Lead role in commissioning the camera, developing and debugging data reduction pipeline, and interpreting on-sky data.
- Combined optical, X-ray, and mm-wave observations to constrain more realistic models for the distribution of dark and baryonic matter in 20 massive galaxy clusters.
  - Gained experience working with weak lensing (Subaru/HST), strong lensing (HST), X-ray (Chandra/XMM), and SZ (Bolocam) data products.
  - Authored code in C to interface Bolocam SZ data with an existing framework for modeling/fitting X-ray and lensing observations of galaxy clusters.

Undergraduate Research Assistant 2007 – 2009
University of Michigan - Ann Arbor
Advisor: Timothy McKay
Thesis: Cross-Correlation Between Halo Mass and the Sunyaev-Zel'dovich Effect in the Millennium Gas Simulation

- Characterized completeness of the optically identified GMBCG cluster catalog using N-body simulations and X-ray cluster catalogs.
- Devised technique for combining optically identified cluster catalogs with future large-scale SZ surveys to measure the average 3D pressure distribution of the Intra-Cluster Medium in low-mass clusters. Tested using the Millennium Gas Simulation.

Presentations

SPIE Astronomical Telescopes + Instrumentation, Montreal — 2014
Full Instrument Model for the Multiwavelength Sub/millimeter Inductance Camera

CLASH Collaboration Meeting, London — 2013
Joint Analysis of X-ray and SZ Observations of CLASH Clusters

Low Temperature Detectors 15, Pasadena, CA — 2013
Noise Performance of the Multiwavelength Sub/millimeter Inductance Camera Detectors **(Poster)**

Caltech Observational Cosmology Lunch Talk, Pasadena, CA — 2011 | 2012 | 2013

Publications

[1] J. Sayers, C. Bockstiegel, S. Brugger, N. G. Czakon, P. K. Day, T. P. Downes, R. P. Duan, J. Gao, A. K. Gill, J. Glenn, S. R. Golwala, M. I. Hollister, A. Lam, H. G. LeDuc, P. R. Maloney, B. A. Mazin, S. G. McHugh, D. A. Miller, A. K. Mroczkowski, O. Noroozian, H. T. Nguyen, J. A. Schlaerth, **S. R. Siegel**, A. Vayonakis, P. R. Wilson, and J. Zmuidzinas. The status of MUSIC: the multiwavelength sub-millimeter inductance camera. *Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series*, volume 9153, August 2014.

[2] N. G. Czakon, J. Sayers, A. Mantz, S. R. Golwala, T. P. Downes, P. M. Koch, K.-Y. Lin, S. M. Molnar, L. A. Moustakas, T. Mroczkowski, E. Pierpaoli, J. A. Shitanishi, **S. R. Siegel**, and K. Umetsu. Galaxy Cluster Scaling Relations between Bolocam Sunyaev-Zel'dovich Effect and Chandra X-ray Measurements. *ArXiv e-prints*, June 2014.

[3] J. Sayers, T. Mroczkowski, M. Zemcov, P. M. Korngut, J. Bock, E. Bulbul, N. G. Czakon, E. Egami, S. R. Golwala, P. M. Koch, K.-Y. Lin, A. Mantz, S. M. Molnar, L. Moustakas, E. Pierpaoli, T. D. Rawle, E. D. Reese, M. Rex, J. A. Shitanishi, **S. R. Siegel**, and K. Umetsu. A Measurement of the Kinetic Sunyaev-Zel'dovich Signal Toward MACS J0717.5+3745. *Astrophysical Journal*, 778:52, November 2013.

[4] J. Sayers, N. G. Czakon, A. Mantz, S. R. Golwala, S. Ameglio, T. P. Downes, P. M. Koch, K.-Y. Lin, B. J. Maughan, S. M. Molnar, L. Moustakas, T. Mroczkowski, E. Pierpaoli, J. A. Shitanishi, **S. R. Siegel**, K. Umetsu, and N. Van der Pyl. Sunyaev-Zel'dovich-measured Pressure Profiles from the Bolocam X-Ray/SZ Galaxy Cluster Sample. *Astrophysical Journal*, 768:177, May 2013.

[5] J. Sayers, T. Mroczkowski, N. G. Czakon, S. R. Golwala, A. Mantz, S. Ameglio, T. P. Downes, P. M. Koch, K.-Y. Lin, S. M. Molnar, L. Moustakas, S. J. C. Muchovej, E. Pierpaoli, J. A. Shitanishi, **S. R. Siegel**, and K. Umetsu. The Contribution of Radio Galaxy Contamination to Measurements of the Sunyaev-Zel'dovich Decrement in Massive Galaxy Clusters at 140 GHz with Bolocam. *Astrophysical Journal*, 764:152, February 2013.

[6] S. R. Golwala, C. Bockstiegel, S. Brugger, N. G. Czakon, P. K. Day, T. P. Downes, R. Duan, J. Gao, A. K. Gill, J. Glenn, M. I. Hollister, H. G. LeDuc, P. R. Maloney, B. A. Mazin, S. G. McHugh, D. Miller, O. Noroozian, H. T. Nguyen, J. Sayers, J. A. Schlaerth, **S. R. Siegel**, A. K. Vayonakis, P. R. Wilson, and J. Zmuidzinas. Status of MUSIC, the MUltiwavelength Sub/millimeter Inductance Camera. *Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series*, volume 8452, September 2012.

[7] J. A. Schlaerth, N. G. Czakon, P. K. Day, T. P. Downes, R. Duan, J. Glenn, S. R. Golwala, M. I. Hollister, H. G. LeDuc, P. R. Maloney, B. A. Mazin, H. T. Nguyen, O. Noroozian, J. Sayers, **S. R. Siegel**, and J. Zmuidzinas. The Status of Music: A Multicolor Sub/millimeter MKID Instrument. *Journal of Low Temperature Physics*, volume 167, pages 347–353, May 2012.

[8] J. Hao, T. A. McKay, B. P. Koester, E. S. Rykoff, E. Rozo, J. Annis, R. H. Wechsler, A. Evrard, **S. R. Siegel**, M. Becker, M. Busha, D. Gerdes, D. E. Johnston, and E. Sheldon. A GMBCG Galaxy Cluster Catalog of 55,424 Rich Clusters from SDSS DR7. *Astrophysical Journal, Supplement*, 191:254–274, December 2010.