

Michael B. Zemcov

Division of Physics, Mathematics, and Astronomy

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Research Interests

Experimental and observational cosmology from ground based, sub-orbital, and orbital platforms, including:

- Multi-wavelength studies of cosmological structure formation using statistical source population, intensity mapping, and tomographic measurements.
- The composition of the extragalactic background from both direct measurements and detailed studies of the sources which comprise it.
- Measurements of the cosmic microwave background radiation including the Sunyaev-Zel'dovich effect and polarization.
- Development of enabling technologies for astrophysics from the near infra-red to the millimeter.

Education

Ph.D. in Physics, Cardiff University, Cardiff, United Kingdom, November 2006

Thesis title: *Measurement of the Temperature and Polarization Anisotropies in the Cosmic Microwave Background with QUaD*, Advisers: Profs. Walter Gear & Philip Mauskopf

B.Sc. with Honors in Physics, University of British Columbia, Vancouver, Canada, May 2003

Thesis title: *Measuring the Sunyaev-Zeldovich Increment in Massive Galaxy Clusters*, Adviser: Prof. Mark Halpern

Professional Experience

Senior Postdoctoral Fellow, The California Institute of Technology, Pasadena, CA, 2009 – Present

JPL Affiliate Scientist, NASA Jet Propulsion Laboratory, Pasadena, CA, 2009 – Present

NASA Postdoctoral Fellow, NASA Jet Propulsion Laboratory, Pasadena, CA, 2006 – 2009

Visiting Postdoctoral Scholar, The California Institute of Technology, Pasadena, CA, 2006 – 2009

Graduate Student Instructor, Cardiff University, Cardiff, United Kingdom, 2003 – 2006

Junior Research Scientist, The University of British Columbia, Vancouver, Canada, 2000 – 2003

Research Experience

Over a decade of research experience in experimental astrophysics and cosmology, with specialization in multi-wavelength studies of the extra-galactic infrared background, the cosmic microwave background radiation including polarization and the Sunyaev-Zeldovich effect, and reionization. Experienced in instrument design, integration, data analysis, and scientific interpretation of results. Extensive scientific and project management experience including a wide range of team sizes and platforms from ground based to sub-orbital and space observatories.

Research Experience (continued)

- **QUaD** (2003 - 2008)

Assisted with cryogenic commissioning, system integration, and testing of optical, electronic and cryogenic components. Performed early simulation of data analysis pipeline leading to a major involvement in the data analysis effort. Key roles in instrument characterization, systematic error identification and control, calibration, and scientific output.

- **CIBER & CIBER-2** (2006 - Present)

CIBER's lead postdoctoral scholar with key roles in all aspects of the project. Major contributions include leading the instrument design, integration, commissioning and fielding, data analysis, and scientific interpretation efforts. Role as co-Investigator of the new CIBER-2 payload is a continuation of this program.

- **Herschel-SPIRE** (2008 - Present)

Leadership roles in instrument data analysis and science interpretation. Associate Scientist in the SPIRE Guaranteed Time team, an Instrument Team working member, a co-Investigator in the key program galaxy cluster survey, and the Principle Investigator of several ongoing data analysis programs. Lead designer and coordinator for a "big-data" 10-node, 30 TB, 160 core computer cluster for Herschel data storage and analysis.

- **Ground-Based Submillimeter** (2009 - Present)

Co-Investigator of both the SCUBA-2 Cosmology Legacy Survey and the SCUBA-2 lensing cluster survey. Lead various studies with Z-Spec, including the first high-resolution spectral measurement of the SZ effect. Various science projects involving Bolocam and AzTEC data analysis. Assisted commissioning MUSIC, a four-band trans-millimetric KID-based camera.

- **TIME** (2012 - Present)

Co-Investigator of the Tomographic Ionized-Carbon Mapping Experiment (TIME), leading instrument simulation and science work packages, and lead roles in data acquisition and data analysis software development.

- **LAMP** (2012 - Present)

Co-Investigator of the Lyman Alpha Mapping Project (LAMP). Responsible for major work packages including hardware specification and design, observation strategy, and data analysis development.

- **SPHEREx** (2014 - Present)

Co-Investigator and Instrument Scientist of the Spectro-PHOTometer for the Extragalactic structure, Reionization and Ices eXplorer, an experiment concept to be proposed to the 2014 NASA small explorer (SMEX) call.

- **Technology Development**

Leading a number of technology development programs including optimization of HAWAII-2 HgCdTe arrays for demanding space applications and new CMOS-based detectors for optical applications.

Involved in design studies for next-generation low and medium resolution sub-mm spectrometric technologies, driven by the need for kilo-pixel or larger sub-mm arrays to measure line emission from the epoch of reionization, high redshift star forming galaxies, and other extragalactic science cases.

Teaching Experience

2006 – Present, California Institute of Technology: Graduate student mentoring/co-supervision of: Alicia Lanz, Joseph Smidt, Ketron Mitchell-Wynne, Matthew Weiss, Kohji Tsumura, Toshiaki Arai, Min Gyu Kim, Ian Sullivan. Undergraduate student mentoring/supervision of: Anson Lam, Andrew Meek, Neelay Fruitwala, Tommy Taak, Timothy Wood.

2003 – 2006, Cardiff University: Physics teaching assistant.

Grand Prize Judge, Intel ISEF Science Fair Competition, May 2014

Teaching Experience (continued)

Selected teaching references from current and former students (please contact for further information):

Mrs. Alicia Lanz	Graduate Student, The California Institute of Technology	alicialanz@caltech.edu
Mr. Andrew Meek	Undergraduate Student, St. Andrew's University	am2487@st-andrews.ac.uk
Mr. Christian Ward	Graduate Student, Temple University	tuf27176@temple.edu

Regular contributor to the “Titanium Physicists” Podcast on which topics in modern physics are presented to the general public, <http://titaniumphysicists.brachioloopemedia.com> (rated 5 stars on iTunes).

Featured on Canadian Broadcasting Corporation's weekly science show “Quirks & Quarks”, November 2014

Professional References

Prof. James Bock, California Institute of Technology, jjb@astro.caltech.edu
 Prof. Asantha Cooray, The University of California - Irvine, acooray@uci.edu
 Prof. Philip Mauskopf, Arizona State University, Philip.Mauskopf@asu.edu
 Dean Walter Gear, Cardiff University, Walter.Gear@astro.cf.ac.uk
 Prof. Mark Halpern, The University of British Columbia, halpern@physics.ubc.ca
 Prof. Sunil Golwala, California Institute of Technology, golwala@astro.caltech.edu
 Prof. Jason Glenn, The University of Colorado - Boulder, Jason.Glenn@colorado.edu
 Prof. Ken Ganga, Université Paris Diderot, ganga@apc.univ-paris7.fr

Completed, Current, and Pending Grants

Title: “Complete Spectral Mapping of the Sub-millimetre Sunyaev-Zel'dovich Effect in Galaxy Clusters”

Status: PI, Completed

Agency: NASA (Herschel OT2)

Title: “Exploring the Epoch of Reionization with C+ Line Tomography”

Status: PI, Completed

Agency: NASA (JPL Director's Fund)

Title: “The Cosmic Infrared Background Experiment-2”

Status: Co-I, Current

Agency: NASA (APRA)

Title: “The North Ecliptic Pole Extragalactic Background Light Fluctuations Survey”

Status: Co-I, Current

Agency: NASA (Spitzer)

Title: “Mapping the Epoch of Reionization with C+ Tomography”

Status: Co-I, Current

Agency: 2013 KISS BILLION C+ Technical Development Funding

Title: “Galaxy Cluster Train Wreck Forensics”

Status: Co-I, Pending

Agency: NASA (ADAP)

Honors, Awards, Professional Memberships

NASA Achievement Award for CIBER, 2014

NASA Achievement Award for Herschel-SPIRE Commissioning, 2010

NASA Postdoctoral Fellowship, 2006 – 2009

Honors, Awards, Professional Memberships (continued)

Antarctic Service Medal, 2006, 2007

Cardiff University Scholarship, 2003 – 2006

Royal Astronomical Society Student Grant, 2006

Fellow of the Royal Astronomical Society

Member of the American Astronomical Society

Service as Member/Chair of NASA Grant Review Panels

Service as Referee/Reviewer, *The Astrophysical Journal*, *Astronomy & Astrophysics*, *The Monthly Notices of the Royal Astronomical Society*

Invited Talks

“Near-IR Background Fluctuation Results from the Cosmic Infrared Background Experiment” *KICP Seminar* (Scheduled), University of Chicago, March 2015

“CIBER, Fluctuations in the Near IR Background, and the Intra-halo Light” *Cosmology on the Slopes* (Invited Talk), Aspen CO, March 2015

“Near-IR Background Fluctuation Results from the Cosmic Infrared Background Experiment” *Cosmology Seminar*, Arizona State University, November 2014

“Rocket Experiment Finds Missing Light from the Universe” *NASA Editorial Board Meeting*, Washington, D.C., October 2014

“New Results from the Cosmic Infrared Background Experiment” *NASA UV-Vis PI Annual Meeting*, Washington, D.C., September 2014

“The Near IR Background and the Cosmic Infrared Background Experiment” *Deciphering the Cosmic Infrared Background Workshop*, Banyuls, France, October 2012

“Measurement of the Sunyaev-Zel’dovich Effect Increment with Large Aperture Sub-mm Telescopes” 220th *AAS Meeting Special Session “High Angular Resolution Sunyaev-Zel’dovich Effect”*, Anchorage, Alaska, June 2012

“Measuring Light from the Epoch of Reionization with the Cosmic Infrared Background Experiment” *The Near Infrared Background and the Epoch of Reionization Workshop*, Austin, Texas, May 2012

“Measuring Light from the Epoch of Reionization with the Cosmic Infrared Background Experiment” *NASA Sounding Rocket Working Group*, Washington, D.C., September 2011

“Measuring Light from the Epoch of Reionization with the Cosmic Infrared Background Experiment” *Cosmic Radiation Fields - Sources in the Early Universe Workshop*, Hamburg, Germany, November 2010

“Measuring Light from the Epoch of Reionization with CIBER” *Stanford Cosmology Seminar*, Stanford University, May 2008

“Measuring the Polarization of the Cosmic Microwave Background with QUaD” *Astronomy Colloquium*, Oxford University, July 2007

“First Year CMB Temperature and Polarization Results from QUaD” *JPL Astronomy Seminar*, Jet Propulsion Laboratory, June 2007

“QUaD: Measurement of the CMB Polarization from the South Pole” *Observational Cosmology Seminar*, California Institute of Technology, March 2006

“Measuring the Polarization of the Cosmic Microwave Background with QUaD” *Astronomy Colloquium*, The University of Colorado Boulder, June 2005

Selected Publications

*Harzing's Publish or Perish*¹ reports an *h*-index of 33 for 11 years since first publication, based on published papers, and Google Scholar indicates an *i*10-index of 62 over the same time period.

Zemcov, M., Smidt, J., Arai, T., et al., 2014. “On the Origin of Near-Infrared Extragalactic Background Light Anisotropy.” *Science*, 346, 6210.

Sayers, J., Mroczkowski, T., **Zemcov, M.**, et al., 2013. “A Measurement of the Kinetic Sunyaev-Zel’dovich Signal Toward MACS J0717.5+3745.” *The Astrophysical Journal*, 778, 52.

Zemcov, M., Arai, T., Battle, J., et al., 2013. “The Cosmic Infrared Background Experiment (CIBER): A Sounding Rocket Payload to Study the near Infrared Extragalactic Background Light.” *The Astrophysical Journal Supplement*, 207, 31.

Zemcov, M., Blain, A., Cooray, A., et al., 2013. “HerMES: A Deficit in the Surface Brightness of the Cosmic Infrared Background due to Galaxy Cluster Gravitational Lensing.” *The Astrophysical Journal Letters*, 769, L31.

Viero, M. P., Wang, L., **Zemcov, M.**, et al., 2013. “HerMES: Cosmic Infrared Background Anisotropies and the Clustering of Dusty Star-forming Galaxies.” *The Astrophysical Journal*, 772, 77.

Hanson, D., Hoover, S., Crites, A., et al., 2013. “Detection of B-Mode Polarization in the Cosmic Microwave Background with Data from the South Pole Telescope.” *Physical Review Letters*, 111, 14, 141301.

Zemcov, M., Aguirre, J., Bock, J., et al., 2012. “High Spectral Resolution Measurement of the Sunyaev-Zel’dovich Effect Null with Z-Spec.” *The Astrophysical Journal*, 749, 114.

Gong, Y., Cooray, A., Silva, M., et al., 2012. “Intensity Mapping of the [CII] Fine Structure Line during the Epoch of Reionization.” *The Astrophysical Journal*, 745, 49.

Zemcov, M., Blain, A., Halpern, M., et al., 2010. “Contribution of Lensed SCUBA Galaxies to the Cosmic Infrared Background.” *The Astrophysical Journal*, 721, pp. 424–430.

Zemcov, M., Rex, M., Rawle, T. D., et al., 2010. “First detection of the Sunyaev Zel’dovich effect increment at $\lambda < 650\mu\text{m}$.” *Astronomy and Astrophysics*, 518, pp. L16+.

Zemcov, M., Ade, P., Bock, J., et al., 2010. “Characterization of the Millimeter-Wave Polarization of Centaurus A with QUaD.” *The Astrophysical Journal*, 710, pp. 1541–1550.

Brown, M. L., Ade, P., Bock, J., et al., 2009. “Improved Measurements of the Temperature and Polarization of the Cosmic Microwave Background from QUaD.” *The Astrophysical Journal*, 705, pp. 978–999.

Zemcov, M., Borys, C., Halpern, M., et al., 2007. “A study of the Sunyaev-Zel’dovich increment using archival SCUBA data.” *Monthly Notices of the Royal Astronomical Society*, 376, pp. 1073–1098.

¹<http://www.harzing.com/resources.htm#/pop.htm>