

## CURRICULUM VITAE

**David M. Wittman**

529 Physics

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### EMPLOYMENT

- 2010—present** Associate Professor of Physics, University of California, Davis.  
**2006—2010** Assistant Professor of Physics, University of California, Davis.  
**2004—2006** Assistant Research Physicist, University of California, Davis.  
**1997—2004** Member of Technical Staff, Bell Laboratories, Lucent Technologies (this is the title given to permanent researchers at Bell Labs).

### EDUCATION

- 1997** PhD, Astronomy, University of Arizona  
**1990** AB cum laude, Physics, Harvard University

### RESEARCH HIGHLIGHTS

I am an observational cosmologist focusing on gravitational lensing and dark matter. In 2000 I published the first detection of cosmic shear; in 2001, the first detection of a galaxy cluster based on its lensing signal alone and the first tomographic lensing analysis; and in 2006 the first well-defined sample of shear-selected clusters. I then led the Deep Lens Survey (DLS) data processing team, calibrating this 100-night, two-hemisphere survey by 2012 and soon thereafter co-authoring world-class results in cosmic magnification and cosmic shear, including tomography. After discovering a merging galaxy cluster in DLS data I shifted my focus to merging clusters to better constrain dark matter particle models. I have discovered and surveyed many more of these collisions, and developed new methods for understanding their dynamics. I have 70 refereed publications, 5552 citations, and an h-index of 28.

### TEACHING HIGHLIGHTS

I have taught astronomy and physics to students of all levels, from pre-K (in my role as Scientist in Residence at Peregrine School) to PhD. I emphasize student engagement, active learning, the development of metacognitive skills, and the unity of knowledge—a beautiful aspect of science not evident to most students in most of their courses. I stay effective by constantly assessing impacts of my courses on student content understanding and self-efficacy. I have developed a curriculum to bring relativity to non-physics students, who are fascinated by it but are shut out by standard curricula. My textbook *Elements of Relativity* was published by Oxford University Press in 2018.

## GRANTS AS PRINCIPAL INVESTIGATOR

- 2019—2021** National Science Foundation: *Using Velocity Fields to Improve Gravitational Lensing Mass Measurements of Galaxies and Galaxy Clusters*, \$212,369.
- 2015—2019** National Science Foundation: *Anatomy of a Merger: Understanding the Dynamics of Galaxy Cluster Mergers*, \$346,101.
- 2013—2015** Space Telescope Science Institute: *Probing Dark Matter with a New Class of Merging Clusters*, \$127,870.
- 2008—2012** Large Synoptic Survey Telescope (LSST) Corporation: *Shear Analysis of the LSST Dataset*, \$458,070.
- 2007—2008** Spitzer Space Telescope Science Center: *Shear-Selected Galaxy Clusters: Stellar Mass Content and Star Formation History*, \$49,900.
- 2007** LSST Corporation: *Weak Lensing Computing Requirements*, \$70,000.
- 2005—2010** NASA Long-Term Space Astrophysics (LTSA): *Probing Dark Matter and Dark Energy with Shear-Selected Clusters of Galaxies*, \$769,544.
- 2004—2006** Space Telescope Science Institute: *Probing the Mass Distribution at High Redshift in the Hubble Space Telescope Ultra-Deep Field*, \$81,300.

## HONORS AND AWARDS

- 2019** Nominated for the American Physical Society's Dwight Nicholson Medal for Outreach
- 2018** Nominated for the UC Davis Chancellor's Achievement Award for Diversity and Community
- 2015—2016** Fulbright Scholar
- 2007** Nominated for Excellence in Education award sponsored by Associated Students of UC Davis.
- 1993** SPIE Scholarship in Optical Engineering (graduate)
- 1988—1990** John Harvard Scholar (undergraduate)
- 1986—1990** National Merit Scholar (undergraduate)

## PUBLICATIONS

A list of publications is attached separately. As of July 2019 I have 70 refereed papers and 116 nonrefereed publications, with 5,552 citations and an h-index of 28. For your convenience [here is a link to the full list on ADS](#) (once there you can change the sorting from by-citations to by-date).

I have also published a textbook, *Elements of Relativity* (Oxford University Press, 2018). I wrote this to enable college courses in relativity that assume no prior knowledge of physics (hence can reach a large audience of interested students) while still challenging students to think at a college level.

Submitted papers in the refereeing process as of July 2019:

- *Precision Weak Gravitational Lensing Using Velocity Fields: Fisher Matrix Analysis* by David Wittman and Matthew Self, submitted to *Astrophysical Journal*
- *Chandra Observations of the Spectacular Abell 3411–12 Merger Event* by F. Andrade-Santos, R. van Weeren, G. di Gennaro, D. Wittman, and 16 more co-authors, submitted to *Astrophysical Journal*

## INVITED TALKS AT SCIENTIFIC MEETINGS

- Toward Better Merger Modeling*, Workshop on Self-interacting Dark Matter, Copenhagen, Denmark, August 2017
- Merging Galaxy Clusters as Dark Matter Colliders*, PATRAS Workshop on Axions, WIMPS, and WISPS, Thessaloniki, Greece, May 2017
- Dark Matter in Galaxy Clusters: Past, Present, and Future*, National Astronomy Teaching Summit, San Francisco, August 2016
- Dark Matter in Galaxy Clusters: Past, Present, and Future*, American Association of Physics Teachers annual meeting, Sacramento, July 2016
- Merging Galaxy Clusters as Dark Matter Colliders*, Dark Matter-Cairo, Cairo, December 2015
- Designing and Running a Graduate Admissions Boot Camp*, APS Bridge Program Summer Meeting, College Park, MD, June 2014
- Invited lecturer*, Summer School & Workshop: Weak and Strong Gravitational Lensing, Beijing, China, July 2011
- Future Large Optical Surveys*, First International Symposium of Science with the SOAR Telescope, Maresias Beach, Brazil, May 2011
- Shaping Attitudes Toward Science in an Introductory Class*, Summer Institute on Teaching and Technology, Davis, CA, June 2010
- Weak Lensing Surveys in the Next Decade*, Dark Side of the Universe '09, Melbourne, Australia, June 2009
- Weak Lensing Surveys*, 3rd International Workshop on the Interconnection between Particle Physics and Cosmology, Oklahoma University, May 2009
- Systematics in Future Surveys*, DUEL (Dark Universe with Extragalactic Lensing) meeting, Victoria, BC, June 2008
- A Consumer's Guide to Future Weak Lensing Surveys*, Dark Side of the Universe '07, Minneapolis, MN, June 2007
- LSST*, Probing the Universe with Weak Lensing Surveys meeting, Marseilles, France, April 2007
- (A Consumer's Guide to) Weak Lensing Surveys*, COSMO 06, Lake Tahoe, CA, September 2006
- Statistical and Computational Challenges in Large Astronomical Surveys*, Opening Workshop, Spring 2006 Program on Astrostatistics; Statistical and Applied Mathematical Sciences Institute, Research Triangle Park, NC, January 2006
- LSST*, Workshop on Probing the Dark Universe with Subaru and Gemini, Waikoloa, HI, November 2005
- LSST Simulations*, SNAP meeting, LBNL, June 2005
- Weak Lensing with the Blanco 4-m*, Dark Energy Survey meeting, Fermilab, May 2005
- LSST Simulations: From High Redshift to the Top of the Atmosphere*, LSST Simulation Meeting, UC Davis, March 2005
- Weak Lensing Science Requirements*, LSST Science Requirements Meeting, SLAC, March 2005

*Weak Lensing Requirements on an Atmospheric Dispersion Compensator*, LSST ADC Meeting, SLAC, September 2004

*Shear-Selected Clusters from the Deep Lens Survey*, Workshop on Studies of Dark Energy and Cosmology from X-ray Cluster Surveys, Greenbelt, MD, Jan. 15, 2004

*The Large Synoptic Survey Telescope*, INPAC (Institute for Nuclear and Particle Astrophysics and Cosmology) meeting, San Diego, Oct. 4, 2003

*Shear-Selected Clusters from the Deep Lens Survey*, SLAC Summer Science Institute, Aug. 8, 2003

*Weak Lensing by Large-Scale Structures*, Princeton/PUC Dark Matter workshop, San Pedro de Atacama, Chile, July 2000

## **SEMINARS, COLLOQUIA, CONTRIBUTED TALKS**

*Overconfidence: diagnosis and steps toward treatment*, National Astronomy Teaching Summit, San Francisco, August 2016

*Merging Galaxy Clusters as Dark Matter Colliders*, Leiden Observatory, Leiden, Netherlands, April 2016

*Merging Galaxy Clusters as Dark Matter Colliders*, Hamburg University, Hamburg, Germany, April 2016

*Merging Galaxy Clusters as Dark Matter Colliders*, University of Coimbra, Coimbra, Portugal, March 2016

*Merging Galaxy Clusters as Dark Matter Colliders*, Instituto de Astrofísica, Lisbon, Portugal, October 2016

*Merging Cluster Collaboration: Dynamics of 25 Radio-Selected Mergers*, Snowcluster 2015 - The Physics of Galaxy Clusters, Snowbird, UT, March 2015

*Merging Galaxy Clusters and the Nature of Dark Matter*, colloquium for Kansas State University Physics Department, Manhattan, KS, September 2013

*Cosmology & Dark Matter Panel*, INPAC–MRPI General Meeting, Asilomar, CA, April 2013

*Merging Galaxy Clusters and the Nature of Dark Matter*, seminar for Cerro Tololo Inter-American Observatory, La Serena, Chile, January 2013

*Massive Sky Surveys in the Coming Decade*, Physics Colloquium, California State University, Sacramento, September 2012

*MultiFit Overview*, LSST Weak Lensing meeting, Princeton, NJ, August 2009

*MultiFit Overview*, LSST Galaxies Collaboration meeting, Tucson, AZ, May 2009

*Redshift Distributions and  $p(z)$* , Photometric Redshift Accuracy Testing meeting, IPAC/Caltech, Pasadena, December 2008

*Stacking and MultiFit*, LSST Data Management Applications Meeting, IPAC/Caltech, Pasadena, February 2008

*Massive Sky Surveys of the Next Decade*, Sonoma State Physics Colloquium, Feb. 4, 2008

*Massive Astronomy Surveys in the Next Decade*, UC Berkeley Neyman Statistics Seminar, October 10, 2007

*Cosmic Shear with the Deep Lens Survey*, Cosmology in Northern California, May 8, 2007

*Weak Lensing*, LSST All-Hands Meeting, December 4, 2006

*Large Optical Astronomy Surveys*, UC Davis Statistics Colloquium, November 30, 2006

*Shear-Selected Clusters from the Deep Lens Survey*, UC Berkeley Astrophysics Seminar, September 5, 2006

*Shear-Selected Clusters from the Deep Lens Survey*, Fermilab Astrophysics Seminar, May 22, 2006

*Weak Lensing Cosmology: Past, Present, and Future*, UC Davis Cosmology Seminar, February 21, 2006

*Shear-Selected Clusters from the Deep Lens Survey*, Stanford Linear Accelerator Center seminar, November 3, 2005

*Shear-Selected Clusters from the Deep Lens Survey*, UC Santa Cruz colloquium, April 28, 2004

*The Deep Lens Survey*, Stanford Linear Accelerator Center seminar, May 7, 2003

*The Deep Lens Survey*, UC Davis Cosmology Seminar, March 12, 2003

*The Deep Lens Survey*, Society of Photo-Optical Instrumentation Engineers, Waikoloa, HI, August 2002

*Detecting Cosmic Shear*, Stanford Linear Accelerator Center, Feb. 6, 2001

*Detecting Cosmic Shear*, Lawrence Berkeley National Laboratory, Feb. 8, 2001

*Detecting Cosmic Shear*, Rutgers University Astrophysics Seminar, March 8, 2001

*Frontiers in Weak Gravitational Lensing*, Bell Labs Physical Sciences Research Seminar, May 16, 2001

*Detecting Cosmic Shear*, Institute for Advanced Study, March 2000

*The Normal Cluster Weak Lensing Survey: Masses, Mass Profiles, and M/L Ratios of Ten Clusters at  $z \approx 0.2$* , conference on *Constructing the Universe with Clusters of Galaxies*, Paris, July 2000

*Weak Lensing with the Big Throughput Camera*, National Observatory, Rio de Janeiro, Brazil, May 4, 1999

*The Shear Correlation Function Out to 20'*, conference on *Gravitational Lensing: Recent Progress and Future Goals*, Boston University, July 28, 1999

*Big Throughput Camera: The First Year*, SPIE Conference on Large Telescopes and Instrumentation, Kona, Hawaii, March 1998

*A Hitchhiker's Guide to M33*, Lawrence Livermore National Laboratory, November 1996

*A Hitchhiker's Guide to M33*, Bell Labs, November 1996

*High-resolution infrared imaging utilizing a tip-tilt secondary mirror*, SPIE Conference on Large Telescopes and Instrumentation, Kona, Hawaii, March 1994

## **PUBLIC/SCHOOL TALKS**

*Open Questions in Cosmology* seminar for the Research Experiences for Undergraduate program, June 2010, 2012, 2014, 2016, 2017, 2018

*Grad School: The Good, the Bad, and the Ugly*, California State University Sacramento, May 2018

*Dark Matter and Gravitational Lensing*, Davis Kiwanis Club, April 2017

*Physics and Astronomy*, Mathematical and Physical Sciences Day, UC Davis, February 2017

*Strange New Worlds*, Peregrine School, December 2016

*Gravitational Lensing*, UC Davis Astronomy Club, May 2015

*The Solar System*, Science In the River City workshop, Sacramento, March 18, 2014

*Earth: Mostly Harmless*, Science In the River City workshop, Sacramento, January 28, 2014

*Galaxy Collisions Reveal Nature of Dark Matter*, seminar for the Multicultural Organization of Science Students, California State University, Sacramento, November 2012

*Standing On The Shoulders Of Giants: Understanding Force, Motion, And Orbits*, Science In the River City workshop, Sacramento, March 27, 2012

*All Your Astronomy Questions Answered*, talk for students at Tercero Residence, Davis, CA, June 2011

Patwin Elementary School, Davis, CA, November 2009

Rutherford Elementary School, Stillwater, MN, December 19, 2006

Patwin Elementary School, Davis, CA, Oct. 27, 2006

Franklin Grade School, Westfield, NJ, March 30, 2004

Science Saturday, Westfield High School, NJ, March 23, 2002

St. Vincent de Paul School, Stirling, NJ, April 27, 2001

*Gravitational Lensing and Dark Matter*, World of Science, Murray Hill, NJ, March 31, 2001

Roosevelt Middle School, Westfield, NJ, Jan. 11, 2001

Science Saturday, Westfield High School, NJ, Jan. 6, 2001

Roosevelt Middle School, Westfield, NJ, Dec. 20, 1999

*Big Throughput Camera: Window on the Universe*, Amateur Astronomers, Inc., Cranford, NJ, Dec. 18, 1998

## **MAJOR OUTREACH ACTIVITIES**

I am on the steering committee and the graduate committee of Cal-Bridge, a program to help diverse undergraduates thrive in physics/astronomy and bridge up to PhD programs. I also mentor students and run workshops for Cal-Bridge, and I have also mentored two students in UC Davis' MURPPS (Mentorships for Undergraduate Research Participants in the Physical and Mathematical Sciences) program.

I am the founder of the California Graduate Physics Admissions Boot Camps and organizer of northern California camp, 2010–2012 and 2016–present. These camps inform and prepare undergraduate students to expand their career options in physics, at no charge to them.

I participate in many outreach/recruitment events at UC Davis, such as MPS (Mathematical and Physical Sciences) Day in 2017 (which I helped plan and run), Envision UC Davis in 2018, the UC LEADS annual meeting in 2017, and Grad Scoop in 2018 and 2019.

Coordinator for Astronomy and Solar System events at Sacramento Regional Science Olympiad, 2007–2013, 2015, 2017, 2018

Scientist in Residence, Peregrine School (an innovative elementary school), Davis, CA, 2011–2013

Faculty member for COSMOS (California State Summer School for Mathematics and Science), 2011 and 2014

Visiting Scientist, Peregrine School, Davis, CA, 2009–2011

*Minor and less recent activities are omitted here for brevity.*

## COURSES TAUGHT

**For non-scientists:** First-year Seminar in Scientific Reasoning; Astronomy 10G: Stars, Galaxies, Universe (nominated for the Associated Students of UC Davis Excellence in Education award; also taught as an honors course); Astronomy 10S: Solar System; Physics 10: Topics in Physics (relativity; also taught as an honors course, Integrated Studies 8A).

**Introductory:** Physics 9C: Electricity and Magnetism (for engineers and physicists)

**Upper division:** Physics 153: Extragalactic Astrophysics; Physics 155: General Relativity; Physics 156: Introduction to Cosmology

**Graduate:** Physics 250: Weak Gravitational Lensing; Physics 250: Cosmology with Galaxy Surveys; Physics 265: High Energy Astrophysics; Physics 266: Data Analysis for Astrophysics

**Group Study:** I have led physics majors in creating animations to help beginners grasp physical principles important for understanding astronomy. The **resulting animations** are used by astronomy educators nationwide and benefit not only the general education students who use the animations, but also the physics majors who deepened their understanding of physics in the process.

## OTHER EDUCATION ACTIVITIES

**Advising** I am an undergraduate adviser and a graduate adviser for my department; in both capacities I advise students on courses to take and on broader issues affecting their education and career. I have taken Mental Health Gatekeeper training to assist with this.

**Research mentoring** I have graduated four PhD students and am currently mentoring one more. I have also mentored three postdoctoral researchers, two MS students, 25 undergraduates and one precocious high school student in research since joining the UCD faculty in 2006.

**Campus-wide** I served as chair of the First-Year Experience subcommittee for improving undergraduate education at UCD in 2014-15, as a mentor for the University Honors Program in multiple years, and on the Campus Judicial Board 2012-2015.

**International** I taught at the 2011 Beijing Summer School on Gravitational Lensing.

**SERVICE** (*Department and university service is omitted for brevity.*)

- 2019—present** Time Allocation Committee, University of California Observatories
- 2000—present** Referee for publications including *Science*, *Astronomy & Astrophysics*, *Astrophysical Journal*, *Astrophysical Journal Letters*, and *Monthly Notices of the Royal Astronomical Society*. I typically review about three papers each year.
- 2019** Proposal reviewer, Fulbright Commission Portugal
- 2018** Book proposal reviewer, Oxford University Press
- 2017** Proposal reviewer, National Science Foundation Astronomy and Astrophysics Grants
- 2016** Proposal reviewer, Millennium Science Initiative
- 2015—2016** Proposal reviewer, Fulbright Commission Portugal
- 2015** Reviewer/panelist for NASA WFIRST awards
- 2014** Reviewer, *21st Century Astronomy* textbook, fourth edition
- 2000—2014** Deep Lens Survey public data release and support <http://dls.physics.ucdavis.edu>
- 2007—2013** Co-chair, LSST Weak Lensing Science Collaboration
- 2013** External reviewer, Dark Energy Survey operational readiness review
- 2010—2011** Docent educator at Cameron Park Rotary Community Observatory.
- 2010** Panelist, National Optical Astronomy Observatories (NOAO) Survey Program Review
- 2009** External reviewer, SDSS-3 hardware Critical Design Review
- 2009** Reviewer, *21st Century Astronomy* textbook, third edition
- 2008** Proposal reviewer, France Berkeley Fund
- 2008** Reviewer/panelist for NSF CAREER awards
- 2005** Chair, Weak Lensing Working Group, LSST Science Requirements meeting
- 2004—2005** represented LSST on a joint LSST/SNAP statement of complementarity
- 2001—2004** Deep Lens Survey liaison for the Hands-On Universe educational project
- 2002—2004** Member, Bell Labs Research Computing Support Committee
- 2002—2004** Founder and organizer, Bell Labs Astrophysics Journal Club
- 2002—2003** Member, LSST Data Working Group, a panel charged by NOAO to determine if and how it was feasible to manage and do science with the immensely large planned LSST dataset.
- 1999—2001** Founder and maintainer of the LSST website <http://www.lsst.org>
- 1997—2000** Observing and data reduction support for community users of the Big Throughput Camera on the Cerro Tololo Inter-American Observatory 4-m telescope