
APARNA VENKATESAN

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Department of Physics and Astronomy

University of San Francisco

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EDUCATION

Ph.D., 2000, Astronomy and Astrophysics, The University of Chicago

Thesis Topic: Reionization Models and the Cosmic Microwave Background

Thesis Advisor: Dr. Angela V. Olinto

M.S., 1994, Astronomy and Astrophysics, The University of Chicago

B.A., 1993, Astronomy (with Distinction in All Subjects), Cornell University

Advisor: Dr. Steven Squyres

RESEARCH INTERESTS

My scientific interests lie primarily in theoretical cosmology, including studies of the first stars and quasars, cosmological reionization, cosmic element synthesis, the microwave background, dark matter, and gravitational lensing. I have also worked in high-energy astrophysics (gamma-ray bursts and cosmic rays) and planetary astronomy as an undergraduate and graduate student.

PROFESSIONAL APPOINTMENTS

- **Chair, Department of Physics and Astronomy**, University of San Francisco, Aug. 2014–present
- **Associate Professor of Physics and Astronomy**, University of San Francisco, Fall 2012–present
- **Assistant Professor of Physics and Astronomy**, University of San Francisco, Fall 2006–Summer 2012, conducting research on cosmology and the first stars, and co-creating two new astronomy and astrophysics minors at USF
- **Lecturer and Research Associate**, University of Colorado, Boulder, Jan.–July 2006
- **NSF Astronomy and Astrophysics Postdoctoral Fellow**, University of Colorado, Boulder,

June 2002–Dec. 2005, performed research on the properties, formation epochs and cosmological feedback from the first stars, supernovae and quasars

- **Postdoctoral Research Associate**, University of Colorado, Boulder, 2000–2002 (Supervisor: Prof. J. Michael Shull), worked on projects in cosmology, reionization and first-light sources
- **Farr Fellow and Graduate Research Assistant**, The University of Chicago, 1993–2000 (Thesis Advisor: Prof. Angela Olinto), worked on projects in high-energy astrophysics and cosmology
- **Graduate Research Assistant**, Los Alamos National Laboratory, Summer 1994 (Supervisor: Dr. Richard Epstein), analyzed the statistics of data from the BATSE instrument on the *Compton Gamma-Ray Observatory* satellite
- **Undergraduate Research Assistant and Data Analyst**, Cornell University, 1990–1993 (Advisor: Prof. Steven Squyres), analyzed and processed the first three years of data from the Magellan Mission to Venus at Cornell University. Created unique database of images that was subsequently used widely by the planetary science research community, and by the Encyclopaedia Britannica

HONORS, AWARDS AND GRANTS

- Lead USF Faculty Member in national 19-institution consortium, The Undergraduate ALFALFA Team, awarded a 3-year collaborative grant for \$437,883 by the National Science Foundation, 2012–2015
- USF Dean’s Scholar award, \$2500 stipend and 1-course teaching release, 2012–2013
- Awarded USF Jesuit Foundation Grant for \$5K to develop a new course at USF titled “A History of Astronomy: Ancients, Jesuits and Modern Cosmology”, May 2012
- PI on Cottrell College Science Award (Research Corporation), \$45 K awarded for proposal titled “The Effects of Helium Reionization in the Early Universe”, for PI and undergraduate research to be performed at USF, 2010–2013
- Received a \$500 grant from the Travel Grants for Women Speakers Program administered by the American Physical Society to support the visit of a female colloquium speaker to USF’s Department of Physics and Astronomy, July 2010
- Received a \$1500 conference grant to attend and present research at the meeting “From First Light to Newborn Stars”, Tucson, AZ, March 2010
- PI on American Astronomical Society Small Research Grant (\$1500) for proposal titled “Multi-Wavelength Detections of the First Stars”, 2006
- PI on National Science Foundation Astronomy and Astrophysics Postdoctoral Fellowship (award amount \$185 K), University of Colorado, Boulder, 2002–2005
- Selected with full funding to be on the US delegation to the IUPAP International Conference on Women in Physics, UNESCO, Paris, 2002
- Awarded conference grants for attending 8 meetings, schools and workshops, 1996–2004
- Farr Fellowship, The University of Chicago, 1993–1997
- NASA Space Grant Fellowship, Cornell University, Summers of 1991 and 1992

- Graduation with distinction in all subjects, Cornell University, 1993
- Dean's List, Cornell University, 1990–1993
- International Students and Scholars' Scholarship, Cornell University, 1989–1993

Internal Funding at USF:

- Awarded \$1000 faculty stipend from the USF College of Arts & Sciences Undergraduate Research Project Applications for creating new research project opportunities for undergraduate students, Summer 2009
- Awarded \$450 by USF Dean's Office grant to subsidize undergraduate research travel to Arecibo Observatory, Puerto Rico, Fall 2011
- **Received 18 awards from the USF College of Arts and Sciences Faculty Development Fund (FDF), 2006–present, with the last 3 years' awards listed here:**
 - \$1100, Publications Costs for Journal Articles in Astrophysics, Spring 2011
 - \$893, Conference Travel to present research at the 2011 Santa Fe Cosmology Summer Workshop, Summer 2011
 - \$2341, Conference Travel to attend/speak at the summer meeting of the American Astronomical Society (AAS), Anchorage, AL, *The Escape of Ionizing Radiation from Early Galaxies*, Summer 2012
 - \$1900, Publication Costs for Journal Articles in Astrophysics, Fall 2012
 - \$5846, Undergraduate RA stipends and Equipment (part of Cottrell award matching funds), Spring 2013
 - \$1545, Conference Travel to attend/speak at the 223rd meeting of the AAS, Washington D.C., *Finding the 99% Today: The Cosmological Role of Dwarf Galaxies*, Fall 2013
 - \$1611, Undergraduate RA stipends on project *Constraints on the first-stars mass function using dwarf galaxy data in the nearby universe*, Fall 2013
 - \$1100, Research Collaboration Travel to Carnegie Observatories for project *The Escape of Ionizing Radiation from Dwarf Galaxies*, Spring 2014
 - \$1611, Undergraduate RA stipends on project *Constraints on the first-stars mass function*, Spring 2014
 - \$887, Conference Travel to present research at the 2014 Santa Fe Cosmology Summer Workshop, *The Cosmological Role of Dwarf Galaxies*, Summer 2014

RESEARCH PUBLICATIONS IN REFEREED JOURNALS

Background on Journals: The Astrophysical Journal (U.S.-based) is the leading international research journal in astronomy and astrophysics. Monthly Notices (U.K.-based) is one of the world's leading research journals in astronomy and astrophysics, as well as one of the longest established. The Letters section in each of these journals allows for rapid publication of short papers that are considered during peer review to be high-impact original research.

- J. M. Cannon et al. 2014, *Discovery of a Gas-rich Companion to the Extremely Metal-poor Galaxy DDO 68*, The Astrophysical Journal (Ap.J.) Letters, 787, L1-L7
- A. J. Benson, **A. Venkatesan** & J. M. Shull 2013, *The Escape of Ionizing Radiation from Early Galaxies*, Ap.J., 770, 76–87
- P. Scott, **A. Venkatesan**, E. Roebber, P. Gondolo, E. Pierpaoli & G. Holder 2011, *Impacts of Dark Stars on Reionization and Signatures in the Cosmic Microwave Background*, Ap.J., 742, 129–142
- **A. Venkatesan** & A. J. Benson 2011, *X-rays and hard UV radiation From the First Galaxies: Ionization Bubbles and 21 cm Observations*, Monthly Notices of the Royal Astronomical Society (MNRAS), 417, 2264–2275
- J. M. Shull & **A. Venkatesan** 2008, *Constraints on First-Light Ionizing Sources from Optical Depth of the Cosmic Microwave Background*, Ap.J., 685, 1–7
- **A. Venkatesan** 2006, *A Cosmic Milestone: Constraints from Metal-poor Halo Stars on the Cosmological Reionization Epoch*, Ap.J. Letters, 641, L81–L84
- **A. Venkatesan**, B. B. Nath & J. M. Shull 2006, *The Radiative Transport of Dust in Primordial Galaxies and Second-Generation Star Formation*, Ap.J. 640, 31–40
- J. Tumlinson, **A. Venkatesan** & J. M. Shull 2004, *Nucleosynthesis, Reionization, and the Mass Function of the First Stars*, Ap.J., 612, 602–614
- **A. Venkatesan**, R. Schneider & A. Ferrara 2004, *Early Enrichment of Quasars by First Stars*, MNRAS Letters, 349, L43–L48
- **A. Venkatesan** & J. W. Truran 2003, *The Ionizing Efficiency of the First Stars*, Ap.J. Letters, 594, L1–L4
- K. Wada & **A. Venkatesan** 2003, *Feedback From the First Supernovae in Protogalaxies: The Fate of the Generated Metals*, Ap.J., 591, 38–42
- **A. Venkatesan**, J. Tumlinson, & J. M. Shull 2003, *Evolving Spectra of Pop III Stars: Consequences for Cosmological Reionization*, Ap.J., 584, 621–632
- J. Tumlinson, J. M. Shull, & **A. Venkatesan** 2003, *Cosmological Effects of the First Stars: Evolving Spectra of Population III*, Ap.J., 584, 608–620
- **A. Venkatesan** 2002, *Mutual Constraints Between Reionization Models and Parameter Extraction From Cosmic Microwave Background Data*, Ap.J., 572, 15–24
- **A. Venkatesan**, M. L. Giroux, & J. M. Shull 2001, *Heating and Ionization of the Intergalactic Medium by an Early X-Ray Background*, Ap.J., 563, 1–8
- **A. Venkatesan** 2000, *The Optical Depth to Reionization as a Probe of Cosmological and Astro-*

physical Parameters, Ap.J., 537, 55–64

- **A. Venkatesan** 2000, *The Optical Depth to Reionization as a Probe of Cosmological and Astrophysical Parameters*, Ph.D. Thesis, The University of Chicago
- **A. Venkatesan**, A. V. Olinto & J. W. Truran 1999, *Neutron Stars and Black Holes as MACHOs*, Ap.J., 516, 863–871
- **A. Venkatesan**, M. C. Miller & A. V. Olinto 1997, *Constraints on the Production of Ultra-High-Energy Cosmic Rays by Isolated Neutron Stars*, Ap.J., 484, 323–328

WHITE PAPERS FOR ASTRO2010 (THE ASTRONOMY AND ASTROPHYSICS DECADEAL SURVEY)

- J. Cooke et al. 2009 (19 authors, alphabetical), *First Light Sources at the End of the Dark Ages: Direct Observations of Population III Stars, Proto-Galaxies, and Supernovae During the Reionization Epoch*, Astro2010: The Astronomy and Astrophysics Decadal Survey, Science White Papers, no. 53, paper available at: <http://xxx.lanl.gov/abs/0902.4602>
- A. Cooray et al. 2009 (48 authors, alphabetical), *A New Era in Extragalactic Background Light Measurements: The Cosmic History of Accretion, Nucleosynthesis and Reionization*, Astro2010: The Astronomy and Astrophysics Decadal Survey, Science White Papers, no. 54, paper available at: <http://xxx.lanl.gov/abs/0902.2372>

CONFERENCE PROCEEDINGS AND PRESENTATIONS

- L. Y. Yung & **A. Venkatesan** 2014, *Constraints on First-Stars Models From Observations of Local Low-Mass Dwarf Galaxies and Galactic Metal-Poor Halo Stars*, BAAS, **246.54**
- **A. Venkatesan** 2014, *Finding the 99% Today: The Cosmological Role of Dwarf Galaxies*, BAAS, **226.04**
- **A. Venkatesan** & A. J. Benson 2012, *The Escape of Ionizing Radiation from Early Galaxies*, BAAS, **422.01**
- **A. Venkatesan** & A. J. Benson 2011, *Feedback from X-rays and Hard Ionizing Radiation from the First Galaxies*, BAAS, **231.03**
- **A. Venkatesan** & L. J. Rothschild 2009, *From Dark to Life: The Creation of the Biogenic Elements in the Early Universe*, BAAS, **305.02**
- **A. Venkatesan** 2008, *Microwave Background constraints on the efficiency of high-redshift star formation*, Meeting: Cosmology in Northern California 2008 (KIPAC, Stanford University), talk online at: <http://kipac-prod.stanford.edu/collab/seminars/special/080418/Venkatesan/view>
- **A. Venkatesan** 2006, *Constraints from Metal-Poor Halo Stars on the Cosmological Reionization Epoch*, online proceedings of The First Stars and Evolution of the Early Universe INT Program 06-2a (University of Washington, Seattle), at: http://www.int.washington.edu/talks/WorkShops/int_06_2a/

- **A. Venkatesan** 2006, *Detecting the transition from Pop III to Pop II stars*, New Astronomy Reviews, 50, 108
- **A. Venkatesan** 2004, *Observational Signatures of the First Stars*, KITP Program: Galaxy-Intergalactic Medium Interactions, Kavli Institute for Theoretical Physics, University of California, Santa Barbara
- **A. Venkatesan** 2004, *The Ionizing Efficiency and Mass Function of the First Stars*, BAAS, **34.08**
- **A. Venkatesan** 2004, *The Night Sky and Native American Worldviews*, BAAS, **96.04**
- **A. Venkatesan** 2003, *The Duration of Metal-Free Star Formation And Associated Consequences*, “First Stars II” meeting, Penn State University, talk online at: <http://www.astro.psu.edu/users/DELETE/tabel/II/program.html>
- **A. Venkatesan** 2002, *Reionization and Metal Enrichment by the First Stars*, KITP Program: The New Cosmology Confronts Observation: The Cosmic Microwave Background, Dark Matter, Dark Energy, and Brane Worlds, Kavli Institute for Theoretical Physics, University of California, Santa Barbara
- J. Tumlinson, J. M. Shull, & **A. Venkatesan** 2002, *Cosmological Reionization by the First Stars: Evolving Spectra of Population III*, ASP Conference Proceedings, v. 267, p. 433 (ASP: San Francisco)
- **A. Venkatesan** 2002, *Constraints on the Primordial Power Spectrum From the Reionization Epoch*, BAAS, **86.05**
- J. Tumlinson, **A. Venkatesan** & J. M. Shull 2001, *Cosmological Reionization by the First Stars: Evolving Spectra of Population III*, BAAS, **16.03**
- **A. Venkatesan** & J. W. Truran 2001, *Observational Signatures of the First Stars*, in proceedings of “Cosmic Evolution”, p. 335 (World Scientific), eds. E. Vangioni-Flam, R. Ferlet and M. Lemoine, Paris, November 13-17, 2000, astro-ph/0101338
- **A. Venkatesan**, J. M. Shull & M. L. Giroux 2001, *The Impact of an Early X-ray Background on the Intergalactic Medium*, BAAS, **58.03**
- **A. Venkatesan** 1999, *Reionization as a Probe of Cosmology and Early Astrophysics*, BAAS, **55.06**
- **A. Venkatesan**, E. Gates & A. V. Olinto 1998, *MACHOs: Hidden Hunks in the Halo?*, 19th Texas Symposium on Relativistic Astrophysics and Cosmology, Paris, France, Eds.: J. Paul, T. Montmerle, and E. Aubourg (CEA Saclay)
- **A. Venkatesan**, talks at the annual *Great Lakes Cosmology Workshops*, 1996-1999
- **A. Venkatesan**, M. C. Miller & A. V. Olinto 1997, *High Energy Cosmic Rays From Neutron Stars*, BAPS, **B7.07**

OTHER PUBLICATIONS

- **A. Venkatesan**, solicited piece in the popular science magazine *Pour La Science* (the French arm of Scientific American) on the first stars in the universe, Summer 2014
- **A. Venkatesan**, Review/essay on “The Jesuit Guide to (Almost) Everything: A Spiritual Guide to Real Life” by James Martin, S. J., *Conversations on Jesuit Higher Education* magazine, Fall 2011
- **A. Venkatesan** & C. M. Urry 2002, *The Status of Women in Physics - What, Why and How to Change*, STATUS (a publication of the AAS Committee on the Status of Women in Astronomy), June 2002 issue. Also to be printed in the Fall issue of the CSWP Gazette, and the APS Forum on Physics and Society newsletter.
- S. Tobias, C. M. Urry & **A. Venkatesan** 2002, *Physics: For Women, the Last Frontier*, Science, 296, 1201. Also reprinted in the Journal of Science Education and Technology.
- C. M. Urry et al. 2002, *Women in Physics in the United States*, proceedings of the IUPAP 2002 International Conference on Women in Physics.

SELECTED PRESENTATIONS SINCE 2000

Talks Related to Research: All invited talks below are marked with **(I)**.

- Talk at the 2014 Santa Fe Cosmology Summer Workshop, Santa Fe, NM, July 2014
- Seminar, University of Maryland, College Park, MD, Jan. 2014
- Talk at the annual Undergraduate ALFALFA Team Workshop, Arecibo Observatory, Puerto Rico, Jan. 2014 **(I)**
- Talk at the American Astronomical Society Meeting, Washington, D.C., Jan. 2014
- Seminar, Raman Research Institute, Bangalore, India, March 2013 **(I)**
- Colloquium, Institute of Astronomy, Honolulu, HI, Nov. 2012 **(I)**
- Galaxy Lunch Seminar, Cornell University, Ithaca, NY, Oct. 2012
- Talk at the American Astronomical Society Meeting, Anchorage, AL, June 2012
- Seminar, Arizona State University, Tempe, AZ, October 2011 **(I)**
- Talk at the 2011 Santa Fe Cosmology Summer Workshop, Santa Fe, NM, July 2011
- Seminar, The University of Chicago, Chicago, IL, April 2011 **(I)**
- Talk at the American Astronomical Society Meeting, Seattle, WA, January 2011
- Talk for the Peninsula Astronomical Society, Mountain View, CA, Sept. 2010 **(I)**
- Talk at the meeting “From First Light to Newborn Stars”, Tucson, AZ, March 2010
- Colloquium, University of San Francisco, San Francisco, CA, February 2010
- Talk for the San Francisco Amateur Astronomers, San Francisco, CA, February 2010 **(I)**
- Talk at the American Astronomical Society Meeting, Pasadena, CA, June 2009 **(this received media attention; see below)**

- Talk at the Cosmology in Northern California meeting, KIPAC/Stanford University, April 2008
- Colloquium in *What Physicists Do* series, Sonoma State University, Sonoma, CA, 2007 (I)
- Colloquium, Inter-University Center for Astronomy and Astrophysics, Pune, India, 2007 (I)
- Colloquium, University of California, Berkeley, CA, 2006 (I)
- Colloquium, San Jose State University, San Jose, CA, 2006 (I)
- Talk at First Stars Conference, University of Washington, Seattle, WA, 2006 (I)
- Colloquium, University of Michigan, Ann Arbor, MI, 2005 (I)
- Talk at workshop on *Probing Early Structure Formation with Mass, Light and Chemistry*, University of Minnesota, Minneapolis, MN, 2005 (I)
- Colloquium, Indian Institute of Science, Bangalore, India, 2005 (I)
- Seminar, Raman Research Institute, Bangalore, India, 2005 (I)
- Seminar, University of California, San Diego, CA, 2005 (I)
- Plenary Talk, *First Light Detection* workshop, University of California, Irvine, CA, 2005 (I)
- Seminar, University of Chicago, Chicago, IL, 2005 (I)
- Colloquium, University of Colorado, Boulder, CO, 2004 (I)
- Review talk, Workshop on “Chemical Enrichment of the Early Universe”, Santa Fe, NM, 2004 (I)
- Talk at the American Astronomical Society Meeting, Denver, CO, 2004 (**this received media attention; see below**)
- Colloquium, Space Telescope Science Institute, Baltimore, MD, 2004 (I)
- Lecture in “Key Concepts of Science” series, Portland State University and Science Integration Institute, Portland, OR, 2003 (I)
- Talk at “First Stars II” meeting, Penn State University, College Station, PA, 2003
- Seminar, Caltech, Pasadena, CA, 2003
- Colloquium, Arcetri Astrophysical Observatory, Florence, Italy, 2002 (I)
- Talk at the American Astronomical Society Meeting, Albuquerque, NM, 2002
- Colloquium (ORNL Physics Division), Oak Ridge National Lab, Oak Ridge, TN, 2002 (I)
- Colloquium, The University of Chicago, Chicago, IL, 2002 (I)
- Talk at the American Astronomical Society Meeting, Pasadena, CA, 2001
- Talk at the symposium “Cosmic Evolution”, Institut d’Astrophysique de Paris, Paris, France, 2000

Talks on broader science topics, and topics related to the representation of women and minorities in science: All invited talks below are marked with (I).

- Talk on the 2013 Nobel Prize in Physics as part of *Nobel Prizes Explained* event, University of San Francisco, October 2014
- Benjamin Dean Lecture, California Academy of Sciences, San Francisco, CA, May 2012 (I)
- Talk for the Peninsula Astronomical Society, Los Altos, CA, Sept. 2010 (I)
- Talk for the San Francisco Amateur Astronomers, Feb. 2010 (I)
- Benjamin Dean Lecture, California Academy of Sciences, San Francisco, CA, 2006 (I)

- Talk on “The Night Sky and Native American Worldviews” at the American Astronomical Society Meeting, Denver, CO, 2004
- Talk on “Women in Astronomy: Successes and Challenges”, sponsored by the LEAP program, University of Colorado, Boulder, CO, 2003 (I)
- Panelist at CSWA report and discussion of the IUPAP 2002 International Conference on Women in Physics, American Astronomical Society Meeting, Albuquerque, NM, 2002 (I)
- Colloquium (ORNL Committee for Women, Association for Women in Science, and Women in Science), Oak Ridge National Lab, Oak Ridge, TN, 2002 (I)
- Speaker on the First Stars as part of the “Origins” theme at the Second Annual Science Integration Conference, Portland, OR, 2001 (I)

MEDIA APPEARANCES

SCIENCE-RELATED:

- **Fall 2014:** Featured in the upcoming book *Lighting the City, Changing the World: A History of the Sciences at the University of San Francisco*, written by Alan Ziajka (associate vice provost for academic affairs and university historian at USF).
- **June 2009, Research profiled by Space.com, picked up by Yahoo News and other news sites:** Interviewed by writer Andrea Thompson at Space.com on early results from an astrobiology collaboration with Dr. Lynn Rothschild (NASA-Ames). The feature article, titled “*Could Life Be 12 Billion Years Old?*”, is online at:
<http://www.space.com/scienceastronomy/090617-aas-bio-elements.html>
- **2006, Featured in “Chasing Hubble’s Shadows”:** This book by science writer Jeff Kanipe includes multiple quotes from me on the masses and formation epochs of the first stars in the universe.
- **May/June 2004, Research profiled in US and international news:** My research on the first stars’ mass function with Jason Tumlinson and Mike Shull was featured in more than two dozen US and international news publications, wires and online publications (e.g., Sky and Telescope, The Washington Times, Sciencedaily.com, Spaceref.com, et alia.). This also appeared in several regional and national newspapers in India, and was otherwise reprinted in multiple languages.

GENERAL:

- **NPR/Tech Nation Interview, Fall 2013:** Interviewed by Dr. Moira Gunn on Tech Nation (NPR) on the 2013 Nobel Prize in Physics awarded for the discovery of the Higgs Boson. Aired in Fall 2013 and Spring 2014
- **Winter 2011:** Advertisement for USF that aired on television sports channels during USF Basketball Games. Translated into 10 languages. Video on Youtube at:
<http://www.youtube.com/watch?v=Kg3cwzlZxK4>
- **July 1, 2002:** Featured in article *An Indian Star in Astrophysics* in Madras Musings, a Chennai-

based fortnightly magazine (Chennai, India).

- **March 8, 2002:** Featured in the *Talk of the Town* column in the national newspaper The Hindu (Chennai, India).
- **March 8, 2002:** Featured in *Women in Physics* on International Women's Day in the daily newspaper The Midday (Mumbai, India).

TEACHING AND OUTREACH EXPERIENCE

(A) USF EXPERIENCE:

Assistant Professor of Physics and Astronomy, Fall 2006–Spring 2012

Associate Professor of Physics and Astronomy, Fall 2012–present

- Contributed to a strong expansion of the undergraduate astronomy program at USF by co-creating (with Prof. Horacio Camblong) two new minors in astronomy and astrophysics at USF. Taught multiple courses and labs covering topics in astronomy and astrophysics, as well as general physics and modern physics
- Created and introduced several new courses on astronomy and astrophysics (detailed below), 2007–present
- Participated in the USF iPad study (Summer through Fall 2010) on the teaching and research effectiveness of the iPad in higher education. Used the iPad in lectures as an interactive teaching/learning tool and student discussion activities, and explored its use in research-related remote telescope observing. Also used it in the training night(s) of USF's astronomy courses' observation TAs through interactive sky maps and night sky atlases. Contributed to a USF-based iPad wiki and gave a presentation on my findings on its use for astronomy teaching and research
- Regular talks and speaking engagements for professional and public audiences, amateur astronomy societies/clubs and science museums in San Francisco and the Bay Area, 2006–present
- Presentations on astronomy topics several times a year in the pre-K and elementary school system in San Francisco, 2006–present

Courses taught at USF: Led lectures and/or laboratory sections for the physics and astronomy courses listed below. Designed course material and syllabi, including course research projects, traditional blackboard and PowerPoint lecture presentations, as well as more modern aids to effective teaching, e.g., in-class clicker questions, interactive lecture tutorials, simulations, video clips and data-based movies, iPad presentations, and student-centered discussions and activities. When teaching Physics 120 or 121, I also managed a team of several lab TAs and a team of \sim a dozen observation TAs. **Courses/labs I developed and introduced to USF's curriculum are listed in bold.**

Physics 110 lecture course (General Physics I – Mechanics): Fall 2006, Fall 2011

Physics 110 labs (2): Fall 2006

Physics 120 lecture course (Astronomy: Earth to the Cosmos): Spring 2007, Spring 2008, Spring 2009, Fall 2009, Fall 2013

Physics 120 lab (1): Spring 2011

Physics 121 lecture course (Planetary Astronomy): Spring 2008, Fall 2008, Spring 2010, Fall 2010, Spring 2014, Fall 2014

Physics 121 labs (2): Spring 2011

Physics 195 lecture and labs (First-Year Seminar: The Extreme Universe): Fall 2011

Physics 221 (Ancient Astronomy): Spring 2015, the first science class at USF with a Cultural Diversity designation

Physics 240 (Modern Physics): Fall 2008

Physics 343 (Astrophysics: Stellar Structure and Evolution): Spring 2007, Spring 2009, Spring 2011

Physics 350 (Physics Colloquium): Spring 2010, Fall 2010

Physics 398/399 (Directed Studies): Summer 2011, Spring 2012

Curriculum development at USF:

Physics 121 (Planetary Astronomy): This is an introductory astronomy course for non-science majors covering the modern scientific knowledge of the origin and properties of planets, moons, comets, asteroids, and planetary systems. Exciting frontier topics in this field are also covered such as the search for extrasolar planets, ongoing missions to discover Earth-like or habitable worlds, the definition of what constitutes a planet, climate change and global warming, and astrobiology. This course satisfies Core requirements and is a critical component of the course sequence for the new astronomy minor at USF.

Physics 121 labs: Co-developed (with Prof. Terry Mulera) a number of new laboratories on planetary astronomy topics, involving modern computational analyses and hands-on experiments (such as building shield volcanoes and comets). Also modified and expanded previous laboratories.

Physics 343 (Astrophysics: Stellar Structure and Evolution): This is an upper-division astrophysics course for physics majors covering the formation and evolution of stars, their deaths as white dwarfs, neutron stars and black holes, and, a brief review of modern cosmology. Through assignments and a term research project, students are exposed to current astronomical observations and scientific literature on these topics as well as public astrophysical codes.

This course is part of the course sequence for the new astrophysics minor at USF.

Physics 195 (First-Year Seminar: The Extreme Universe), Fall 2011: This course will cover the many fascinating discoveries in modern astronomy of extreme phenomena and environments in our universe, such as black holes, hot Jupiters around other stars, asteroid impacts on Earth, the nature of time and space, dark matter, dark energy, the possibility of life on other worlds, and even of other universes.

This course is part of the First-Year Seminar course offerings at USF, which aim to introduce freshmen to USF and San Francisco through interactive small-classroom settings, broad-appeal course topics, and mentoring/assistance with university life.

Physics 221 (Ancient Astronomy), Spring 2015: This course focuses on the historical development of astronomy, including the astronomy and cosmology of ancient cultures and peoples, the role and contributions of Jesuit astronomers and the Jesuit scientific tradition, and, the development of modern cosmology through the scientific revolution.

This course will be the first science class at USF that satisfies the Core's Cultural Diversity designation and will be part of the course sequence for the USF astronomy minor.

(B) PRE-USF TEACHING/OUTREACH EXPERIENCE:

- **Lecturer**, University of Colorado, Boulder, Jan.–July 2006, taught introductory astronomy course on stars and galaxies with 200 students
- **Instructor**, University of Colorado Upward Bound Programs, Boulder, CO, Summers 2002, 2003 and 2005, Astronomy Course, taught and mentored Native American high school students as part of a college preparation program
- **Associate Member**, Science Integration Institute (SII), a nonprofit organization based in Portland, OR, dedicated to helping people use the scientific process and its insights to be an integral part of their daily lives
- **Volunteer judge and moderator** for the 2003 Native American Science Bowl, Colorado Springs, CO
- **Volunteer**, Sommers-Bausch Observatory public open house, CU-Boulder, 2000–2002
- **Instructor**, The Adler Planetarium, Chicago, IL, July 1999, Adult Course Program: Dark Matter and Cosmology
- **Consultant and Tutor**, University of Chicago, 1998-1999, for internet-based astronomy outreach work with high school students in Idaho
- **Teaching Assistant**, The University of Chicago, Fall Quarters of 1995, 1996 and 1997, Natural Sciences 101: The Origin and Evolution of the Universe
- **Volunteer Assistant**, Center for Astrophysical Research in Antarctica (CARA) at The University of Chicago, 1996–1997, for outreach courses designed for local high school students
- **Teaching Assistant**, Cornell University, 1992, for introductory undergraduate courses on planetary science - led recitation sections and graded assignments