Tejaswi Venumadhav Nerella — Curriculum Vitae

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Education

California Institute of technology 2010-2015
Ph.D. in Physics,
Advisor: Christopher Hirata

Indian Institute of Technology, Kanpur 2005-2010
M.Sc (Integrated) in Physics

Research Interests

My research area is astrophysics, with a primary focus on cosmology. I have research interests in a number of areas, including but not limited to the pre-atomic era of the very early universe, recombination, reionization, and binary systems.

I am interested in doing cosmology with the 21-cm signal from neutral hydrogen during the reionization epoch. My current work in this area focuses on developing new methods to study observables such as primordial magnetic fields and gravitational waves using high-resolution maps of the 21-cm line. I also enjoy thinking about radio interferometry, and have previously worked on its application to studying the global 21-cm signal. In a broader sense, I also think about aspects of cosmic structure formation in the dark-ages, and its implications for observables in the later universe.

I am also interested in the use of the Cosmic Microwave Background (CMB), and Large Scale Structure (LSS) as probes of curvature fluctuations in the primordial universe. I am currently developing a computer-algebra system to perform non-linear evolution of stochastically seeded fields from first-principles. I plan to use it to evaluate all lowest-order corrections to the two-, three- and four-point correlation functions of the CMB and LSS purely due to non-linear evolution.

My other research interests include weak interactions of neutrinos in the early universe, and the secular evolution of binary systems. Previously, I have worked on tidal deformation of neutron stars, and its consequence for their internal oscillatory modes. Apart from these topics, at various periods, I have worked on orbital resonances in eccentric binaries, optics design for CMB experiments and, very briefly dabbled in X-ray fluorescence from kilonovae.

Academic Honors

Schmidt Fellowship 2015
Institute for Advanced Study

Robert A. Millikan Fellowship 2010
California Institute of Technology

International Fulbright Science and Technology Award 2010
Bureau of Education and Cultural Affairs, U.S. Department of State

President's Gold Medal for the best academic performance in the graduating class in all disciplines, IIT Kanpur 2010

General Proficiency Medal for the best academic performance in the graduating class in Physics, IIT Kanpur — 2010

Summer Undergraduate Research Fellowship
California Institute of Technology — 2007, 2008

Academic Excellence Award
IIT Kanpur — 2007, 2008, 2009, 2010

Silver Medal, 36th International Physics Olympiad — 2005

KVPY Fellowship
Department of Science and Technology, Govt. of India — 2004

NTSE Fellowship
National Council of Educational Research and Training, Govt. of India — 2003

Work Experience

Member — Sep 2015-Present
Institute for Advanced Study, Princeton

Graduate Student — Sep 2010-Aug 2015
California Institute of Technology, Pasadena
Advisor: Christopher M. Hirata

Visiting Scientist — May-August 2009
Max-Planck-Institut für Physik komplexer Systeme, Dresden
Advisor: Roderich Moessner

Summer Undergraduate Research Fellow — May-August 2008
California Institute of Technology, Pasadena
Advisor: Re'em Sari

Summer Undergraduate Research Fellow — May-August 2007
California Institute of Technology, Pasadena
Advisor: Andrew Lange

Refereed publications

- **Venumadhav, T.**, Chang, T.-C., Doré, O., & Hirata, C. M. (2015), Astrophysical Journal, 826, 116
  Title: A practical theorem on using interferometry to measure the global 21 cm signal
- **Venumadhav, T.**, & Hirata, C. M. (2015), Physical Review D, 91, 123009
  Title: Stability of small-scale baryon perturbations during cosmological recombination
- **Venumadhav, T.**, Zimmerman, A., & Hirata, C. M. (2014), Astrophysical Journal, 781, 23
  Title: The stability of tidally deformed neutron stars to three- and four-mode coupling
- **Venumadhav, T.**, Haque, M., & Moessner, R. (2010), Physical Review B, 81, 054305
  Title: Finite-rate quenches of site bias in the Bose-Hubbard dimer

Preprints

- Dai, L., **Venumadhav, T.**, Sigurdson, K. (2016), arXiv:1605.09398
  Title: The effect of lensing magnification on the apparent distribution of black hole mergers
- Gluscevic, V., **Venumadhav, T.**, Fang, X., Hirata, C. M., Oklopčić, A., Mishra, A. (2016), arXiv:1604:06327
  Title: A new probe of magnetic fields in the pre-reionization epoch: II. Detectability
- **Venumadhav, T.**, Cyr-Racine, F.-Y., Abazajian, K. N., & Hirata, C. M. (2015), arXiv:1507.06655
  Title: Sterile neutrino dark matter: A tale of weak interactions in the strong coupling epoch
  Accepted; to appear in Physical Review D
- **Venumadhav, T.**, Oklopčić, A., Gluscevic, V., Mishra, A., & Hirata, C. M. (2014), arXiv:1410.2250
  Title: A new probe of magnetic fields in the pre-reionization epoch: I. Formalism
  Submitted to Physical Review D

Manuscripts in Preparation

- Hirata, C. M., **Venumadhav, T.**, Gluscevic, V., Mishra, A., & Oklopčić, A. (2014)
  Title: Primordial gravitational waves and circular polarization in the redshifted 21 cm line

Work in Progress

- Computing all the lowest-order corrections to the CMB power spectrum due to non-linear evolution
  Collaborators: de Putter, R., Doré, O., Hirata, C. M. (planned 2015)

Other work

- Probing Primordial Magnetic Fields with 21-cm Line Observations of the High-redshift Intergalactic Medium
  Oklopčić, A., Gluscevic, V., Hirata, C.M., Mishra, A., **Venumadhav, T.** (2014)
  AAS presentation by Oklopčić, A.
- Spin-orbit resonances for satellites on highly eccentric orbits, SURF (2008)
  Mentors: Re'em Sari and Daniel Babich
  Report at `http://www.its.caltech.edu/~tnerella/draft_v7.pdf`
- Wave plate modeling, SURF (2007)
  Mentor: Andrew Lange
  Report at `http://www.its.caltech.edu/~tnerella/waveplate_07.pdf`

Talks and poster presentations

- Talk, CMB Spectral Distortions From Cosmic Baryon Evolution, RRI, Bengaluru. 2016
- Seminar, International Centre for Theoretical Sciences, TIFR. 2016
- Cosmology seminar, Perimeter institute. 2016
- Cosmology lunch, joint w/ IAS and Princeton University. 2016
- Astrophysics informal seminar, IAS. 2016
- Seminar, Inter University Center for Astronomy and Astrophysics, Pune. 2015
- Seminar, National Center for Radio Astronomy, Pune. 2015

- Talk, The Primordial Universe after Planck, IAP, Paris. 2014
- Seminar, McGill University, Montreal. 2014
- Seminar, CITA, Toronto. 2014
- ITC Seminar, Harvard University, Boston. 2014
- Cosmology lunch, joint w/ IAS and Princeton University. 2014
- Talk, Theoretical Astrophysics in Southern California (TASC), UCSD, San Diego. 2014
- Special seminar, KICP, University of Chicago. 2014
- Cosmology Lunch talk, CCAPP, Ohio State University, Columbus. 2014
- Poster, Gravitational Wave Physics and Astronomy Workshop (GWPAW) at IUCAA, Pune. 2013
- Seminar, Inter University Center for Astronomy and Astrophysics, Pune. 2013
- Talk, Theoretical Astrophysics in Southern California (TASC), Carnegie Observatories, Pasadena. 2012
- Poster, Summer school on cosmology, ICTP, Trieste. 2012

Teaching Experience and outreach

- Volunteer for event on occasion of partial solar eclipse Oct 2014
  Location: McKinley School, Pasadena
- Volunteer for public viewing of Supernova SN2014J Jan 2014
  Location: California Institute of Technology, Pasadena
- Teaching assistant for Ph 12a: Waves, taught by Jeff Kimble Fall 2012
- Volunteer for public event on the occasion of Venus transit May 2012
  Location: California Institute of Technology, Pasadena

References

Christopher M. Hirata
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Columbus, OH 43210, USA
email: hirata.10@osu.edu

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California Institute of Technology
MC 350-17
1200 E California Blvd
Pasadena, CA 91125, USA
email: cott@tapir.caltech.edu

Olivier Doré
Jet Propulsion Laboratory
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4800 Oak Grove Drive
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email: olivier.p.dore@jpl.nasa.gov