

# CURRICULUM VITAE

SARBANI BASU

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## Educational History:

- 1983 – 1986 University of Madras, India  
Bachelor of Science with Physics Major and Mathematics and Chemistry  
as supporting subjects.
- 1986 – 1988 University of Poona, India, Master of Science (Physics)
- 1988 – 1993 Tata Institute of Fundamental Research, Mumbai, India  
Doctor of Philosophy (Physics) from the University of Bombay (1993).

## Positions held:

- 2005 – Professor, Astronomy Department, Yale University
- 2005 – 2007 Director of Graduate Studies, Astronomy Department, Yale University
- 2004 – 2005 Associate Professor, Astronomy Department, Yale University
- 2002 – 2004 Director of Graduate Studies, Astronomy Department, Yale University
- 2001 – 2002 Director of Graduate Admissions, Astronomy Department, Yale University
- 2000 – 2004 Assistant Professor, Astronomy Department, Yale University
- 1997 – 1999 Post doctoral fellow, Institute for Advanced Study, Princeton, NJ 08540, U.S.A.
- 1994 – 1997 Post doctoral fellow, Theoretical Astrophysics Center, Institute for Physics and Astronomy,  
University of Aarhus, Denmark
- 1993 – 1994 Post doctoral fellow, Queen Mary & Westfield College, University of London, U.K.

## Honors and awards:

- (1) NSF CAREER grant, 2004.
- (2) Hellman Family Faculty Fellowship, 2002, Yale University
- (3) The M.K. Vainu Bappu Gold Medal for the year 1996 awarded by the Astronomical Society of India

## Publications:

125 refereed publications, 100 conference proceedings as of September 2011

## Broad Fields of Research:

- (1) **Helioseismology:** Helioseismic study of the structure and dynamics of the Sun; using the Sun as a laboratory to test the physics therein; refine techniques of helioseismic inversion; study of solar-cycle related changes in the Sun;
- (2) **Solar and Stellar structure:** modeling solar structure; study of solar variability; physical properties of stellar interiors.
- (3) **Asteroseismology:** Studying the properties of pulsating stars; developing techniques of using asteroseismic data to infer properties of stars.

## **Membership of professional organizations**

- (1) International Astronomical Union
- (2) American Astronomical Society
- (3) Astronomical Society of India
- (4) American Association for the Advancement of Science

## **External Funding**

- (1) 2000-2004: PI NASA grant NAG5-10912 (\$ 157,358), “Probing Cycle-Related Changes in the Outer Layers of the Ring-Diagram Analysis.”
- (2) 2002-2005: PI NSF Grant, ATM 026130 (\$ 347,314), “Solar Variability: Modeling and Helioseismic Studies.”
- (3) 2006-2012: Co-I, NASA project “Helioseismic and Magnetic Imager for Solar Dynamics Observatory,” (\$ 357,490 for Co-I).
- (4) 2004-2009: P.I., NSF Career grant (\$597,442), “CAREER: Solar Variability in the Classroom and in Research.”
- (5) 2006-2009: P.I., NASA grant NNG06GD13G (\$ 193,931) “Probing the structure and dynamics of the outer layers of the Sun”,
- (6) 2008-2011: P.I., NSF grant ATM 0737770 (\$ 399,383) “Helioseismology and Solar Magnetic Fields: Studying the forward problem”
- (7) 2009-2012: P.I., NASA ATFP grant NNX09AJ53G (\$ 369,534) “Modeling convection in stars: from 3D simulations to 1D approximations”
- (8) 2010-2013: P.I., NASA grant NNX10AE60G (\$ 373,404) “The structure and dynamics of the solar interior during the minimum of cycle 24”
- (9) 2011-2014: P.I. NASA Education and Public Outreach grant NNX11AH34G “ Solar Cycle Investigations: NASA Science Exploration for Middle School Students and Teachers” (\$ 310,820)
- (10) 2011-2014: P.I. NSF grant AST-1105930 “Journey to the Centre of Stars: Testing Stellar Evolution with Asteroseismology” (\$ 345,486)

## **Teaching Experience**

- (1) Supervisor in mathematics for undergraduate students, Queen Mary and Westfield College, London, U. K. This involved conducting problem-solving classes for small groups of Engineering students for one year, two hours a week.
- (2) Supervisor for courses “Stellar Structure and Evolution” and “Stellar Oscillations” for graduate students, Aarhus University, Denmark. Conducting problem solving classes, two hours per week. I was the supervisor for two semesters.
- (3) Occasional lecturer in “Stellar Structure and Evolution”, for graduate students, Aarhus University, Denmark. I was in essence a substitute lecturer and gave five, one-and-a-half hour lectures.
- (4) Teach graduate level courses “Stellar Astrophysics”, “Radiative Processes in Astrophysics” and “Solar Physics” at Yale University.
- (5) Teach undergraduate course “ Stars and Their Evolution” at Yale University.

## **Supervision**

*Post-doctoral:* Matthew Templeton (2000 - 2002, currently at the American Organization of Variable Star Observers), LingHuai Li (2002 - 2004), Anwesh Mazumdar (2005 - 2007, currently at the Homi Bhabha Centre for Science Education, Mumbai India), Chia-Hsien Lin (2006 - 2007, currently at the Institute of Space Science, National Central University, Taiwan), Sebastien Deheuvels (2010 - present)

*Research Scientists:* LingHuai Li (2004 - present)

*Graduate Students:* Charles Baldner (2006 - 2010), Lisa Esch (2008 - present), Joel Tanner (2008 - present), Ning Gai (visiting student from Beijing Normal University; 2009 - 2010)

*Research projects, graduate students:* Hugh Crawl(2002), Brooke Simmons (2002), Jeffrey Van Duyne (2002), R. Katherine Vieira (2003), Andrew Cantrell (2004), Lisa Ferrara (2007), Joel Tanner (2007), Ana Bonaca (2011), John M. Brewer (2011)

*Senior Theses:* Daniel Isquith (2002), Braxton Collier (2004-2005), Ronli Diakow (2005-2006), Jeffrey Z. Thompson (2005-2006)

*Undergrad. summer project:* Catherine Finlay Izard (2003), Anna Mandel (2004), Braxton Collier (2005)

*Freshman advising:* Freshman advisor, academic years 2001-2003, 2005-2007, 2009-2011 for freshmen of Timothy Dwight College, Yale University (three/four advisees each year).

## **Committee memberships**

- (1) Chair, Tinsley Award Nominating committee of the American Astronomical Society (2010 – present)
- (2) Member, Steering Committee, *Kepler* Asteroseismic Science Consortium (2010 – present)
- (3) Member Scientific Advisory Committee, Global Oscillation Network Group (GONG) (2003 – present)
- (4) Member Data Users Committee, Global Oscillation Network Group (GONG) (1999 – present)
- (5) Member, Tinsley Award Nominating committee of the American Astronomical Society (2008 – 2010)
- (6) Member, National Solar Observatory Users' Committee (2005 – 2011)
- (7) Reviewer, National Research Council's Decadal Survey for Astronomy, 2010
- (8) Member, Steering Committee of the Solar Physics Division Summer School (2005 – 2008)
- (9) Reviewer, National Research Council's report "Committee on Strategic Guidance for NSF's Support of the Atmospheric Sciences" (2007)
- (10) Member, Scientific Organizing Committee, GONG2006/SOHO 18/Helas 1 meeting "Beyond the Spherical Sun," Sheffield, U.K., August 2006
- (11) Member, Scientific Organizing Committee, SOHO 17 meeting "10 Years of SOHO and Beyond", Sicily, May 2006.
- (12) Chair, Nominating Committee of the Solar Physics Division of the American Astronomical Society (2004)
- (13) Chair, Scientific and Local Organizing Committees, GONG 2004 -SOHO 14 meeting, New Haven, CT, USA, July 2004

- (14) Member, Scientific Organizing Committee, SOHO 12/GONG 02 Workshop, Big Bear, October 2002
- (15) Member, Scientific Organizing Committee, SOHO 6/GONG 98 Workshop, Boston, June 1998.
- (16) Member, MOWG, NASA LWS programme ( 2006 – 2008)
- (17) Member Scientific Organizing Committee, 2010 Sagan Summer Workshop

### Peer-review activities

- (1) Referee for *Astrophysical Journal*, *Astronomy & Astrophysics*, *Monthly Notices of the Royal Astronomical Society*, *Reviews of Modern Physics*, *Solar Physics*, *Nature*, *Physical Review Letters*, *Europhysics Letters*
- (2) NASA review panels 2000, 2003, 2008, 2011
- (3) Mail-in reviewer for NASA proposals 2001, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010
- (4) Mail-in reviewer for NSF proposals 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010
- (5) Mail-in reviewer for United Kingdom Particle Physics and Astrophysics Research council's proposals 2004
- (6) Reviewer for the Austrian Science Fund (FWF), 2005, 2007
- (7) Reviewer for Canadian Space Agency, 2007

### Miscellaneous

- (1) 2000: Supervised a high-school student's project submitted for the Intel (formerly Westinghouse) award.
- (2) Lecturer, Program for Talented Youth, Yale Univ., November 11, 2000. Organized by the Johns Hopkins University Center for Talented Youth
- (3) Lectured on Helioseismology at the Theoretical Advanced Study Institute 1998, Boulder, Colorado, June 1998.
- (4) Lead seminar series on Solar Variability under the auspices of the Yale-New Haven Teachers' Institute, Summer 2005.
- (5) Lecturer, Program for Talented Youth, Yale Univ., October 28, 2006. Organized by the Johns Hopkins University Center for Talented Youth
- (6) Lead seminar series on the astronomy, mathematics and physics of the solar system under the auspices of the Yale-New Haven Teachers' Institute, Summer 2007
- (7) Lecturer at the Kodai School on Solar Physics, December 2006
- (8) Lecturer, XXII at the XII Canary Island Winter School of Astrophysics 'Astroseismology', November, 2010

### Colloquia and Seminars

- (1) **Spatial and Temporal Evolution of Gas and Heavy Elements in the Galaxy**  
Indian Institute of Science, Bangalore, India, January, 1993
- (2) **Multiplicity Corrected Initial Mass Function of the Solar Neighbourhood**  
Indian Institute for Astrophysics, Bangalore, India, January, 1993
- (3) **Spatial and temporal evolution of gas and heavy elements in the Galaxy**  
Queen Mary and Westfield College, London, U.K., September 1993

- (4) **The Seismic Sun**  
Institute for Advanced Study, Princeton, NJ, January 1997
- (5) **The Seismic Sun**  
Rutgers University, New Brunswick NJ, November 1997
- (6) **The Seismic Sun**  
Yale University, New Haven CT, January 1999
- (7) **Testing Stellar Equations of State Using Helioseismology**  
Tata Institute of Fundamental Research, Mumbai India, January 1999
- (8) **Peering into the Sun**  
Carnegie Institute of Washington, Washington DC, October 1999
- (9) **Peering into the Sun**  
Massachusetts Institute of Technology, Boston MA, November 1999
- (10) **Peering into the Sun**  
Ohio State University, Columbus OH, March 2000
- (11) **Probing the heart of the Sun**  
Wesleyan University, Middletown CT, November 2000
- (12) **Temporal variations of solar structure and dynamics**  
Tata Institute of Fundamental Research, Mumbai India, March 2001
- (13) **Helioseismology and the Solar Neutrino Problem**  
Yale Center for Astronomy and Astrophysics, February 2002
- (14) **Solar Cycle Related Changes in the Sun**  
University of Arizona, April 2002
- (15) **What has Helioseismology Revealed about the Solar Cycle?**  
Tata Institute of Fundamental Research, Mumbai India, December 2002
- (16) **Peering into the Sun**  
University of Southern California, Los Angeles, February 2003
- (17) **Helioseismology and Solar Variability**  
Carnegie Institute of Washington, Washington DC, May 2003
- (18) **What have we learned about the solar cycle using helioseismology?**  
Rutgers University, New Brunswick NJ, October 2003
- (19) **Solar Variability and How it Affects Us**  
Yale New Haven Teachers' Institute, New Haven, CT, April 2004
- (20) **Astronomy and Astrophysics Today**  
Timothy Dwight College, Yale University, New Haven CT, February 2005
- (21) **Some recent results in helio- and asteroseismology**  
University of Rochester, Rochester, N.Y., April 2005
- (22) **Some recent results in helio- and asteroseismology**  
University of Massachusetts, Amherst, M.A., May 2005
- (23) **Seismology of the Sun and Stars**  
Dartmouth College, Hanover N.H., March 2006
- (24) **Trouble in Paradise: A tale of solar abundances**  
Yale University, New Haven, CT, September 2006
- (25) **Journey to the Centre of the Sun**  
Columbia University, New York, NY, October 2006

- (26) **Trouble in paradise: A tale of solar abundances**  
California Institute of Technology, Pasadena, CA, November 2006
- (27) **A journey to the centre of the Sun**  
Astronomical Society of New Haven, June, 2007
- (28) **So what's the matter with solar abundances**  
Institute for Advanced Study, Princeton, N.J., March 2008
- (29) **Peering into the heart of the Sun**  
Westport Astronomical Society, Westport, CT, April 2008
- (30) **Peering into the heart of the Sun: What have we learned during solar cycle 23**  
Beijing Normal University, Beijing, China, October 2008
- (31) **The problem with solar abundances: Do we have the solution yet?**  
National Astronomical Observatories Headquarters, Beijing, China, October 2008
- (32) **What have we learned during solar cycle 23**  
Yunnan Observatory, Kunming, China, October 2008
- (33) **Journeying to the centre of the Sun**  
University of Montreal, Montreal, Canada, November 2008
- (34) **The Seismic Study of the Sun and Other Stars**  
Max Planck Institute for Solar System Physics, Germany, May 2009
- (34) **Interpreting Helio- and Asteroseismic Data**  
University of Birmingham, Birmingham, U.K., June 2009
- (35) **A Journey to the Centre of the Sun**  
Yale Society of Physics Students, New Haven, CT, USA, February 2010
- (36) **Studying the Sun**  
Peabody Fellows Summer Solar Science Program, New haven, CT, August 2011

**Invited Talks in Conferences:**

- (1) **Determining Solar Structure from Oscillation Frequencies**  
Joint Discussion Group 3, XXII IAU General Assembly Meeting, The Hague, Netherlands, August 1994.
- (2) **The Seismic Sun**  
IAU Symposium 181: Sounding Solar and Stellar Interiors, Nice, France, October 1996.
- (3) **Helioseismic Inversions: massive data sets and the determination of Solar Structure**  
“Massive Data Sets” session, Joint Mathematics Meetings of the American Mathematical Society, San Diego, USA, January 1997
- (4) **Inverse Problems in Helioseismology**  
“Astrophysics & Algorithms: A DIMACS Workshop on Massive Astronomical Data Sets”, Princeton, May 1998
- (5) **The Seismic Sun** (award lecture)  
19th meeting of the Astronomical Society of India, Bangalore, February 1999
- (6) **Solar Differential Rotation**  
“Astrophysical Turbulence,” Santa Barbara, May 2000

- (7) **Solar Structure Inversions: Some Recent Results**  
 “XITH IRIS and LOWL/ECHO Workshop: Prospects for Ground Based Helioseismology at Low Degree,” Boulder CO, June 2000
- (8) **Helioseismically Deduced Solar Cycle Related Changes in the Sun**  
 “1st Joint Scientific Assembly of IAGA-IASPEI”, Hanoi, Vietnam, August 2001
- (9) **What does helioseismology tell us about structural changes with the solar cycle?**  
 SOHO11 symposium, “From Solar Min to Max: Half a solar cycle with SOHO,” Davos, Switzerland, March 2002.
- (10) **Changes in the Sun: 1995 to 2001**  
 2002 Spring Meeting of the American Geophysical Union, Washington DC, May-June 2002
- (11) **Stellar Inversions**  
 “Asteroseismology across the HR diagram.” Conference in Porto, Portugal July 2002
- (12) **Helioseismic estimates of the latitudinal dependence of solar structure and dynamics**  
 “3D stellar Evolution.” Workshop held at the Dept. of Applied Science, UC Davis, Livermore, CA, July 2002.
- (13) **Effect of Asymmetry on Ring-Diagram mode Parameters**  
 “Local Helioseismology Comparison Workshop,” National Solar Observatory, Tucson, AZ, March 2003.
- (14) **What does the Sun Teach us about Properties of Matter (Parker Lecture)**  
 Solar Physics Division Meeting, Laurel MD, June 2003
- (15) **Rings diagrams: strengths and uncertainties**  
 “Local Helioseismology Comparison Workshop,” JILA, University of Colorado, Boulder CO, July 2003
- (16) **Helioseismic evidence of mixing in the Sun**  
 “Chemical Abundances and Mixing in Stars in the Milky Way and its Satellites,” ESO-Arcetri Workshop, Italy, September 2004
- (17) **Studying Stellar Evolution with (Helio)Seismology**  
 American Astronomical Society Meeting 207, Washington. D.C., January 2006.
- (18) **Interpreting solar frequencies: Methods and techniques**  
 “SOHO 17: 10 Years of SOHO and Beyond,” Giardini Naxos, Italy, May 2006.
- (19) **What has helioseismology taught us about the Sun?**  
 “Cool Stars 14,” Pasadena, CA, November 2006
- (20) **Are Inputs to Standard Solar Models Correct?**  
 American Astronomical Society Meeting 210, Honolulu, HI, May 2007
- (21) **Helioseismic evidence of changes inside the Sun**  
 Forum on Solar Influence on Climate, New Haven, CT, March 2008
- (22) **The solar metallicity problem: Do we have the solution?**  
 “GONG 2008/SOHO XXI: Solar-stellar dynamos as revealed by helio- and asteroseismology,” Boulder, CO, August 2008
- (23) **The problem with solar abundances: Do we have the solution yet?**  
 Workshop on Variable Stars, Beijing, China, November 2008
- (24) **Helioseismology as a diagnostic of the solar interior**  
 “HELAS: Synergies between solar and stellar modelling,” Rome, Italy, June 2009

- (25) **Changes in solar structure and rotation during solar cycle 23**  
 Joint Discussion 11: “New Advances in Helio- and Astero-Seismology,” IAU General Assembly, Rio de Janeiro, Brazil, August 2009
- (26) **Oscillations in Clusters: Report on KASC Working Group # 2**  
 3rd Kepler Asteroseismology Workshop, ‘Kepler Asteroseismology in Action’, Aarhus, Denmark, June 2010
- (27) **GONG 2010 - SOHO 24: A summary of the conference**  
 GONG 2010 - SOHO 24: A new era of seismology of the Sun and solar-like stars, Aix-en-Provence, France, July 2010
- (28) **The issue of solar abundances**  
 ”The power of helio- and asteroseismology”, Aarhus, Denmark, October 2010
- (29) **Asteroseismology**  
 Princeton Center for Theoretical Science program ‘Seismology of the Earth and Stars’, May 2011
- (30) **The structure of the solar tachocline**  
 Princeton Center for Theoretical Science program ‘Differential Rotation in Stars’, May 2011
- (31) **Why we need *SONG***  
 4th SONG workshop, College of Charleston, Charleston, SC, September 2011

**Contributed Talks in Conferences:**

- (1) **The Effect of Stellar Multiplicities on the IMF and Global Star Formation Rates**,  
 “Star Formation, Galaxies and the Interstellar Medium,” Marciana Marina, Elba, Italy, May 1992
- (2) **Inversion of Combined and Homogeneous Data Sets**  
 Working Group 9 (Internal Structure and Inversion), 4th SOHO Workshop on Helioseismology, Pacific Grove, California, USA, April 1995.
- (3) **Helium Abundance in the Solar Envelope**  
 Working Group 11 (Frequencies of High Degree Solar Oscillations) 4th SOHO Workshop on Helioseismology, Pacific Grove, California, USA, April 1995.
- (4) **Solar Structure as Revealed by 1 Year LOWL Data**, “Windows Windows on the Sun’s Interior,” India, October 1995
- (5) **Solar Cycle Variation of Large Scale Flows in the Solar Interior**  
 “Helioseismic diagnostics of solar activity,” Stanford, July 1999
- (6) **Studying Asphericity in the Solar Sound Speed**  
 “SOHO 10/GONG 2000 Workshop: Helio- and Asteroseismology at the dawn of the millennium” Tenerife, Spain, October 2000.
- (7) **Ring Diagram Analysis of the Characteristics of Solar Oscillation Modes in Active Regions**  
 “Local-area Helioseismology”, workshop held at Stanford Univ., Palo Alto, CA, April 2001.
- (8) **Ring Diagram Analysis of the Structure of Solar Active Regions**  
 “Local-area Helioseismology Comparisons,” workshop held at the National Solar Observatory, Tucson, AZ, February 2004.
- (9) **Differences between the current solar minimum and those of cycles 23 and 22**  
 “SOHO 23: Understanding a Peculiar Solar Minimum,” Northeast Harbor, ME, September 2009

- (10) **Are recent solar heavy element abundances consistent with helioseismology?**  
GONG 2010 - SOHO 24: A new era of seismology of the Sun and solar-like stars, Aix-en-Provence, France, July 2010
- (11) **How different was the last solar minimum?**  
The 61st Fujihara Seminar “Progress in solar/stellar physics with helio- and asteroseismology,” Hakone, Japan, March 2011