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Research Interests

Circumstellar interaction of Supernovae: Multiwavelength (eg. radio, optical, X-ray) observations and modeling of the interaction of supernova shock with material surrounding the progenitor.

Ultra High Energy Cosmic Rays: Magnetic fields and particle acceleration in relativistic blastwaves produced by the ejecta of relativistic supernovae or outflows from super massive black holes.

Supernova Feedback: Role of supernova-driven mechanical energy injection in determining the dynamical and thermal history of baryons; its effect on galactic structure and evolution.

Radio Surveys: Future prospects for 21 cm and transient astronomy with upcoming radio telescopes.

Education

- **Tata Institute of Fundamental Research** Mumbai, India
Doctor of Philosophy (ongoing, advisor: Professor Alak Ray) Aug. 2009 - Onwards
– School of Physical Sciences, TIFR, Mumbai, India
- **Tata Institute of Fundamental Research** Mumbai, India
Master of Science (in Physical Sciences) Aug. 2006 - July 2009
– School of Physical Sciences, TIFR, Mumbai, India
- **University of Calcutta** Kolkata, India
Bachelor of Science (Department Valedictorian, Honours in Physics) Aug. 2003 - Jun. 2006
– St. Xavier's College, Kolkata, India

Fellowships and Honours

ITC Predoctoral Fellowship 2010: Appointed as a Fellow in the Institute for Theory and Computation (ITC), Harvard University, for November 2010.

TIFR Scholarship 2006-Onwards: Selected by the TIFR test and interview to receive research scholarship to attend graduate school at TIFR.

JEST 2006: Obtained 1st Rank in the nationwide Joint Entrance Screening Test for admission to PhD programmes in Physics at Indian research institutes.

NIUS 2004-2006: Chosen National Initiative on Undergraduate Science program at HBCSE, TIFR to participate in undergraduate nurture program and received travel and book grant.

JBNSTS 2003-2006: Was selected by the Jagadis Bose National Science Talent Search to be a recipient of their Senior Scholarship covering complete undergraduate study and book grant.

Refereed Publications

“Radio Emission from Green Peas: Implications for Magnetic Fields in Young Galaxies”,
Chakraborti, S.; Yadav, N; Cardamone, C; Ray, A; submitted (2011).

“Neutral Hydrogen Tully Fisher Relation: The case for Newtonian Gravity”, **Chakraborti, S.**;
Khedekar, S; submitted (2011).

- “A New Tolman Test of a Cosmic Distance Duality Relation at 21 cm”, Khedekar, S; **Chakraborti, S.**; **Physical Review Letters** **106**, 221301 (2011).
- “Supernova Feedback Keeps Galaxies Simple”, **Chakraborti, S.**; **Astrophysical Journal**, **732**, 105 (2011).
- “Baryon Loaded Relativistic Blastwaves in Supernovae”, **Chakraborti, S.**; Ray, A.; **Astrophysical Journal** **729**, 57 (2011).
- “An Expanding Neutral Hydrogen Supershell Evacuated by Multiple Supernovae in M101”, **Chakraborti, S.**; Ray, A.; **Astrophysical Journal** **728**, 24 (2011).
- “Engine-driven Relativistic Supernovae as Cosmic Ray Accelerators beyond the GZK Limit”, **Chakraborti, S.**; Ray, A.; Soderberg, A. M.; Loeb, A.; Chandra, P.; **Nature Communications** **2**, 175 (2011).
- “A Relativistic Type Ibc Supernova Without a Detected Gamma-ray Burst”, Soderberg, A. M.; **Chakraborti, S.**; Pignata, G.; Chevalier, R. A.; Chandra, P.; Ray, A.; Wieringa, M. H.; Copete, A.; Chaplin, V.; Connaughton, V.; Barthelmy, S. D.; Bietenholz, M. F.; Chugai, N.; Stritzinger, M. D.; Hamuy, M.; Fransson, C.; Fox, O.; Levesque, E. M.; Grindlay, J. E.; Challis, P.; Foley, R. J.; Kirshner, R. P.; Milne, P. A.; Torres, M. A. P.; **Nature** **463**, 513 (2010).
- “The High-Metallicity Explosion Environment of the Relativistic Supernova 2009bb”, Levesque, E. M.; Soderberg, A. M.; Foley, R. J.; Berger, E.; Kewley, L. J.; **Chakraborti, S.**; Ray, A.; Torres, M. A. P.; Challis, P.; Kirshner, R. P.; Barthelmy, S. D.; Bietenholz, M. F.; Chandra, P.; Chaplin, V.; Chevalier, R. A.; Chugai, N.; Connaughton, V.; Copete, A.; Fox, O.; Fransson, C.; Grindlay, J. E.; Hamuy, M. A.; Milne, P. A.; Pignata, G.; Stritzinger, M. D.; Wieringa, M. H. **Astrophysical Journal Letters** **709**, L26 (2010).
- “Verification of the Rayleigh scattering cross section”, **Sayan Chakraborti**, **American Journal of Physics** **75**, 824 (2007).

Conference Proceedings

- “Afterglows of Mildly Relativistic Supernovae: Baryon Loaded Blastwaves”, **Chakraborti, S.**; Ray, A.; **GRB 2010** at Annapolis (2010).
- “Engine-driven Relativistic Supernovae as Sources of Ultra High Energy Cosmic Rays”, Ray, A.; **Chakraborti, S.**; **GRB 2010** at Annapolis (2010).

Press Coverage

- Indian Express:** “TIFR discovers sources of ultra high energy cosmic rays”, 6 March 2011
- Deccan Herald:** “Einstein’s still right”, 1 March 2011
- CERN Courier:** “SN 2009bb: where are the gamma rays?”, 24 February 2010

Telescope Time Allocations

- Chandra Cycle 13:** Co-Investigator of approved proposals on type IIP supernovae (PI: Alak Ray) and type Ibc supernovae (PI: Alicia Soderberg), July 2011
- GMRT Cycle 20:** Principal-Investigator of approved proposals titled “Relativistic ejecta from SN 2009bb: Blastwave evolution and particle acceleration”, March 2011

GEMINI Cycle 2011A: Principal-Investigator of approved proposal titled “The nature of the Interstellar Medium in the cavities blown by Supernovae in M101”, with GEMINI North Cycle 2011A; observations carried out, data analysis under way

GMRT Cycle 19: Co-Investigator of approved proposals titled “A grin without a cat: Relativistic ejecta from SN 2009bb without a GRB counterpart”; Principal-Investigator of “GMRT search for radio emission from Green Peas” and “SN 1996aq: Orphan afterglow or impact with circumstellar shell?”, September 2010

GMRT Cycle 18: Co-Investigator of approved proposals titled “A grin without a cat: Relativistic ejecta from SN 2009bb without a GRB counterpart”, “A bright radio supernova in a starburst galaxy M82”, March 2010

GMRT Cycle 17: Principal-Investigator of approved proposals titled “Nature of localized emission in the face-on spiral galaxy M101” and “SN 1996aq: Orphan afterglow or impact with circumstellar shell?”. Co-Investigator of approved proposals titled “GMRT follow up observations of an enigmatic Type II_n supernova SN 2006jd”, “A bright radio supernova in a starburst galaxy M82” and “A grin without a cat: Relativistic ejecta from SN 2009bb without a GRB counterpart”, September 2009

ALBA Cycle 2009APRS: Principal-Investigator of approved proposal titled “A wide field map of the nearby spiral galaxy NGC 300 and its supernova remnants with the LBA”, using the Australian Long Baseline Array Cycle 2009APRS, April 2009

GEMINI Cycle 2009A: Principal-Investigator of approved proposal titled “The nature of the Interstellar Medium in the cavities blown by Supernovae in M101”, with GEMINI North Cycle 2009A; no useful data obtained

GMRT Cycle 15: Principal-Investigator of approved proposal titled “HI in Nearby Spiral Galaxies with Supernovae”, September 2009

HCT Cycle 15: Principal-Investigator of approved proposal titled “Sites of Supernovae in Nearby Spiral Galaxies”, in Himalayan Chandra Telescope, September to December 2008

Workshops Attended

GRB 2010 at Annapolis: Attended and presented poster at the *GRB 2010* conference at Annapolis, USA.

27th Winter School in Theoretical Physics: Attended the 27th Winter School in Theoretical Physics on *Frontiers in High-Energy Astrophysics* at Jerusalem, Israel.

ASI Meeting Was invited (see YAM award below) to present poster at *Meeting of the Astronomical Society of India*, held at IIA, Bangalore, India.

SNe & GRB at Darjeeling 2008: Presented work on sites of supernovae in nearby spiral galaxies at conference held at Darjeeling, India.

YAM 2008: Won the best poster award at the *The Young Astronomers' Meet* to be held at Mahatma Gandhi University in Kottayam, India.

JIGSAW 2007: Attended the *Joint Indo-German School And Workshop* on Neutrinos in Physics, Astrophysics and Cosmology at TIFR, Mumbai, India.

Academic Visits and Invited Talks

CCAPP, Ohio State University: Talk and collaboration on the astroparticle physics of cosmic rays from supernovae (Basudeb Dasgupta) ; December 2010

ITC, Harvard University: Talk and work on mildly relativistic supernovae and other topics (Alicia Soderberg, Abraham Loeb) November 2010

Astronomy Department, Caltech: Talk and introduction to the Palomar Transient Factory project (Shrinivas Kulkarni); October 2010

Skills

Radio Astronomy Tools: GMRT and VLA data acquisition and analysis (both continuum and 21 cm spectroscopy) with AIPS. Handling of large data volumes and 3D data cubes. Extensive (3 years as PI) experience with operating the GMRT.

Optical Astronomy Tools: Visible (eg. HCT: Himalyan Chandra Telescope) and UV (eg. GALEX) data acquisition and reduction (both photometry and slit spectroscopy) with IRAF. Experience with operating the HCT.

Other Astronomy Tools: Supernova spectral matching with SNID, supernova line formation with SYNOW, querying large databases (eg SDSS, GALEX) with SQL.

Symbolic and Numerical Computation: Computer assisted solution of mathematical problems with Mathematica. Numerical computations with Fortran, C/C++ programs and Matlab and IDL scripts.

Teaching Experience

Astronomy Olympiad 2011: Lectured on *Stellar Death* and *Galaxies*, to students at the Orientation-cum-Selection Camp (OCSC) for Indian students to be sent to International Astronomy Olympiad (IAO). Results awaited.

Astronomy Olympiad 2010: Lectured on *Stellar Death* and *Galaxies*, to students at the Orientation-cum-Selection Camp (OCSC) for Indian students to be sent to International Astronomy Olympiad (IAO). These students became Olympiad champions with with 3 gold medals.

Astronomy & Astrophysics 2010: Teaching Assistant on TIFR core course on Astronomy & Astrophysics delivered by *Professor Alak Ray*.

Astronomy & Astrophysics 2009: Teaching Assistant on TIFR core course on Astronomy & Astrophysics delivered by *Professor D. Narasimha*.

Public Outreach

Chai and Why: Delivered public lecture titled "Explosions in the Cosmos" for the Chai and Why program run jointly by TIFR and Prithvi Theatre, Mumbai; September 2010.

Extracurricular Activity

Amateur chess player: Represented St. Xavier's College, Kolkata, at intercollegiate Chess tournaments.

Amateur fossil collector: Extensive collection of Ammonites (ancient sea creatures which became extinct at the end of the Cretaceous period) found over the Himalayan ranges.