Curriculum vitae
of
Jayanta Roy

Current Affiliation:

Fellow-D,
National Centre for for Radio Astrophysics,
Tata Institute of Fundamental Research,
Pune, India.

Area of research:

- Pulsar Astrophysics
- High performance computing for Radio Astronomy

Research projects:

- Designed and implemented a real-time software back-end for the GMRT.
- Search for millisecond pulsars at the positions of Fermi LAT unassociated sources.
- Timing and polarization studies of newly discovered millisecond pulsars.
- Designed and implemented a gated correlator for studying millisecond pulsars.
- Designed and implemented a multi-pixel beamformer and searched for young pulsars in the Supernova Remnants.
- Study of timing noise and glitches in a young pulsar.
- Design and development of a real-time Radio Transient detection pipeline.
- Simultaneous multi-frequency coherently de-dispersed study of the giant pulses.
- INDO-AUSTRALIAN Very Long Baseline Interferometric experiments.

Collaborators:

- Dr. Bhaswati Bhattacharyya (IUCAA)
- Dr. Paul Ray (Naval Research Laboratory)
- Prof. Yashwant Gupta (NCRA-TIFR)
- Prof. Matthew Bailes and the Pulsar group of Swinburne Centre for Astrophysics and Supercomputing for Australia-India strategic Research Fund (AISRF) collaboration
- Dr. Ue-Li Pen (Canadian Institute of Theoretical Astrophysics)
- Prof. Dipankar Bhattacharya (IUCAA)
- Dr. Scott Ransom (NRAO)
- Prof. David A. Green (University of Cambridge)
- Dr. Wojciech Lewandowski (University of Zielona Gora)
- Prof. Rajaram Nityananda (NCRA-TIFR)
- Members of Pulsar search consortium of Fermi LAT team
- Members of Pulsar timing consortium of Fermi LAT team
- Pulsar group of Curtin University of Technology
- VLBI group of CSIRO - Australia Telescope National Facility
- Collaboration for Astronomy Signal Processing and Electronics

Research (CASPER), University of Berkeley
• Intel networking and software development group

PhD Research:

Thesis Title: *Design and development of a software back-end for the GMRT and its applications to pulsar studies*
Institute: National Centre for Radio Astrophysics
Tata Institute of Fundamental Research (NCRA-TIFR)
Expected Year of Completion: 2012

Educational Qualification

Master of Science (M.Sc.)
in Physics

Thesis Title:	*GMRT pulsar timing studies of the young pulsar J1833−1034 : detection of multiple glitches.*
Year of Completion :	2010.
Institute:	National Center for Radio Astrophysics, Tata Institute of Fundamental Research, Pune, India.

Bachelor of Technology (B.Tech.)
in Electronics and
Telecommunication Engineering

Year of Completion :	2002.
Institute:	Institute of Engineering and Management, University of Kalyani, West Bengal, India.

Employment Details

Fellow−D	2009 onwards National Center for Radio Astrophysics, Tata Institute of Fundamental Research, Pune, India.
Research Associate	2004−2009 National Center for Radio Astrophysics, Tata Institute of Fundamental Research, Pune, India.
Scientific Officer−C	2002−2004 Giant Metrewave Radio Telescope, Tata Institute of Fundamental Research, Pune, India.

Technical Expertise

- Extensive experience in high performance computing, including vectorized processing on multi-core CPU resources as well as CUDA programming on Graphics Processing Unit (GPU).

- Extensive experience in building radio astronomy signal processing back-end receiver.
- Extensive experience in radio astronomical observations of pulsars and continuum sources at lower frequencies − 150, 244, 325, 610 and 1400 MHz − with the Giant Metrewave Radio Telescope (GMRT).
- Extensive experience in writing codes for analysis of low frequency radio data from pulsars.
- Extensive experiences in using pulsar signal processing packages PRESTO, SIGPROC, DSPSR and PSRCHIVE.
- Extensive use of cluster computing for search of radio pulsars; developed PRESTO based pulsar search pipeline using the cluster of computers.
- Extensive experience in pulsar timing analysis using packages like TEMPO, TEMPO2.
- Expertise in Radio Interferometry techniques and data analysis using AIPS (Astronomical Image Processing Software).
- Expertise in parallel programming with MPI and OpenMP on CPU.
- Expertise in numerical and non-numerical scientific computing using C, C++, FORTRAN, Matlab, Octave and Python.
- Extensive use of Linux and Windows operating environment for scientific work.
- Used many packages supported by Linux operating system : Latex, Gnuplot, Xfig, Gimp, Open-Office, different editors like vi, emacs etc.
- Expertise in Shell scripting.
- Expertise in evaluating observatory time-frequency standard using inter-comparison techniques and pulsar.
- Expertise in developing "RxCAL" − A tool for GMRT receiver calibration.

Teaching Experience

- Lectures on the "Digital Correlator" for the Radio Astronomy School − 2011 in NCRA-TIFR
- Supervised master project on "optimisation of pulsar signal processing applications on GPU" in 2011 for two Pune University students
- Supervised winter project in 2011 on "pulsar incoherent dedispersion using the GPU" for IIST-Thiruvananthapuram student
- Supervised one summer and one winter project about "radio astronomy signal processing on GPU" for IIT-Kharagpur and IIT-Chennai engineering student in 2010−2011
- Supervised two master students from Pune University on "implementing the radio astronomy interferometric correlation on GPU" in 2010

- Lectures on the "GMRT and its signal flow" for the Visiting Student Research Program − 2010 in NCRA-TIFR
- Supervised six months internship projects in 2009 on "Development of cluster monitoring tool for the GSB" for three students from IIIT, Allahabad.
- Supervised three student projects in 2009 on "GSB with wide-bandwidth" and "Scopes of RFI removal in the GSB" for engineering student from NIT-Warangal and IIT-Chennai.
- Supervised one master project in 2007 on "building a FPGA based high bandwidth digital back-end" for IIIT, Pune student.
- Supervised a student project in 2006 on "Algorithms for Phased Array Beam Generation" for two students from Institute of Radio Physics and Electronics, University of Calcutta.

Research Accomplishments

- Design and development *a real-time high performance computing back-end* receiver for the GMRT :
  I have designed and implemented of a 32 antennae, 32 MHz, dual polarization, fully real-time software back-end (GSB) for the GMRT. This fairly sophisticated flexible back-end receiver enhances the productivity of the telescope. This is the first instance of building such a real-time back-end using high performance computing for array telescope like the GMRT. The GSB is now released for regular GMRT observations, since middle 2010 and replaced the old GMRT hardware backend.
- *Search for millisecond pulsations* in the nearby universe at the positions of Fermi LAT unassociated sources and the *follow-up timing studies* of them:
  We have discovered six interesting MSPs within the error boxes of Fermi LAT sources at the GMRT over the period of only one and half year, which enhanced the population of such MSPs by 12%. These discoveries are very important scientific outcome from India using the GMRT, since these are the first discoveries of Galactic disk millisecond pulsations at the GMRT.
- Design and implementation of a *gated correlator* for studying MSPs :
  I have developed a coherently dedispersed MSP gating correlator at the GMRT motivated by the requirement of localising the newly discovered faint Fermi MSPs. This imaging technique uses the dedispersed visibility data folded with period, acceleration and jerk (period double derivative). We could localise the tighter and fainter binary MSPs in the "ON-OFF" image plane, even outside the half power beam of the GMRT. This is the first instance of building such gated interferometer working on higher order rotational parameter space for studying binary MSPs.
- *Multi-pixel beamformer* and search for young pulsars in the Supernova Remnants :
  I have developed a multi-pixel beamformer technique which can be used for enhancing the capabilities for studying pulsars using an interferometric array. This efficient technique combines the enhanced sensitivity of a coherent array beamformer with the wide field-of-view seen by an incoherent array beamformer. We have successfully used this technique of multi-pixel beamformer to obtain the precise locations of newly discovered millisecond pulsars with the GMRT. I have been also using this for efficient searching of young pulsars in extended remnants where the pulsar could have moved a significant distance from the centroid.

- Timing of young Pulsar to study its rotational irregularities :
  I have been working for long-term timing a young pulsar, PSR J1833-1034, in the galactic supernova remnant G21.5-0.9. We detected fairly frequent occurrence of lower amplitude glitches (4 in 5.5 years).

- Design and development of a real-time Radio Transient detection pipeline :
  I have been working as a leading member of the NCRA team for the development of a radio transient detection pipeline using the GSB as a part of the AISRF (Australia-India Strategic Research Fund) collaboration with the Swinburne University of Technology.

- Low-frequency coherently de-dispersed polarimetric study of millisecond pulsars at the GMRT : The enhanced capability of the GSB of generating the high time resolution coherently de-dispersed pulse profile allows us to recover the intrinsic sharpness of the profile, which in-turn enable us to study the MSPs in great details, specially their polarization properties, which are poorly studied at low frequency.

- GMRT EoR Experiments :
  GMRT EoR project is aimed to measure the power spectrum of 21 cm neutral hydrogen emission during the epoch of re-ionization.

- INDO-AUSTRALIAN Very Long Baseline Interferometric experiments :
  We have successfully demonstrated the fringes in the long inter-continental baselines (e.g. GMRT-Mopra, GMRT-Hobart and GMRT-ATCA) from the Indo-Australian VLBI experiments using the GSB. This opens up the possibility of GMRT to participate in the International VLBI experiments.

Other academic activities and Awards

- Being the designer, planner and implementer of the Supercomputer at the GMRT, trained a group of people to maintain the same and also in the continuous process of upgrading the network and compute power of the cluster.

- Assisting various astronomers from India and abroad in Radio observations with the GMRT.

- Participated in science day activities in GMRT.

- Life time member of Astronomical Society of India

- LOC member in the conference on High performance Computing in Observational Astronomy, IUCAA, India, October, 2009

- I have been honoured by "Bharat Jyoti Award" along with a Certificate of Excellence from India International Friendship Society on 27th March 2012

Press and Media

- The remarkable discovery of six millisecond pulsars by us at the GMRT, were announced in a press conference held at NCRA at on 30th March 2012. The discovery news was reported in at least eight national newspapers (Telegraph, Times of India, Indian Express, DNA, Sakal times, Sakal, Maharashtra Times, Pudhari, Lokmat, and in Financial Express, Bangalore on 13th April etc).

- Our work was casted in All India Radio Pune Akashvani through an interview on 10th April at 8:40 AM (in a program named "Bisesh Barta").

Institutional visits and Conferences attended

- Neutron Stars: Inside and Outside conference at the Saha Institute of Nuclear Physics, Kolkata, India, October, 2012.
- S N Bose National Centre for Basic Science, Kolkata, India, October 2012.
- CASPER−2011 Conference on "Radio Astronomy Back-end", NCRA-TIFR, October, 2011.
- Indo-Russian Workshop on "High Performance Computing in Science and Technologies" organized by C-DAC, Pune, November, 2010.
- Pulsar conference 2010, Sardinia, Italy, October, 2010.
- Visit to Max Plank Institute for Radio Astronomy, Bonn, Germany, October, 2010.
- Visit to Jodrell Bank Centre for Astrophysics, University of Manchester, UK, October, 2010.
- Visit to University of Zielona-Gora, Poland, October, 2010.
- Visit to Swinburne University of Technology, Melbourne, Australia, June, 2010 for AISRF collaborative research.
- Visit to Raman Research Institute, Bangalore, March, 2010.
- Conference on High performance Computing in Observational Astronomy: Requirements and Challenges, in IUCAA, October 2009.
- Conference on Low Frequency Radio Universe, in NCRA-TIFR, December, 2008.
- XXIXth General Assembly of International Union of Radio Science, Chicago, Illinois, USA, August, 2008.
- Visit to University of California, Berkeley, USA, August, 2008.
- Visit to Allan Telescope Array, California, USA, August, 2008.
- Visit to California Institute of Technology, USA, August, 2008.
- Visit to Swinburne University of Technology, Melbourne, Australia, April, 2008 for AISRF collaborative research.
- Annual meeting of the Astronomical Society of India, Hyderabad, India, February, 2007.
- Young Astronomer Meeting, GMRT, Pune, December, 2005.
- XXVIIIth General Assembly of International Union of Radio Science, New Delhi, India, October 2005.

- Summer School on "Radio Interferometry and Synthesis imaging" at NCRA-TIFR, May-July, 2003.

Selected Presentations

- Invited talk in "Neutron Stars: Inside and Outside" conference at the Saha Institute of Nuclear Physics, Kolkata, India, October, 2012.
  title: "Search for millisecond pulsars at the GMRT and exotic discoveries"

- Talk in the Academic Day -2011, NCRA-TIFR, November, 2011.
  ''Discovery of six millisecond pulsars within the Fermi LAT error boxes using the GMRT"

- Invited talk in CASPER−2011 Conference on "Radio Astronomy Back-end", NCRA-TIFR, October, 2011.
  ''A real-time transient detection pipeline using the GSB"

- Invited talk in Indo-Russian Workshop on "High Performance Computing in Science and Technologies" organized by C-DAC, Pune, in November 2010.
  ''HPC in Radio Astronomy"

- Poster presentations in the Pulsar conference 2010, Sardinia, Italy, October, 2010.
  ''Pulsar timing using the GMRT : Detection of multiple glitches from a young pulsar J1833-1034" and "A sensitive search for young pulsars in supernova remnants using the GMRT"

- Invited talk in Max Plank Institute for Radio Astronomy, Bonn, Germany, October, 2010.
  ''Development of the HPC band-end for the GMRT"

- Invited talk in Jodrell Bank Centre for Astrophysics, University of Manchester, UK, October, 2010.
  ''Development of the HPC band-end for the GMRT and its applications for pulsar studies"

- Astronomy & instrumentation talk, Raman Research Institute, Bangalore, India, March, 2010.

- Invited talk in the conference on High performance Computing in Observational Astronomy, IUCAA, India, October, 2009.

- Contributed talks in the conference on Low Frequency Radio Universe, in NCRA-TIFR, December, 2008.

- Contributed talk in the XXIXth General Assembly of International Union of Radio Science, Chicago, Illinois, USA, August, 2008.

- Invited talk in Radio Astronomy Department, University of California, Berkeley, USA, August, 2008.

- Invited talk in California Institute of Technology, USA, August, 2008.

- Astronomy & instrumentation talk, Swinburne University of Technology, Melbourne, Australia, April, 2008.

- Astronomy & instrumentation talk, NCRA-TIFR, India, September, 2007.

- Invited talk in Young Astronomer Meeting, GMRT, Pune, December, 2005.
- Contributed talk in the XXVIIIth General Assembly of International Union of Radio Science, New Delhi, India, October 2005.
- Contributed talk in the GS-75 Conference, GMRT, India, March, 2004.

Publication list

Publications (in refereed journals) :

- *Radio Detection of the Fermi LAT Blind Search Millisecond Pulsar J1311-3430*
  Ray P. S., Ransom S. M., Cheung C. C., Giroletti M., Cognard I., Camilo F., Bhattacharyya B., Roy J. et al., 2012, ApJ Letters (submitted, astroph:1210.6676

- *A multi-pixel beamformer using an interferometric array and its application towards localisations of newly discovered pulsars*
  Roy, J.; Bhattacharyya, B.; & Gupta, Y., 2012, accepted for publication in MNRAS Letters, arXiv1209.3858R.

- *Observations of four glitches in the young pulsar J18331034 and study of its glitch activity*
  Roy, J.; Gupta, Y.; & Lewandowski, W., 2012, MNRAS, 424, 2213R.

- *The GMRT Epoch of Reionization experiment: a new upper limit on the neutral hydrogen power spectrum at z 8.6*
  Paciga, G.; Chang, T.; Gupta, Y.; Nityanada, R.; Odegova, J.; Pen, U.; Peterson, J. B.; Roy, J.; Sigurdson, K., 2011, MNRAS, 413, 1174.

- *A real-time software backend for the GMRT*
  Roy, J.; Gupta, Y.; Pen, U.; Peterson, J. B.; Kudale, S.; Kodilkar, J., 2010, Experimental Astronomy, 28, 25.

- *The GMRT EoR experiment: limits on polarized sky brightness at 150 MHz*
  Pen, U.; Chang, T.; Hirata, C. M.; Peterson, J. B.; Roy, J.; Gupta, Y.; Odegova, J.; Sigurdson, K., 2009, MNRAS, 399, 181.

Publications in preparation (to be submitted by 2012 in refereed journals):

- *Discovery of an eclipsing Black Widow PSR J1544+4937 in a Fermi source with the GMRT*
  Bhattacharyya, B.; Roy, J.; et al., 2012a, ApJ Letters (in preparation; by November 2012).

- *A gating correlator for studying millisecond pulsars using interferometric array*
  Roy, J.; Bhattacharyya, B.; 2012b, ApJ Letters (in preparation; by November 2012).

- *Discovery of five millisecond pulsars at the positions of Fermi sources using the GMRT*
  Bhattacharyya B.; Roy, J; et al., 2012c, ApJ Letters (in preparation; by December 2012)

Publications (Conference proceedings) :

- *Radio Searches of Fermi LAT Sources and Blind Search Pulsars: The Fermi Pulsar Search Consortium*
  Ray P. S. et al., 2012, *2011 Fermi Symposium proceedings*, arXiv: 1205.3089.

- *Detection of multiple glitches from the young pulsar J1833−1034*
  Roy, J.; Gupta, Y.; & Lewandowski, W., 2011, AIPC, 1357, 134R.

- *A sensitive search for young pulsars in supernova remnants using the GMRT*
  Roy, J.; Gupta, Y.; & Green, D. A., 2011, AIPC, 1357, 54R.

- *Glitches from the Young Pulsar J1833−1034*
  Roy, J.; Gupta, Y.; Lewandowski, W., 2009, ASPC, 408, 299.

- *The GMRT Search for Reionization*
  Pen, U.; Chang, T.; Peterson, J. B.; Roy, J.; Gupta, Y.; Bandura, K., 2008, AIPC, 1035, 75.

- *HI signal from the epoch of reionization: A pilot observation with the GMRT*
  Roshi, D. A.; Sethi, S. K.; Pen, U.; Peterson, J.; Subrahmanyan, R.; Chang, T.; Hirata, C.; Roy, J.; Gupta, Y., 2006, IAUJD, 12E, 50R.

Technical reports :

- *Phase stability and GMRT's frequency standard*
  Roy, J; Venkatasubramani, T. L.; Joshi, B. C., 2004
  http://ncralib1.ncra.tifr.res.in:8080/jspui/bitstream/2301/179/1/R00212.pdf.

- *Conceptual representation of RxCal - A tool for GMRT receiver calibration*
  Roy, J; Venkatasubramani, T. L., 2004
  http://ncralib1.ncra.tifr.res.in:8080/jspui/bitstream/2301/178/1/R00213.pdf.

Personal information

Name: Jayanta Roy

Biography: Born in West Bengal, India
30th November, 1978.
Male, Married.

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