Gurudatt Gaur

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Education

Ph.D. Physics Institute for Plasma Research, Gandhinagar, India (July 2013).

M.Sc. Physics, **First Class**, Aligarh Muslim University, Aligarh, India (2005).

B.Sc. (*Honors*) **Physics**, **First Class**, Aligarh Muslim University, Aligarh, India (2003).

Research & Employment

Adjunct Faculty, **Ahmedabad University, Ahmedabad, India** (Since Aug 2021)

Visiting Faculty, **St. Xavier's College (Autonomous), Ahmedabad** (Since Jul 2021)

Associate Professor, **Chandigarh University, Chandigarh, India** (Jul - Aug 2021)

Institute of Advanced Research, Gandhinagar, India (October 2015 - April 2021)
Assistant Professor[1]

- SNR dependent multi-detector geometric coincidence algorithm for search of compact binary coalescences
- Parameter estimation of binary compact objects using amplitude-corrected waveforms
- Nonlinear simulations of current gradient driven instability in the electron current layers

Institute for Plasma Research, Gandhinagar, India (July 2013 - October 2015)
Post Doctoral Fellow[2] Mentor: Predhiman Kaw, Anand Sengupta.

- Development of multi-detector geometric coincidence method using IMRPhenomB metric
- Implementation of geometric coincidence method using IMRPhenomB metric into PyCBC gravitation wave pipeline
- Running the PyCBC pipeline to compare the performance of our method with the earlier version of geometric coincidence method (using post-Newtonian metric)
- Comparing the performance of our method with the exact match coincidence method (implemented in O1 and onward searches)
- Linear and nonlinear studies to understand the interplay of tearing and surface preserving electron magnetohydrodynamics modes in a current layer

Institute for Plasma Research, Gandhinagar, India (September 2006 - July 2013)
Research Scholar Advisor: Amita Das

- Development of a 2D and 3D nonlinear fluid codes based on Finite Difference Scheme to study the shear driven Electron -Magnetohydrodynamics instabilities in plasmas.

[1] Had a concurrent post-doc offer from IUCAA, Pune.
[2] Had a concurrent post-doc offer from USTC, China.

- Used MATLAB programing to analyze the data from 2D and 3D codes.
- Development of a MATLAB code to solve a Matrix Eigenvalue problem.
- Implementation of analytical methods to carry out the stability analysis for 2D and 3D perturbations.

Teaching & Outreach

Courses taught at UG and PG level:

Elements of Modern Physics (UG)	*Thermodynamics and Statistical Mechanics* (UG)
Classical Mechanics (UG & PG)	*Statistical Mechanics* (PG)
General Physics (UG)	*Computational Physics with Python* (PG)
Plasma Physics (PG)	*General Relativity* (PG)
Engineering Mechanics (UG)	*Scientific Methods* (PG)
Numerical Methods for Engineers (UG)	*Basic Mathematics and Statistics* (PG)
Electrical Circuits & Electronics (UG)	*Advanced Mathematics and Its Applications* (PG)

Instructor for a 5 days national level online course on Numerical Methods Using Python.

Delivered lectures on Statistical Mechanics during summer school program at St. Xavier's College, Ahmedabad.

Delivered a warm up talk on Gravitation Wave Astronomy at IAR, Gandhinagar before the Public Lecture by Professor Bala Iyer (ICTS-TIFR) on Gravitational Wave Detection and 2017 Nobel Physics Prize.

Delivered a Science Day Lecture "Newton, Einstein and Gravitational Waves" at Kadi Sarva Vishwavidyalaya.

Delivered a Guest Lecture "Waves in Space and the Universe" at World Space Week organized by Brahmand - The Astronomy Club, PDEU, Gandhinagar.

Services

- Developed and implemented MSc Physics Program at IAR (Offered from 2017-18).
- Developed and implemented BTech Program at IAR (Offered from 2017-18).
- Developed and implemented MSc Data Science Program at IAR (Offered from 2020-21).
- Established various Students' Clubs (in total 10) at IAR ranging from Coding club to STEM club, Literary club to Environment club to enhance the learning experience of the students at IAR, Gandhinagar.
- Organized various Board of Studies and Academic Council meetings at IAR.
- Served on the selection/interview panel for faculty positions at IAR.
- Member, Board of Management, Member, Board of Governors, IAR.
- Coordinator of IUCAA Center for Astronomy Research and Development (ICARD) at IAR Gandhinagar.
- Set up the UG and PG Physics Laboratories and Engineering Workshop.
- Served as Chairman of Internal Quality Assurance Committee, Academic Committee, Students Disciplinary Committee, Examination and Assessment Committee.

Students Mentoring

- Three PhD students (guiding while I were at IAR, Gandhinagar)

  1. Chetan Verma
     Proposed Thesis Title: On the Aspects of Gravitational Wave Astronomy: Detection and Parameter estimation of CBC signals
  2. Sushmita Mishra
     Proposed Thesis Title: A Study on Electron Scale Instabilities in Plasma
  3. Divya Dileep
     Proposed Thesis Title: Simulation and Noise Budgeting of the aLIGO Pre-Stabilized Laser System

- Several MSc Physics students on the projects on Theoritical/Computational Plasma Physics, Gravitational wave astronomy, Data Analysis, Computational Chemistry. **Note:** One masters' project student Ms. Nishka Sheth selected for fully funded PhD position at University of Saskatchewan to work on Plasma Physics.

- One student for BTech (CSE) final semester project in collaboration with IIT, Gandhinagar.

- Two BSc students. One from PDPU Gandhinagar (now pursuing Masters in Astrophysics at Ludwig Maximimilians University of Munich) and the other one from Wilson College, Univ. of Mumbai.

Technical Abilities

- Extensive knowledge of data analysis techniques applicable to detection and parameter estimation of gravitational wave signals from compact binary coalescences.
- Extensive knowledge of fluid and particle simulations.
- Understanding of high throughput computing using *Condor*. Basic understanding of high performance computing.
- Skilled in developing and optimizing FORTRAN codes for numerical simulations.
- Extensive knowledge in MATLAB/Octave for numerical programming, 3-D plotting, volume data visualization, animation etc.
- Other programing skills: Python, shell programing. Basic knowledge of C/C++.
- Extensive knowledge of different analytical and numerical methods applicable to plasma physics.
- Familiarity with Operating Systems and Architectures: OS - Windows 98/2000/XP and higher versions, Mac, Linux.
- Softwares Used: MATLAB, GNUPLOT, Mathematica, XFIG, Gimp, Latex, MS-Word, Kile, MS-Power-point, Open-office, Libre-office
- Numerical Libraries Used: LCPFCT, IMSL, Numerical Recipes, Antia, Netlib, GSL, FFTW, LAL (*LIGO Algorithm Library*).

Projects & Grants

Coordinator of a Supercomputer Facility sponsered by GUJCOST, Goverment of Gujarat, at IAR, Gandhinagar.

Co-PI of SERB Extra Mural Project "A Bayesian approach for CBC parameter reconstruction and tests of General Relativity using amplitude-corrected post-Newtonian waveforms", funded by Department of Science and Technology, Govt. of India (2017-2019).

Co-PI of Project "Development of plasma rotating electrode process to obtain high purity spherical metallic powders", funded by DAE-BRNS.

Awards, Honors & Scholarships

Visiting Associate at Inter University Center for Astronomy and Astrophysics (IUCAA), Pune, India.

2016 Special Breakthrough Prize in Fundamental Physics (shared between the LIGO founders and the contributors to the discovery) & **Gruber Cosmology Prize** (recognizing the LIGO founders and the entire LIGO discovery team) for the first observation of gravitational waves on September 14, 2015.

Research Fellowship from Department of Atomic Energy, India (September 2006 - August 2012) to carry out PhD. work at IPR, Gandhinagar, India.

Professional Associations

Senior Member, IndIGO-LIGO Scientific Collaboration (LSC) (2014 - 2019).

Member, Indian Initiative in Gravitational Wave Observations (IndIGO) Consortium.

Member, Association of Asia Pacific physical Societies - Division of Plasma Physics (AAPPS-DPP).

Member, Plasma Science Society of India (PSSI).

Training/Courses

Attended Symposium on Frontier Problems in Physics
November 2018, Indian Institute of Technology, Gandhinagar.

Attended Workshop on Black Holes: From Classical to Quantum Gravity
December 2017, Indian Institute of Technology, Gandhinagar.

Attended Summer School on Gravitational Wave Astronomy
June 2015, International Center for Theoretical Sciences -Tata Institute of Fundamental Research, Bangalore.

Attended ICTS Winter School on Experimental Gravitational Wave Physics
December 2013, Raja Ramanna Center for Advanced Technology, Indore.

Attended Cray-TIFR Workshop on High Performance Computing in Physics
February 2011, Tata Institute of Fundamental Research, Mumbai, India.

Attended Discussion Meeting on Intense Laser Fields and Their Interactions With Matter
April 2010, Tata Institute of Fundamental Research, Mumbai, India.

Completed One year pre Ph.D. course work
Sept 2006 - Aug 2007, Institute for Plasma Research, Bhat, Gandhinagar, India.

Talks & Posters

1. *Using Amplitude-Corrected Waveforms for Parameter Estimation of Binary Compact Objects Simulated as Numerical Relativity Waveforms*, IAGRG at BITS-Pilani, Hyderabad, India, January 2019.

2. Lightning talk on poster in Time Series Analysis for Synoptic Surveys and Gravitational Wave Astronomy workshop at ICTS-TIFR, Bangalore, India, March 2017.

3. *An improved search for gravitational waves from binary black holes in LIGO data using multi-detector geometrical coincidence* at International Conference on Gravitation and Cosmology (ICGC-2015), IISER Mohali, India, December 2015.

4. *Search for gravitational waves from binary black holes using geometrical coincidence* at Physical Research Laboratory, Ahmedabad, India, July 2015.

5. Seminar at Institute for Plasma Research, Gandhinagar, India, June 2013.

6. 1^{st} PSSI-Plasma Scholar's Colloquium, IPR, Gandhinagar, India, July 2012.

7. IPR Scholars' Research Colloquium, Institute for Plasma Research, Gandhinagar, India, April 2011 and October 2011.

8. International Symposium on Waves, Coherent Structures and Turbulence in Plasmas, Institute for Plasma Research, Gandhinagar, India, January 2010.
9. Sokendai Asian Winter School, NIFS, Toki, Japan, January 2010.
10. 24th National Symposium on Plasma Science and Technology - Plasma-2009, National Institute of Technology, Hamirpur, India, December 2009.

Publications

9. **The Science Case for LIGO India**
M. Saleem, Javed Rana, V. Gayathri, Aditya Vijaykumar, Srashti Goyal, Surabhi Sachdev, Jishnu Suresh, S.Sudhagar, Arunava Mukherjee, Gurudatt Gaur, Bangalore Sathyaprakash, Archana Pai, Rana X Adhikari, P. Ajith, Sukanta Bose
Classical and Quantum Gravity **39**, 025004 (2022).

8. **Employing Deep Learning for Detection of Gravitational Waves from Compact Binary Coalescences**
Chetan Verma, Amit Reza, Dilip Krishnaswamy, Sarah Caudill and Gurudatt Gaur
Accepted to be published in Conference Proceeding of International Conference on Advancement in Computation and Computer Technologies, October 30 - 31, 2021, Chandigarh University, Mohali, Punjab, India

7. **GW170817: observation of gravitational waves from a binary neutron star inspiral,**
BP Abbott et al. [including Gurudatt Gaur as part of LIGO Scientific Collaboration]
Physical Review Letters **119**, 161101 (2017).

6. **Observation of gravitational waves from a binary black hole merger,**
BP Abbott et al. [including Gurudatt Gaur as part of LIGO Scientific Collaboration]
Physical Review Letters **116**, 061102 (2016).

5. **Properties of the binary black hole merger GW150914,**
BP Abbott et al. [including Gurudatt Gaur as part of LIGO Scientific Collaboration]
Physical Review Letters **116**, 241102 (2016).

4. **Tearing and surface preserving electron magnetohydrodynamics modes in a current layer,**
Gurudatt Gaur and Predhiman Kaw
Phys. Plasmas **23**, 032106 (2016).

3. **Linear and nonlinear studies of velocity shear driven three dimensional electron magnetohydrodynamics instability,**
   Gurudatt Gaur and Amita Das
   Phys. Plasmas **19**, 072103 (2012).

2. **Role of natural length and time scales on shear driven two dimensional electron magnetohydrodynamic instability,**
   Gurudatt Gaur, Sita Sundar, Sharad K. Yadav, Amita Das, Predhiman Kaw, and S. Sharma
   Phys. Plasmas **16**, 072310 (2009).

1. **A comparison of geometrical and exact match coincidence in gravitational wave searches from binary black holes,**
   Under preparation

Professional Activities

Reviewer for:

- Physics of Plasmas (American Institute of Physics, USA)
- International Conference on Condensed Matter and Device Physics-2021 organized by PDEU, Gandhinagar

Member Doctoral Commitee (PhD Student, IPR Gandhinagar)

On Physics JRF Selection Panel, PDPU, Gandhinagar

One of the organizers for PSSI, Plasma Scholars' Colloquium, 2019.

On Jurry for Anveshan 2018 (Student Research Convention) organized at Ganpat University, Mahsana, Gujarat.

Convener, Conference on Recent Progresses in Physical Sciences (CRPPS - 2016).

Convener, A 5 Days Online Course on Numerical Methods Using Python (July 2021).

Convener, Organized a semester long First Course on General Relativity (February - May, 2021). Course Instructor - Dr Rahul Kashyap, Penn State University, USA.

Personal Details

Date of Birth	:	February 27, 1984
Sex	:	Male
Marital Status	:	Married, with two girl children
Wife	:	Scientific Officer - E, IPR, Gandhinagar
Nationality	:	Indian
Language Proficiency	:	English and Hindi

References

Prof. Abhijit Sen
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Institute for Plasma Research, Gandhinagar
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Dr. Anand Sengupta
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