Rion Glenn Nazareth

CURRICULUM VITAE

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Areas of Interest

Interstellar Medium (ISM), Turbulence, Galactic magnetic fields, Data-driven astronomy, Computational Astrophysics, Numerical simulations, Magnetohydrodynamics (MHD), Radiative transfer, and Exoplanet atmospheres.

Current Projects

Estimating Galactic Magnetic Fields from Observable Inputs: A Comprehensive Python Code for Semi-analytical Solutions and Scaling relations. *NISER, Bhubaneswar, India*

[Master's thesis]

Project Supervisor: Dr. Luke Chamandy *Aug 2022 - Current*

- A comprehensive set of codes is presented, which effectively estimates magnetic fields in galaxies using observable inputs. The magnetic fields are estimated using Mean-field dynamo theory.
- **Scaling relations finder (Manuscript submitted to ApJ)** [arXiv][Github]
  - The code solves for the magnetic field resulting in a closed-form analytical solution. This is used to calculate the relevant scaling relations.
- **Semi-analytical model applied to nearby galaxies (Manuscript under preparation)** [Github]
  - The validity of the model is confirmed by comparing the semi-analytical solutions, with the observed magnetic field of the galaxies in our local group.

Research Experience

Automated Detection of Lineaments on the Surface of Europa using Machine Learning. *NISER, Bhubaneswar, India*

[Website]

Project Supervisor: Dr. Subhankar Mishra and Dr. Guneshwar Thangjam *Aug 2021 - Feb 2022*

- Three different models were trained using a data set created using different annotating techniques.
- A novel model was proposed which combined two different techniques in Machine learning (CNNs and random forests).
- This work was presented in Lunar and Planetary Science Conference (LPSC) and the Indian Planetary Science Conference (IPSC).[link to the poster]

Using SOCRATES radiative transfer codes to simulate terrestrial exoplanets. *NISER, Bhubaneswar, India*

[Report]

Project Supervisor: Dr. Jayesh M. Goyal *May 2022 - Dec 2022*

- SOCRATES, a code used to find radiance and fluxes in the Earth's atmosphere was modified to be used in exoplanet atmospheres.
- Different radiative transfer codes were comprehensively studied and a comparison was made between them.

Visualisation of N-body simulation snapshots *NISER, Bhubaneswar, India*

[Github]

Project Supervisor: Dr. Nishikanta Khandai *Feb 2022 - May 2022*

- Visualized snapshots of N-body simulations using different methods.
- Stacked snapshots of the simulations to make a movie out of it.

Constructing Knots of up to five crossing from first principles. *NISER, Bhubaneswar, India*

[Report]

Project Supervisor: Dr. Chethan N. Gowdigere *Jan 2021 - May 2021*

- Using preliminary assumptions and Reidmeister moves constructed knots of up to five crossings.
- Studied the different techniques used to distinguish these knots from one another.

Publications and Conferences

- Luke Chamandy, Rion G. Nazareth, Gayatri Santhosh (2023) Galactic magnetic fields I. Theoretical model and scaling relations. (Manuscript submitted to The Astrophysical Journal and is under review)[arXiv].
- Rion G. Nazareth, Gayatri Santhosh, Luke Chamandy (2023) Galactic magnetic fields II. Applying the model to nearby galaxies. (Manuscript under preparation)
- Abstract No. 2709, Das N., Nazareth R., Mishra S., Thangjam G. Automated Detection of Lineaments on the Surface of Europa using Machine Learning. 53rd Lunar and Planetary Science Conference (2022), Lunar and Planetary Institute, Houston, Texas, USA, March 9, 2022 [Abstract].
- Das N., Nazareth R., Mishra S., Thangjam G. Automated Detection of Lineaments on the Surface of Europa using Machine Learning. Indian Planetary Science Conference (IPSC-2022) Physical Research Laboratory, India, March 14-16, 2022.

Technical Skills

Programming	Python (Pandas, Tensorflow, NumPy, Sympy, Scipy, Matplotlib, Seaborn, Scikit-learn), C++.
Miscellaneous	Linux, Shell (Bash/Zsh), LaTeX, Git and Github, VScode, Canva, ArcGis.
Soft Skills	Time Management, Teamwork, Collaboration, Problem-solving, Documentation, Presentation skills.

Education

National Institute of Science Education and Research (NISER) *Bhubaneswar, India*

Master of Science *August 2018 - May 2023*

- Major in Physical Sciences along with several courses taken in Mathematics
- GPA: 8.50/10
- Recipient of INSPIRE scholarship (awarded to top 1% in India)

St. Aloysius Pre-University College *Mangalore, India*

High School *June 2016 - May 2018*

- Specialised in Physics, Chemistry, Mathematics and Statistics
- Scored 97.17%

Relevant Courses

Astronomy and Astrophysics (9/10)	*Radiative processes in Astrophysics* by Rybicki and Lightman, *Astrophysics for Physicists* by Arnab Rai Choudhuri
Introduction to Cosmology (9/10)	*Introduction to Cosmology* by Barbara Ryden, *Modern Cosmology* by Scott Dodelson
General Theory of Relativity (10/10)	*A first course in General Relativity* by Bernard Schutz, *Spacetime and Geometry: An Introduction to General Relativity* by Sean M. Carroll
Advanced Computational Physics (8/10)	*A Guide to Monte Carlo Simulations in Statistical Physics* by L. Landau and K. Binder, *Computational Physics* by M. Hjorth-Jensen
Machine Learning (8/10)	*Supervised and unsupervised learning, Data-set handling, Machine learning models etc.*
Programming and Data structures (8/10)	*Bash Script, C++, Arrays, Pointers and Linked lists, Abstract data type, etc.*

Achievements

2022	**Abstract selected for Poster presentation,** LPSC conference	*Houston, Texas, USA*
2022	**Abstract selected for Oral presentation,** IPSC conference	*PRL, India*
2018-23	**INSPIRE fellow,** Department of Science and Technology (DST)	*India*
2023	**GATE Exam qualified,** IIT Kanpur	*India*
2018	**Rank 190,** out of 200,000 in the State, Common Entrance test for Engineering	*India*
2018	**Cleared Joint Entrance Exam (JEE),** Main and Advanced	*India*