Vignesh Vaikundaraman

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🌐 vicky1997.github.io

Education

Feb 2023 – Feb 2026 (Expected)	**PhD Student**, *Max Planck Institute for Solar System Research, Göttingen, Germany*, International Max Planck Research School (IMPRS) for Solar System Sciences.
October 2019 – May 2022	**M.Sc Physics**, *Ludwig-Maximilians-Universität München, Germany*, Grade 1.64.
July 2015 – June 2019	**B.Tech Mechanical Engineering**, *SASTRA Deemed University, India*, Grade 7.47/10.
	Desh-Videsh Scholarship to conduct bachelor thesis research at Johns Hopkins University

Research Interests

Planet and Star Formation, Protoplanetary Disks, Formation of the Solar System, Astrophysical Fluid Dynamics, Dust Dynamics, Computational Astrophysics

Publications & Proceedings

Vaikundaraman, V., Drążkowska, J., Binkert, F., Birnstiel, T., and Miotello, A.: *Altered Carbon : Destruction of carbon in protoplanetary disks using Monte Carlo simulations*, Europlanet Science Congress 2022, Granada, Spain, 18–23 Sep 2022, EPSC2022-647, https://doi.org/10.5194/epsc2022-647, 2022.

Amir Jafari, Ethan Vishniac, **Vignesh Vaikundaraman**., *Power and complexity in stochastic reconnection*, Physics of Plasmas 27, 072301 (2020)

Amir Jafari, Ethan Vishniac, **Vignesh Vaikundaraman**., *Statistical analysis of stochastic magnetic fields* Phys. Rev. E 101, 022122 (2020)

Amir Jafari, Ethan Vishniac, **Vignesh Vaikundaraman**., *Magnetic Stochasticity and Diffusion*, Phys. Rev. E 100, 043205 (2019)

Research Experience

May 2021 – Present	**Master's Thesis**, *Ludwig-Maximilians-Universität-München*, Munich, Germany.
	○ **Carbon destruction in protoplanetary disks using Monte Carlo models**
	○ Supervisor: Dr Til Birnstiel, Professor, Ludwig-Maximilians-Universität-München, Germany. Co-Mentors: Dr Joanna Drążkowska, Fabian Binkert.
	○ I setup code to include the physics of carbon destruction within a 1-Dimensional Monte Carlo code for dust evolution to look at photolysis of carbonaceous grains in protoplanetary disks with dust dynamics taken into account.
	○ I included scattering effects by the dust and gas layers to get a a proper prescription for the UV flux values with scattering and absorption processes taken into account. The prescription is also benchmarked with a sophisticated radiative transfer simulation.
	○ I optimised the code using profiling tools and parallel sorting methods suitable with parallel programming resulting in a considerable speed increase.
Feb 2019 – June 2019	**Research Student**, *Johns Hopkins University*, Baltimore, USA.

- **Topology and Stochasticity of Magnetic Fields: A numerical investigation**
- Supervisor: Dr Ethan Vishniac, Research Professor, Department of Physics & Astronomy, Johns Hopkins University, USA. Co-Mentor : Dr Amir Jafari
- I numerically implemented and validated a formulation of topology and stochasticity of turbulent magnetic fields.
- The formulation was numerically tested and proved for phenmonena like Magnetic reconnection and Richardson diffusion in magnetohydrodynamic turbulence for a simulation of incompressible MHD data with periodic boundary conditions.
- I also validated numerically the importance of reconnection power, a quantity to measure the power of magnetic reconnection events using simulated MHD turbulence data.

Nov.2018 – Jan 2019 & May.2018 – July.2018

Research Intern, *Indian Institute of Science Education and Research(IISER)*, Tirupati, India.

- **Study of Binary star cluster IC1848**
- Supervisor: Dr Jessy Jose, Assistant Professor, Department of Physics, IISER, Tirupati, India
- Photometric data from surveys like NEWFIRM, PanSTARRS, 2MASS and Spitzer(Optical, Near Infrared and Far Infrared data respectively) were used to analyse the binary star cluster IC1848 also known as soul nebula.
- I obtained the HR diagram of the data using VOSA (Virtual Observatory SED Analyzer). Further analyses was done on the data in Python to obtain basic properties like average age, mass and radial distances.
- Distances were obtained from the GAIA Data Release 2 and validated with the present values.
- Results were used to resolve the cluster into two based on the binary star system in the region.

& Sep. 2017 – Nov. 2018

Research Student, *Turbulence and Flow Control Lab, SASTRA Deemed to be University*, Thanjavur, India.

Analysis of Airflow generated by a ceiling fan system
- Experimental setup was designed and fabricated to test the flow efficiency of a set of fans in a room. Pitot tubes were used to measure the flow of air.
- Obtained data was analysed statistically in Python to map the flow of air due to a set of fans in a room.

Experimental Analysis of Implementing Roughness on NACA 0018 Airfoil
- Results demonstrated an effective increase in stalling angle of NACA 0018 Airfoil by $4°$
- Techniques: Design and development of experimental methods using a subsonic wind tunnel, statistical analysis in MS Excel

May.2017 – July 2017

Project Trainee, *Caterpillar Private Ltd*, Chennai, India.
- Design of Jigs and Fixtures for convectional drilling machines for a possibilty of reduction of total time.
- Modification of plant layout for a better flow of raw materials and end products.

Technical Skills

Programming Skills	**FORTRAN**, **Python**, **C**, **C++**, **MATLAB**, **Bash**, **OpenMP**, **IDL**
Tools	**Linux**, **Windows**, **LaTeX**, **MS Office**, **GNUPLOT**, **gcc profiling tools**

Coursework

Essential of Advanced Astrophysics, Formation of Disks and planets

Turbulence in neutral fluids and Plasmas, Gravitational Dynamics

Radiative Processes, Stellar Atmospheres & Winds , Numerical Astrophysics Laboratory

Advanced Astrophysics Seminar "Planet Formation" , Machine Learning in Python for Physicists

Advanced Particle Physics , Non-Linear Dynamics and Chaos

Talks & Outreach

○ Star and Planet Formation Lunch, Ludwig-Maximilians-Universität-München, 2021

○ Code Coffee, Ludwig-Maximilians-Universität-München, 2021

○ Invited talk to explain Planet formation in the Language Tamil (spoken in a part of south India) 2022

○ Invited talk on careers in Astrophysics and Space Sciences from an engineering background.

○ Invited lecture demonstration on Indian Classical Violin to the members of the Munich International Orchestra

○ Presented research at the Innovative Design, Analysis and Development Practices in Aerospace and Automotive Engineering Conference 2018

○ Astronomy outreach events through the INSPIRE-DST camp for high school students.

Languages

Deutsch	A1	*Goethe-Institut Trichy, India*
English	Fluent	
Tamil	Mother Tongue	
Telugu	Mother Tongue	

Extra Curricular Activites

○ President of the Astronomy club of SASTRA University (2018-2019). Conducted various events and talks through the same. SEDS SASTRA Blog

○ Playing violin for the past 15 years. Passed the Certificate Exam in Violin from Potti Sreeraamulu Telugu University