Sachin Venkatesh Thakku Saravana Kumar

alias: T.S.Sachin Venkatesh | tssachin.venkatesh@gmail.com | centarsirius.github.io

Research Interests

Computational astrophysics & cosmology and applications of ML, especially galform & galevo, DE and DM. Also worked on GWs, stellar evolution and radio astronomy.

Education

Bachelor of Technology in Engineering Physics Aug. 2018 - May 2022
Delhi Technological University, New Delhi, India
- Overall GPA: 7.43/10 (First class) | **Major GPA: 9.14/10**

Awards and Honors

Honorable Mention for work in applied ML presented at IMECE by ASME	2022
Member - DU IoE grant for establishing radio astronomy lab (INR 300,000)	2021
Special mention by DeepAI for novel work in super-resolution	2021
Scipy and PyData Global Impact scholar	2021
AWS Machine Learning and Intel edge AI scholarship	2020

Publications

Sachin Venkatesh, Srivastava, R., Bhatt, P., Tyagi, P., & Singh, R. (2021). 'A comparative study of various Deep Learning techniques for spatio-temporal Super-Resolution reconstruction of Forced Isotropic Turbulent flows', IMECE2021-69923, ***invited extension in progress for Physics of Fluids***

Sachin Venkatesh (2021). 'Coupling and recoupling of binaries in chaotic three body systems'. Communications of the Byurakan Astrophysical Observatory, 68, 121-124.

Research Experiences

Peering into the Radio Universe - DU IoE project Nov'21 - Present
Delhi University Mentored by Dr. T.R.Seshadri
- Working on the establishment of a radio astronomy lab at DU as a student member for both research and outreach purposes. Currently fabricating different antennae and related electronic circuits to learn more about the radio loud universe.

Student Associate, NANOStars and PSC Oct'21 - Present
NANOGrav Mentored by Dr. Megan DeCesar
- Analyzing pulsar and timing data collected by telescopes like GBT, Arceibo etc. to study new pulsars, their characteristics and other important properties. Trying to implement classification techniques of ML to automate the first stage of this process.

Research Intern May'21 - August'21
Center for Computational Astrophysics, FI Mentored by Dr. L Y Aaron Yung
- Studied dark matter halos and their properties from IllustrisTNG dark run. Tried to implement ML algorithms on merger trees to detect self-similarity across branches.

Student Researcher, Fluid Mechanics group Feb'21 - May'22
Delhi Technological University Mentored by Dr. R.K.Singh
- Investigating the structure of the universe and the CMB fluctuations using branched flows, CUDA and Ray Tracing
- Super-resolution reconstruction of turbulent flows with ML to upscale the resolution of images or videos and enable us to reconstruct high-fidelity images from LR data.

Study of QGP and its properties using heavy-ion collisions Feb'21 - Mar'21
Joint Institute for Nuclear Research, Russia Mentored by Dr. Krystian Roslon
- Generation and analysis of heavy-ion collisions events like pPb and Au-Au using the MC generator - Therminator 2 to study Quark-Gluon Plasma and its properties using pion and kaon pairs

Modeling dust scattering and halos using GALEX data May'20 - Jan'21
Indian Institute for Astrophysics Mentored by Dr. Jayant Murthy
- Studied on the evolution and nucleosysnthesis of O and B type stars and the effect of cosmic dust on scattering and star formation rates. Also worked on analysis of halos around bright stars and deriving inferences from them.

SWAN Antenna Design Challenge Jun'20 - Sep'20
IUCAA, India Mentored by Dr. T.R.Seshadri
- Designed and developed a novel broadband dual polarization antenna element suitable for astronomical observations at low radio frequencies for the SWAN initiative.

Fractals, chaos and their applications August'20
International Science Engagement Challenge Mentored by Andrés López Moreno
- Worked on an interdisciplinary project bridging key concepts of mathematics and physics like the relation between fractals, the Mandelbrot set and chaos theory. Simulated and classified stable and chaotic three body systems on MATLAB and python.

Talks and Posters

'Deep Learning techniques for spatio-temporal Super-Resolution reconstruction and how they can be extended to astronomy and astrophysics' [Talk]
- International Mechanical Engineering Congress & Exposition, ASME Nov'21
- The Canadian Astro-Particle Physics Summer Student Talk,
SNOLAB & Queen's University, Canada Aug'21

'Measure of biases in higher order precessing waveforms' [Poster]
NANOGrav Fall science meeting October 2021

'A study of Chaos in planar three body systems' [Poster]
Presision, Presidency University September 2020

Relevant Coursework

Curriculum: Classical and Quantum Mechanics, Electromagnetism, Statistical Mechanics and Condensed Matter Physics, Optics, Numerical and Computational methods, Atomic and Molecular Physics, Semiconductor Devices, Quantum Computing, Microwave Engineering, Laser and Instrumentation, Cosmology and Astrophysics

MOOCS: AstroTech, Data-driven Astronomy, Introduction into General Theory of Relativity, Statistical Mechanics: Algorithms and Computations, Particle Physics, Machine Learning

Skills

- Programming languages: Python, IDL/GDL, C++
- Operating systems: Linux, Windows, HPC architectures, CUDA
- Software: LaTeX, ds9, Git, COMSOL, MATLAB

Conferences and Workshops

- **Code/Astro 2022, CalTech** June'22
Package developed - PERISTOLE 10.5281/zenodo.6744000 (in progress)
- **NANOGrav Fall Science meeting** Oct'21
- **PyData Global 2021** Oct'21

- **Scipy 2021** July'21
- **EAS 2021 [Volunteer]** July'21
- **ESCAPE Summer School on Data Science for Astronomy, Astroparticle and Particle Physics** June'21
  ESFRI - European Strategy Forum on Research Infrastructures
- **Sokendai Asia winter school** Jan'21
  NAO, Japan
- **IV Joint ICTP-Trieste/ICTP-SAIFR School on Cosmology** Jan'21
  International Centre for Theoretical Physics
- **CfAO fall retreat** Oct'20
  Center for Adaptive optics, UCSC
- **Vienna Summer School on Gravitational Quantum Physics** Sep'20
  University of Vienna
- **Int'l Workshop on Astronomy and Relativistic Astrophysics** Sep'20
  University of Oklahoma

Unsupervised Projects

Heavy Element Nucleosynthesis in GW170817 July'20 - Oct'20
Investigating the evidence for neutron rich nucleosynthesis processes in the EM Data of GW170817 event using data from FERMI and cross correlating the data obtained from LIGO

Applying machine learning to CERN experiments April'20 - May'20
A chain of 5 mini-projects to infer from the data generated by CERN openlab available online. Used several ML algorithms for Z boson mass measurement, particle detection, detector optimization, rare decay search and electromagnetic shower search.

Radio Astronomy Data Analysis July'19 - Nov'19
Recorded observations of various radio sources in the sky (Cygnus A, The Sun etc.) using the SWAN Radio Telescope and analyzed the data. Worked on data analysis of observation of the Vela Pulsar.

Outreach and Mentoring

Mentor, *Major League Hacking* Jan. 2021 - present
- Appointed as a Mentor at Major League Hacking specializing in data science and analysis to help students in hackathons and in their projects

Mentor, *SPARE-DEPTH, Delhi Technological University* Dec. 2020 - present
- Mentoring sophomores and juniors on basic astronomy and astrophysics projects and courses

Outreach & Technical Communicator, *Vigyan Samagam, India* Feb. 2020
- Was involved with the LIGO-India project, the TMT and BARC's MACE telescope and coordinated logistics of public lectures