



Siddharth Dhanpal

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EDUCATION & ACHIEVEMENTS

Tata Institute of Fundamental Research, Mumbai
5th year, Ph.D.
Department of Astronomy and Astrophysics
Advisor - Dr. Shравan Hanasoge

August 2018 - Present

UM-DAE Centre for Excellence in Basic Sciences (UM-DAE-CBS)
Integrated M.Sc in Physics
Department of Physics
CGPA: 8.30

August 2013 - April 2018

Graduate Aptitude Test for Engineering (GATE) - Physics, 2019
All India Rank : 16

Joint Admission Test for M.Sc (JAM)., 2016
All India Rank : 53

Madhava Mathematics Competition - 2014
All India Rank : 7

Chennai Mathematical Institute
Undergraduate Entrance Examination, May 2014
Result: Selected

JEE-Advanced 2013 (Commonly called IIT-JEE)
All India Rank : 3323

FELLOWSHIPS AVAILED

- **Prime minister Fellowship** - This is a prestigious fellowship awarded by CII-SERB to an Industry - Academia (Intel labs - TIFR) project. ([Reference](#))
- Innovation in Science Pursuit for Inspired Research (INSPIRE) Fellow(2013-18).
- Indian Academy of Sciences –Summer Research Fellow-2016. Registration Number: PHYS1586-I

RESEARCH INTERESTS

Asteroseismology, Red-giants, Variable stars, Machine Learning, Artificial Intelligence

FINISHED PROJECTS

Asteroseismology

Measuring Frequency and Period Separations in Red-giant Stars Using Machine Learning: In this project, we have used deep learning to understand the structure of Red-giants from *Kepler* data. There are two parts in this project: (a) we modeled a generalized simulated training dataset using asymptotic theory which perfectly mimic the existing real star data. (b) We have developed a deep neural network to discern solar-like stars from noise and measure astero-seismic parameters $\Delta\nu$, ν_{max} and $\Delta\Pi$. We have discovered ~ 24 new red-giants in the *Kepler* catalogue. We observe that 90% of the predictions agree with existing studies to within 1.5% for $\Delta\nu$, 8% for $\Delta\Pi$, and 5% for ν_{max} . This technique can analyse 1000 stars in just $\sim 5s$ on a modern computer.

M.Sc

A consistency test of general relativity using different multipoles of gravitational radiation from binary black holes: In this project, I have developed a Bayesian implementation to check consistency between different multipole moments of a gravitational wave. We used the MCMC algorithm that extracts physical parameters (chirp mass M_c , mass ratio q etc.) independently and simultaneously from fundamental zeroth moment and higher moments to check consistency.

ONGOING PROJECTS

Asteroseismology

1. *Probing evanescent zone of Red-giants using deep learning:* The aim of the project is to understand the evolution of evanescent zone in Red-giants by measuring the coupling constant q of the stars. We will compare these measurements with theory of two cavity model (a p -mode and a g -mode cavity)
2. *Understanding angular momentum transport in Red-giant stars using Machine learning:* The goal of the project is to infer rotation profile of red-giant stars using neural networks and understand how it evolves. We will compare this evolution with Tayler-Spruit dynamo models.
3. *Detecting regularity in δ -Scuti stars using deep learning:* The goal of the project is to measure $\Delta\nu$ in δ -Scuti stars using deep learning. In these stars, we observe low-radial-order oscillations which don't follow a linear regularity. Therefore, a deep learning algorithm will be useful to identify asymptotic radial orders, measure $\Delta\nu$ and estimate age of the star.

LIST OF PUBLICATIONS

1. *Measuring Frequency and Period Separations in Red-giant Stars Using Machine Learning*
Dhanpal, S., Benomar, O., Hanasoge, S.M., Kundu, A., Dhuri, D., Das, D. & Kaul, B.
The Astrophysical Journal, 2022
DOI : [10.3847/1538-4357/ac5247](https://doi.org/10.3847/1538-4357/ac5247)
2. *A no-hair test for binary black holes*
Dhanpal, S., Ghosh, A., Mehta, A.K., Ajith, P., & Sathyaprakash, B.S.
Physical Review D, 2019
DOI: [10.1103/PhysRevD.99.104056](https://doi.org/10.1103/PhysRevD.99.104056)

SKILLS

Python, Mathematica, C++, Tensorflow API, Pytorch API, Linux, Working in HPC.

OTHER INTERESTS

- Community contribution: [Physics Stack Exchange](#)
- Chess: Rated 1250 on [chess.com](#).