

RESEARCH INTERESTS

- Time-Domain Astronomy
- Transients & Variable Stars
- Astrominformatics
- Data-intensive Astronomy

EDUCATION

Indian Institute of Science Education Research Bhopal

Bhopal, India

Integrated BS-MS in Physics

2017–2022 (expected)

Overall (160 Course Credits):

- 9.04/10 (Original Scale)
- 3.69/4 ([Scholaro's US Conversion](#))

Most Recent 60 Course Credits:

- 9.77/10 (Original Scale)
- 3.92/4 ([Scholaro's US Conversion](#))

RESEARCH EXPERIENCE

MS Thesis: Comparison of Distances for Light Curve Classification

IUCAA & Caltech

Advisors: Prof. Ashish Mahabal, Prof. Ajit Kembhavi and Prof. Sukanta Panda

Aug. 2021 –Present

- Researching new methods for separating ZTF light curves - by distance matrix analysis
- Classification: Creating median-based template for each class and comparing each test object's distance to this template. Prediction is based on minimum distance
- Outlier detection: Calculating the pair-wise distance between all light curves for a class. Light curves consistently having a large distance are marked as outliers
- Doing a comparative analysis of different metrics like Euclidean, Manhattan, Canberra, etc.
- Semester Report: [Click here](#)

Light Curve Feature Extraction

Laboratoire de Physique de Clermont

Advisor: Dr. Johann-Cohen Tanugi

May 2021 –July 2021

- Reorganized the curve fitting pipeline to make feature extraction quicker and more robust
- Worked on improving the feature extraction methods for REcommendation System for SPECTroscopic follow-up ([RESSPECT](#))
- Investigated the use of gaussian process variational autoencoders for feature extraction
- Collaborated as part of the Cosmostatistics Initiative (COIN)
- Report: github.com/siddharthchaini/Improving-Feature-Extraction-RESSPECT

Classification of Faint and Compact Galaxies, Stars and QSOs

IUCAA, Pune

Advisors: Prof. Ajit Kembhavi, Prof. Vivek M and Dr. Kaushal Sharma

Aug. 2020 –Feb. 2021

- Used machine learning for photometric classification of faint and compact sources from SDSS as galaxies, stars or quasars
- Developed a new neural network architecture which uses images as well as photometric parameters
- Created a custom compactness parameter to select training set
- Presented a poster on this work. Manuscript is in prep.

Photometric Classification of Simulated LSST Light Curves

IISER Bhopal

Course Project for DSE 301: Artificial Intelligence and its Scientific Applications

Feb. 2020 – June 2020

- Worked on a solution for the [PLAsTiCC Challenge](#) by implementing an ensemble of deep learning models to classify light curves of astronomical object
- Preprint: [arXiv: 2006.12333](#)
Code: github.com/siddharthchaini/Astronomical-Classification-PLASTICC

Thermodynamic Properties of Ice - A Monte Carlo Study

IISER Bhopal

Course Project for PHY 312: Numerical Methods and Programming

May 2020 – June 2020

- Implemented a Monte Carlo algorithm (Metropolis Hastings) to calculate the residual entropy of a two-dimensional lattice model of ice at various temperatures, and identify a phase transition
- Preprint: [arXiv: 2010.04964](#)
Code: github.com/siddharthchaini/ColdAsIce

Image Reduction and Photometry

IISER Bhopal

IISER Bhopal Astronomy Club: Student Research Group

Feb. 2019 – Present

- As the lead data analyst, worked on codes for image visualisation, image reduction and photometry
- Involved in setting up a Charged Coupled Device (CCD) at IISER Bhopal's observatory housing CGE Pro 1400 HD telescope

PUBLICATIONS, PREPRINTS AND THESES

- [1] **S. Chaini**, A. Mahabal, A. Kembhavi, and S. Panda, “A Comparison of Distance Metrics for Light Curve Classification”, M.S. thesis, IISER Bhopal, (*In Preparation*).
- [2] **S. Chaini**, A. Bagul, A. Deshpande, R. Gondkar, K. Sharma, M. Vivek, and A. Kembhavi, “Photometric classification of compact galaxies, stars and quasars using multiple neural networks”, (*In Preparation* - To be submitted to [MNRAS](#)).
- [3] **S. Chaini** and S. S. Kumar, “Astronomical Classification of Light Curves with an Ensemble of Gated Recurrent Units”, *arXiv:2006.12333 [astro-ph]*, Jul. 2020. [arXiv: 2006.12333 \[astro-ph\]](#).
- [4] T. Bhore, **S. Chaini**, S. Bachoti, V. Khade, and V. Patil, “Thermodynamic Properties of Ice: A Monte Carlo Study”, *arXiv:2010.04964 [cond-mat]*, Oct. 2020. [arXiv: 2010.04964 \[cond-mat\]](#).

POSTERS AND TALKS - PRESENTING AUTHOR

- Oral Thesis Presentation - IISER Bhopal - [Presentation/Report](#) November 2021
“Distance Metrics for Machine Learning in Time-Domain Astronomy”
- Poster Presentation - 2021 IAP colloquium - [Poster/Video](#) October 2021
“Photometric classification of compact galaxies, stars and quasars using multiple neural networks”

TEACHING EXPERIENCE

- **Teaching assistant, Lab assistant and Grader** at IISER Bhopal Jan. 2019 – May 2019
ECS 102 – Introduction to Programming

OUTREACH

- **Astronomy Club** at IISER Bhopal
 - Involved in organizing telescope viewing nights for the IISER Bhopal community
 - Involved in organizing programming tutorials on computational astronomy for IISER Bhopal students

ADDITIONAL RESPONSIBILITIES

- **Head of the Student Research Group** at IISER Bhopal Astronomy Club Aug. 2020 – Aug. 2021
In charge of group activities and data analysis - image reduction and CCD photometry

TECHNICAL SKILLS

Languages: Python, C, C++, Java, Wolfram Language, HTML, SQL, \LaTeX , Assembly Language, Bash
Libraries: Astropy, NumPy, Keras, TensorFlow, pandas, scikit-learn, Selenium, matplotlib, threading, qiskit
Software: Mathematica, SAOImage DS9, Aperture Photometry Tool
Developer Tools: Git, Jupyter, VS Code

OTHER PROJECTS

- Authorship Identification (HSS 322 Project, [Report](#))
 - Wrote a Python program to identify the author of an unknown text by analyzing n-gram frequencies
- Coupled Harmonic Oscillators and Neutrino Oscillations (PHY 206 Project, [Notebook](#))
 - Wrote Mathematica code to solve and simulate a coupled harmonic oscillator for modelling neutrino oscillations
- Call Data Record Analysis (Summer Internship - 2019, [Certificate](#))
 - Developed Python program for Madhya Pradesh Police to analyse criminal activity through call data records

ACHIEVEMENTS AND AWARDS

- [INSPIRE](#) Scholarship for Higher Education (SHE), DST, Government of India 2017–2022
(Amount: ₹300,000)
- Winner, Codeplay - IISER Bhopal's annual hackathon 2019
- Winner, [Model Solvay Conference](#) 2018 - Physics at IISER Bhopal 2018
- Governor's Gold Medal recipient, Hiranandani Foundation School 2015

SELECTED COURSEWORK

- **Physics and Astronomy**
 - Cosmology
 - General Relativity
 - Astronomy & Astrophysics
 - Quantum Mechanics, etc.
- **Mathematics**
 - Probability and Statistics
 - Linear Algebra
 - Calculus, etc.
- **Other**
 - Data Science and Machine Learning
 - Artificial Intelligence
 - Computational Linguistics
 - Atmospheric Science
 - Evolution of the Earth, etc.
- **Summer/Winter Schools**
 - [ZTF Summer School 2021](#)
 - Penn State University's [Summer School in Statistics for Astronomers](#)
 - MPCST, IIT Indore and IIA Bangalore's [2nd Winter School on Observational Astronomy](#)
 - IUCAA Pune's [Introductory Summer School in Astronomy & Astrophysics 2020](#)
- **Online Courses (Coursera)**
 - [Data Driven Astronomy](#)
 - [Algorithms I](#) by Stanford
 - [TensorFlow Specialisation](#)
 - [Applied Machine Learning](#)

Note: These are only a subset of all courses. A full list of courses with their certificates and gradesheets can be found [here](#).

REFERENCES

Prof. Ajit K. Kembhavi

Emeritus Professor,
Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune 4110017, India
akk@iucaa.in

Prof. Ashish Mahabal

Lead Computational Scientist,
California Institute of Technology, Pasadena, CA 91125, USA
aam@astro.caltech.edu

Dr. Johann Cohen-Tanugi

Directeur de Recherche CNRS,
Laboratoire Univers et Particules de Montpellier (LUPM), Montpellier Cedex 05, France
johann.cohen-tanugi@umontpellier.fr

Dr. Vivek M.

Assistant Professor,
Indian Institute of Astrophysics, Koramangala, Bengaluru 560034, India
vivek.m@iiap.res.in

EXTRACURRICULAR ACTIVITIES

- Football (Soccer)
I am passionate about football (soccer) and love to play as well as watch it.
- Computer Programming and FOSS
I am a programming enthusiast, and love learning about and implementing new algorithms, “automating the boring stuff” and developing software to speed up daily activities. I’m also an ardent supporter of free and open source software (FOSS).