Archana Purushothaman

Date of Birth: 31 March 1999 | **Nationality**: Indian | **Gender**: Female | **Mobile No**.: (+91) 9946927491 |
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➢ Publications

Peron, Morlino, Gabici, Amato, Purushothaman and Brusa: " On the correlation between young massive star clusters and gamma-ray unassociated sources", August 2024, APJ Letters, https://arxiv.org/abs/2408.04973

➢ Work Experience

20 SEP 2024 – Current BANGLORE, India — Supervisor(s) : Dr.Arkaprabha Sarangi
INTERN INDIAN INSTITUTE OF ASTROPHYSICS
-Investigated dust formation in core-collapse supernova progenitors, analyzing chemical abundances and their contribution to interstellar dust budgets.
-Utilized KEPLER and MESA stellar evolution models to study the impact of progenitor mass on dust production.

20 MAR 2023 – 20 JUL 2023 Paris, France — Supervisor(s) : Dr.Stefano Gabici, Dr. Marcella Brusa, Dr. Giada Peron
INTERN LABORATOIRE ASTROPARTICULE ET COSMOLOGIE (APC)–UNIVERSITÉ PARIS CITÉ
- Analyze the possibility of star clusters being Cosmic ray acceleration sites through their Gamma ray emissions using positional correlations between star clusters and unidentified gamma-ray sources.
-Performed spectral and morphological analysis of gamma-ray sources, confirming stellar winds as significant cosmic-ray accelerators and estimating their energetic properties.

20 FEB 2023 - 2 MAR 2023 Sicily, Italy — Supervisor(s) : Dr.Bruno Marano, Dr. Giuseppe Lete
INTERN INAF- OSSERVATORIO ASTROFISICO DI CATANIA
- Familiarizing with the operation of the new Astri-Horn prototype for the SST-2M telescope for CTAO.
- Assisting in data calibration, collection, post-processing and visualization of the data from Crab nebula.
- Interact and assist with the scientific and technical staff for observations.

➢ Education

SEPTEMBER 2021 – DECEMBER 2023 Bologna, Italy
MASTERS IN ASTROPHYSICS AND COSMOLOGY Alma Mater Studiorum - Università di Bologna, Italy

Final grade: 86/110 | *Number of credits*: 120 | *Thesis*: Star clusters as Gamma ray emitters

JULY 2017 – MARCH 2020 Thiruvananthapuram, Kerala, India
BACHELOR OF SCIENCE IN PHYSICS University of Kerala, India

Final grade: 7.747/ 10 | *Number of credits*: 120 |
Thesis: A study on the acoustic levitation of liquid droplets to simulate micro-gravity environments and influencing factors on the size of the droplet.

JUNE 2015 – MARCH 2017 Kollam, Kerala, India
HIGHER SECONDARY EXAMINATION - PHYSICS, CHEMISTRY, MATHEMATICS, COMPUTER SCIENCE

SVMMHSS, Vendar, Kottarakkara, Kerala, India
Final grade: 95.5 %

JUNE 2014 – MARCH 2015 Kollam, Kerala, India
SECONDARY SCHOOL LEAVING CERTIFICATE EXAMINATION MTHS for Girls, Pulamon,Kottarakkara, Kerala, India

Final grade: 9 A+, 1 A

➢ Projects

MARCH 2023 – DECEMBER 2023

Star clusters as Gamma ray emitters

- Analyzed multi-wavelength observational data (GAIA, WISE, Fermi-LAT) to identify star clusters as potential cosmic ray accelerators, using positional correlations and statistical techniques like Monte Carlo simulations.
- Performed spectral and morphological analysis of gamma-ray sources, confirming stellar winds as significant cosmic ray accelerators and estimating their energetic properties.
- Estimated Cosmic Ray Power and Gamma-ray Luminosities of star clusters, contributing to the understanding of the role of young stellar clusters as cosmic ray origins.

NOVEMBER 2019 – MARCH 2020

A study on the acoustic levitation of liquid droplets to simulate microgravity environments and influencing factors on the size of the droplet

- Designed and implemented an Arduino-controlled acoustic levitation setup to simulate microgravity environments for liquid droplets.
- Investigated the effects of density, volume, and frequency on levitation, conducting experiments with various liquids to analyze acoustic radiation pressure.
- Demonstrated the feasibility of acoustic levitation for cost-effective microgravity studies, providing an alternative to space-based experiments.

➢ Skills

Programming Languages & Development Tools: MATLAB, C++, Python, R, FORTRAN, Java, JavaScript, HTML, Scilab, Arduino IDE, Jupyter Notebook, Atom IDE
Astrophysics Software: CASA, DS9, XSpec, IRAF, TOPCAT, RMtools, HEASARC, CIAO
Python Libraries and Machine learning: FermiPy, GammaPy, Astropy, Scipy, Numpy, PySpark, PyTorch, TensorFlow, Scikit-Learn, Pandas
Data Processing & Analysis Skills: Data Reduction & Calibration, Spectroscopy, Astrometry, Photometry, Interferometry, Signal Processing, Image Analysis, Monte Carlo Methods, LaTeX
Data Visualization: Matplotlib, Seaborn, Plotly, Bokeh, Gnuplot, TOPCAT, Scikit-Image (for image visualization & processing)

➢ Certifications

Astrophysics & Programming

Data-driven Astronomy
Introduction to Data, Signal, and Image Analysis with MATLAB
Introduction to Programming with MATLAB
Manipulate Coulomb's Law Concepts using Wolfram Notebook
Quantum Sensing, Information Processing, and Computing

Machine Learning & AI

Deep Learning with PyTorch: Build an Auto-Encoder
The PyTorch Basics You Need to Start Your ML Projects
Machine Learning Pipelines with Azure ML Studio
Build a Machine Learning Image Classifier with Python
Natural Language Processing and Capstone Assignment

Statistical & Data Analysis

Bayesian Regression Modeling with rstanarm
Statistical Thinking in Python (Part 1 & 2)
Exploratory Data Analysis With Python and Pandas
Data Analysis Using PySpark

Software Development & Tools

Object-Oriented Programming with Java
Build a Machine Learning Web App with Streamlit and Python
Create Interactive Dashboards with Streamlit and Python

➢ References

Dr. Arkaprabha Sarangi | Assistant Professor | Indian Institute of Astrophysics (IIA), Bangalore, India |
Email: arkaprabha.sarangi@iiap.res.in

Dr. Marcella Brusa | Full Professor | Department of Physics and Astronomy "Augusto Righi", Alma Mater Studiorum - Università di Bologna, Italy | *E-mail* : marcella.brusa3@unibo.it

Dr. Stefano Gabici | Researcher |Laboratoire Astroparticule et Cosmologie (APC) – Université Paris Cité- CNRS-Paris,France | *Email* : gabici@apc.in2p3.fr

Dr. Giada Peron | Research fellow | INAF - Osservatorio Astrofisico di Arcetri, Florence, Italy |
Email : giada.peron@inaf.it