



1222-2022
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UNIVERSITÀ
DEGLI STUDI
DI PADOVA

PhD course of National Interest in Technologies for
Fundamental Research in Physics and Astrophysics

Annual report

Name and surname: Ambresh Mahanarayan Mishra
Cycle and a.a.: XL Cycle, A.Y. 2024/2025
Supervisor: Daniele Gardiol, Dario Barghini

• Research activity carried out during the year

My PhD research is focused on the **development of advanced technologies for multi-platform meteor observation from ground and space**. The main objective is to combine multi-technique observations optical imaging, radio scatter, infrasound, seismic detections, and satellite data into a **coherent and systematic framework**. This integration aims to improve the detection, classification, and trajectory modelling of meteors and fireballs.

During my **first year**, I have:

- Acquired hands-on experience in configuring and calibrating PRISMA cameras, including both newly installed and older stations. This provided me with technical expertise in astrometry calibration, source identification, and catalogue correlation.
- Processed several **PRISMA meteor events** using the pipeline. I carried out **astrometric and photometric reductions, trajectory determination, and dynamic modelling**.
- Analyzed **archival events** from the PRISMA optical network (2018 dataset). Out of 150 confirmed events, 15 were also detected by the infrasound network. I processed all events, distinguishing between **135 non-infrasound events** and **15 infrasound events** to explore the correlation of multi-sensor data.

Challenges encountered included:

- Handling incomplete or inconsistent calibration data for some older PRISMA stations. This required cross-checking archival calibrations and validating results with alternative cameras.
- A major limitation encountered this year was the relatively small number of meteor events detected in the infrasound network. As a result, it was not possible to establish a statistically significant correlation between optical and infrasound detections.

These difficulties were addressed by careful cross-validation, re-running problematic event reconstructions, and discussions with supervisors regarding robust calibration choices.



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- **List of attended courses and passed exams**

- **Advanced Scientific Programming in Matlab** – Passed (6 CFU)
- **Big Data Analysis in Python** – Passed (2.5 CFU)
- **Machine Learning for Physics** – Ongoing (3 CFU)
- **Adaptive Optics for Astronomy** – Ongoing (1.5 CFU)

- **List of attended conferences, workshops and schools, with mention of the presented talks**

- **PhD School “Francesco Lucchin” – Asiago 2025 (26–31 May 2025): *From the Solar System to High-Redshift Galaxies***
- **Scientific Communication in Astronomy School – 3rd edition (Bertinoro, 12–17 Oct 2025)**
- **Italian language course, Chieri (TO), 2025**

- **List of published papers/proceedings**

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- **Thesis title (even temporary)**

“Development of advanced technologies for multi-platform meteor observation from ground and space.”

Date, October 02, 2025


Signature...

Seen, the supervisor


