



UNIVERSITÀ
DEGLI STUDI
DI PADOVA

GammaRays4LIV-DM - Probing Dark Matter and Lorentz Invariance Violation through Synergistic Gamma-Ray Observations

The proposed research project aims to explore two fundamental questions in modern physics: the nature of Dark Matter (DM) and Lorentz Invariance Violation (LIV). DM remains one of the biggest mysteries in science, and Axion-like Particles (ALPs) are a promising candidate for this elusive matter. LIV, on the other hand, challenges one of the foundational principles of physics and could provide insights into quantum gravity. This project leverages the synergy between current and next-generation gamma-ray observatories, including MAGIC and the LST-1 telescope of the Cherenkov Telescope Array Observatory (CTAO), to explore these questions. It will use data from these observatories to conduct a search for ALPs, focusing on the gamma-ray emissions of blazars, which are ideal sources for such studies. This project will extend the exploration of the ALP parameter space, targeting regions that were previously unexplored. In addition, the low-energy sensitivity of LST-1 will enable unprecedented tests of LIV, using gamma-ray bursts (GRBs) to look for deviations in the speed of light at high energies. A key innovation in this project is the application of advanced statistical tools, particularly the Simulation-Based Inference (SBI) method, which will allow for more accurate and robust analysis of the data. Even if no signals are detected, the exclusion of key theoretical parameter values for ALPs and LIV will provide crucial insights, helping to refine or exclude existing models. This project also has broader implications beyond astrophysics. The methodologies developed, such as the application of machine learning techniques, have applications in other scientific fields, including climate modeling, and finance. Finally, the project offers valuable career development opportunities. Working closely with international collaborations such as MAGIC and CTAO will strengthen the researcher's academic profile and open doors for future funding opportunities.

UNIPD Supervisor: Michele Doro

MSCA Fellow: Giacomo D'Amico

Department: Physics And Astronomy "Galileo Galilei"

Coordinator: Università degli Studi di Padova (Italy)

Total EU Contribution: Euro 193.643,28

Call ID: HORIZON-MSCA-2024-PF-01

Project Duration in months: 24

Find out more: <https://cordis.europa.eu/projects/en>