



Annual report

Name and surname: *Salvatore Camposeo*

Cycle and a.a.: *39° cycle, report of 2nd year*

Supervisor: *N. Giglietto (INFN Bari), L. Di Venere (INFN Bari)*

- **Research activity carried out during the year**

Describe the aim of the project (very briefly), discuss the research activity carried out during the year mentioning the difficulties encountered until now and the actions taken to face them. 1 page max in total.

My PhD activity concerns high energy astrophysics, with a particular focus on

- 1) technological research for new gamma-ray space detectors and
- 2) indirect search for dark matter through data collected by existing gamma-ray telescopes. Both activities have been supported by HPC system provided by INFN Bari.

More specifically, the technological research is currently focused on ADAPT telescope (which is expected to fly over antarctic lands in 2026). In particular, in the 2nd year of my PhD, I have been simulating the production of scintillation photons inside this instrument, with the purpose of building an algorithm for reconstruction of the direction of secondary charged particles, which are expected to be produced by the incoming gamma-ray. In order to achieve this goal, a CsI calorimeter surrounded by two planes of wavelength-shifting fibers has been simulated in geant4 (a software which I have been trained for in the 1st PhD year).

The indirect search for dark matter has been performed by analyzing data collected by FermiLAT regarding Jupiter. It is a massive and cold body which could have cumulated a lot of dark matter particles in its core. A possible gamma-ray signal from Jupiter (in particular if it was an emission line) would be a solid proof of dark matter annihilation. Unfortunately, no gamma-ray signal has been detected from Jupiter, but upper limits on flux can provide constraints on cross section for dark matter – nucleon interaction.

In the 2nd year of my PhD, in order to compute these constraints, a detailed research has been carried about all possible gamma-ray emission channels following annihilation between dark matter particles. ADAPT telescope and its successor APT have, among their scopes, the indirect search for dark matter, thanks to their (expected) high sensivity to MeV gamma-rays.



1222 • 2022
800
A N N I



UNIVERSITÀ
DEGLI STUDI
DI PADOVA

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

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

- High-energy particle physics detectors in Space (S. Loporchio)
EXAM PASSED DURING 1st YEAR
- New Technologies for Cherenkov telescopes (S. Loporchio)
EXAM PASSED DURING 1st YEAR
- Scintillators and Silicon Photomultipliers (E. Bissaldi)
EXAM PASSED DURING 1st YEAR
- Simulation of optical photon propagation for generic scintillator-based detectors (D. Serini)
EXAM PASSED DURING 2nd YEAR (November 2025)
- Evolution of galaxies and AGN at high redshift (F. Ricci) ← external course (approved)
EXAM PASSED DURING 2nd YEAR (March 2025)

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

- 5th GRAVIGAMMA Workshop (Bari, 9-11 October 2024)
- PhD school of TECH-FPA doctorate (Padova, 17-21 February 2025)
- 2nd VHEGAM Meeting (Bari, 26-28 May 2025)
Presented talk: "Search for gamma-ray emission from Jupiter with 15 years of Fermi-LAT data"
- ISAPP25 School (Lecce, 9-20 June 2025)
Presented poster: "Current and future perspectives of indirect search for dark matter"
- Conference "Astrophysics and Space Science in Marche II" (Camerino, 1-5 September 2025)
Presented talk: "Indirect search for dark matter by looking at Jupiter"
- Conference of Italian Society of Physics (Palermo, 22-26 September 2025)
- International School "Francesco Romano" (Monopoli, 28 September – 5 October 2025)



1222 • 2022
800
ANNI



UNIVERSITÀ
DEGLI STUDI
DI PADOVA

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

- **List of published papers/proceedings**

- S. Camposo: *A new deepening of mass-radius empirical relation for main sequence stars*,
EmergingScientist vol.9 (2025), DOI: 10.1051/emsci/2025001

- **Thesis title (even temporary)**

*"Current and future perspectives of indirect search for dark matter from solar
system objects"*

Date ...

25/8/25

Seen, the supervisor

Signature...