

Project: TITAN – Frugal Artificial Intelligence and Application in Astrophysics. An ERA Chair HORIZON EUROPE grant funded by the EU.

Position: Ph.D. student position

Start date: September 1st, 2023

Duration: 3 years with possibility of extension

Salary: 15.000-17.000 €/year (gross income depending on family status)



Description Weak Lensing Mass Mapping: Weak gravitational lensing is one of the most promising tools of cosmology offering insights into the evolution of dark-matter structures, as well as helping distinguish between dark energy and models of modified gravity through the generation of two-dimensional mass maps. While small-field mass maps have been frequently used to study the structure and mass distribution of galaxy clusters, wide-field maps have only recently become possible given the broad observing strategies of surveys like CFHTLenS, HSC, DES, UNIONS, and KiDS.

Standard methods for deriving mass maps from weak-lensing observations (e.g. Kaiser & Squires) require smoothing which leads to small-scale information loss, while alternative versions (e.g. GLIMPSE/MCALens) based on sparse reconstruction address some of these issues. In the past few years, promising mass map recovery techniques have emerged exploiting (deep) machine learning.

Within this project, we seek one PhD student who will develop novel data-driven approaches for the robust reconstruction of weak-lensing mass maps in different redshift bins, which will offer uncertainty quantification, as well as the extension of these methods to the sphere. Emphasis will be given to the analysis of large-scale datasets, including ones acquired by the Euclid satellite, to be launched in 2023, which will observe the sky in the optical and infrared. The goal is to be able to map large-scale structures and weak-lensing distortions out to high redshifts, targeting the reconstruction of dark matter mass maps over 15000 square degrees.

The doctoral student will be located at the premises of FORTH with a strong collaboration with the CosmoStat Laboratory at CEA Saclay. The doctoral student will be supervised by [Jean-Luc Starck](#) (FORTH/CEA), [Panagiotis Tsakalides](#) (FORTH), and [Martin Kilbinger](#) (CEA, France)

Required qualifications:

- BSc and MSc in Physics, Computer Science, or a related field
- Good Knowledge of English
- Willingness and ability to work cooperatively within a team, to learn, and to adapt to the project
- Physical presence at FORTH, Heraklion, Crete for the duration of the position

Desired qualifications:

- Experience with the analysis of weak lensing data
- Experience with Euclid simulation data

FORTH is the largest and most prestigious research center in Greece with modern facilities and highly qualified personnel. It comprises ten research institutes located throughout Greece. The Institute of Computer Science ([FORTH-ICS](#)) and the Institute of Astrophysics ([FORTH-IA](#)) are located in the main campus, around 5km south of Heraklion on the island of Crete, Greece. Members from both FORTH-ICS and FORTH-IA are involved in the TITAN project. The group is committed to diversity and equality, encourages applications from women and underrepresented minorities, and supports a flexible and family-friendly work environment. Benefits for this position include retirement, health care, and parental leave. [CEA Paris-Saclay](#) is located 20 km south of Paris, France, near various universities and other research centers. The CosmoStat group is a diverse and multi-disciplinary team of researchers working on various topics in cosmology and data science.



Learning, Research, Innovation

Interested candidates are invited to communicate with J.-L. Starck jstarck@cea.fr and P. Tsakalides tsakalid@ics.forth.gr, sending a cover letter, their CV, and 2 recommendation letters by **November 15, 2022**.