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

Position: Post-doctoral researcher
Start date: Any date within the first semester of 2023
Duration: 2 years with possibility of extension
Salary: 45.000-50.000 €/year (gross income depending on family status)

Description **Radio Weak Lensing:** Radio-astronomy is entering the golden age, with new sensitive instruments such as LOFAR, LWA, and SKA, providing opportunities to study the close and distant universe. Radio Weak Lensing is an emerging field where galaxy shapes are extracted from radio interferometric measurements to perform cosmological studies. Image formation from radio instruments requires the reconstruction from a subset of Fourier components. Given the restored images, the challenge lies in detecting sources and deriving their electromagnetic spectrum in very large images (up to 10k x 10k pixels), while taking into account direction dependent effects.

Recent breakthroughs in computational models such as sparse theory, compressed sensing theory, and deep learning, have made a significant impact. However, state-of-the-art approaches based on regularization cannot identify the shapes of galaxies with sufficient accuracy, while approaches that fit models to galaxies directly on the visibilities become problematic in dense regions, since visibilities encode global spatial information while preventing the use of available shape measurements from optical images. The project TITAN, funded under HORIZON-WIDERA-2022-TALENTS-01 aims to address these challenges by developing cutting-edge frameworks based on advanced signal processing and (deep) machine learning, capable of analyzing large observation datasets.

Within this project, we seek one Postdoctoral Researcher who will explore the introduction of weak lensing-specific constraints in deep learning models that prevent galaxy shape distortions, extending paradigms from optical methodologies to the radio domain. The effort will focus on large-scale reconstruction algorithms able to optimize the measurement of shape parameters from SKA interferometry through the coupling of deep-learning-based image priors with geometric shape regularization. The post-doctoral researcher will be located at the premises of FORTH with a strong collaboration with the CosmoStat Laboratory at CEA Saclay. The post-doctoral researcher will be advised by Jean-Luc Starck (FORTH/CEA), Francois Lanusse (CEA), and Panagiotis Tsakalides (FORTH).

Required qualifications:
- Ph.D. in Astrophysics, Computer Science, or related field
- Experience with the analysis of radio astronomy data
- Publications in related fields
- Working experience in related European and/or national R&D projects

Desired qualifications:
- Experience with SKA-model observations
- Experience with weak lensing models
- Decision-making and representation of the team at national and international levels

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 and their CV by **November 15, 2022**.