

## Multi-messenger astronomy with neutrino telescopes

### *Research Project / Research Group Description:*

Neutrino telescopes are a fundamental player in the increasingly-rich field of multi-messenger astronomy. The combination of experimental efforts to study the Cosmos has historically boosted our knowledge of it. This effort has now been strengthened with two experimental techniques that have entered a mature stage: neutrino astronomy and gravitational waves. The high-energy neutrino signals detected by IceCube or the recent observation of a neutron star merger in different channels (gravitational waves, optical, X-rays, etc.) are just a starting point to understand fundamental questions in astrophysics like the origin of cosmic rays or the mechanisms under the most catastrophic events in the Universe. KM3NeT, successor of ANTARES, is the perfect tool to move forward, thanks to its size, target medium and location.

The ANTARES/KM3NeT research team at IFIC has a long experience in undersea neutrino telescopes, where it is involved in a variety of tasks. The group has built and operated the time calibration system based on optical beacons. It has led the search for neutrino point sources in ANTARES and is presently deeply involved in the indirect search for dark matter using cosmic neutrinos. The team participates also in the KM3NeT telescope which is being deployed in the Mediterranean Sea. Members of the IFIC group have relevant coordination responsibilities in both collaborations

### *Job position description:*

We propose the following research topics in field of neutrino telescopes in the context of multi-messenger astronomy:

#### ANTARES:

- Search for point source of cosmic neutrinos using the whole sample of the ANTARES detector (2007-2018).

#### KM3NeT:

- Study of the sensitivity of KM3NeT to search for neutrino point sources.
- Study of correlations of KM3NeT events with data from other detectors (gamma-rays, X-rays, optical, ultra-high energy cosmic rays, gravitational waves).
- Contributions to the development of an early-alert system to trigger observations in other detectors

In addition, the student will also contribute to the time calibration of the KM3NeT telescope.

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Research project/Research Group website

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