

## Astroparticle and High Energy Physics

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

The Higgs boson discovery at CERN and the recent Nobel prize for the discovery of neutrino oscillations mark the start of a new era in particle physics. Boosted by these achievements and by the expectation of new discoveries in the near future, we propose an interdisciplinary research program covering:

#### 1. Neutrino properties: laboratory and astrophysics.

Neutrino oscillation studies, with emphasis on CP violation and the mass hierarchy to be determined by upcoming oscillation experiments. To gain insight on the origin of neutrino mass, sub-leading effects will be studied.

#### 2. Neutrino masses, origin and implications.

Theoretical models of neutrino mass generation based on new symmetries, and their implications at the LHC and other experiments. We will consider high and low-scale seesaw-type schemes for Majorana and Dirac neutrinos as well as radiative models.

#### 3. New physics at the Large Hadron Collider after the Higgs boson.

Gauge and/or supersymmetric extensions of the Standard Model, as well as new ideas such as extra dimensions will be confronted with experiments, with emphasis on new signals such as those associated to lepton number and lepton flavor violation.

#### 4. Particle cosmology.

Including leptogenesis, dark matter and inflation with emphasis on their connection with neutrino physics. Cosmological bounds on neutrino properties. Dark matter studies, relic density, direct, indirect and collider searches.

### *Job position description:*

The proposed PhD training includes the active participation in summer schools, such as those organized by the ISAPP (International School on AstroParticle Physics) network. The PhD fellow will benefit from the wide research and training experience not only of the local AHEP staff, but also of its postdocs, with enough experience to contribute to the technical training of the PhD students. Moreover the fellow is expected to join the groups' rich network of external collaborators which adds to its lively research atmosphere, contributing positively to the high productivity and maturity of the PhD fellows. Exchanges with high level invited researchers has also been a key feature of our past experience, with a large number of PhD theses prepared at our group over the years. The successful candidate is expected to master the analytical and numerical tools required for the work and to take up all relevant duties needed to develop a high quality PhD. Previous interview is recommended.

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Research project/Research Group website

<https://www.astroparticles.es>



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