Flavor symmetries and new physics beyond the Standard Model

Research Project / Research Group Description:
The flavor problem, the existence of three copies of matter fields with different masses and mixing angles, remains one of the most important open question in fundamental physics nowadays.

The physics responsible for these flavor structures is not contained in the Standard Model. However, we hope that collider experiments, together with lower energies precision experiments, like neutrino physics or flavor changing neutral currents in the lepton and quark sectors, will provide new data to determine the mechanism responsible for them and help us to solve the flavor puzzle.

The leptonic sector and the generation of neutrino masses are perhaps the best scenario where clues on the mechanism responsible for the origin of flavor may be found. If the seesaw mechanism is responsible for the smallness of neutrino masses, we can export the same idea to the charged fermion sector through a Froggatt-Nielsen mechanism. Then, the structure of neutrino masses and mixings could be a direct link to the mechanism responsible of flavor. Moreover, lepton flavor violation processes are especially sensitive to flavor dependent interactions at high scales and we expect results in the near future experiments.

In addition, direct searches of physics beyond the Standard Model at the LHC and future colliders should also provide a lot of flavor information when this new physics is found, and this data would help us to determine the origin of flavor.

Our group at IFIC in Valencia has experience in all these different topics: flavor physics, neutrino phenomenology, extensions of the SM, collider searches, etc. We have stable collaborations with experts from foreign institutions which participate actively in the project. In particular, this project would benefit from present collaborations with Italian, Portuguese and British Universities. Moreover, the presence of several PhD students and postdoctoral researchers working in our group will help the integration of the student.

Job position description:
The candidate will develop his research under the supervision of the group leader and, possibly, other member of the Elementary Particles group or our foreign collaborators, and in collaboration with other local researchers, postdocs and students.

The candidate will learn different topics in flavor symmetries, extensions of the Standard Model, collider phenomenology, precision experiments and astroparticle/cosmological implications.

The project will require both to build flavor symmetries to explain the observed flavor structures in the Standard Model and then to calculate different phenomenological observables in different extensions of the Standard Model that will allow us to confirm or discard the proposed model.

She/he should have a good basis in quantum field theory, relativity and elementary particles.

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Research project/Research Group website
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