Heavy quarkonia above open-flavor meson-meson thresholds: description from QCD based quark models

Research Project / Research Group Description:
Since 2003, with the discovery of the X(3872) charmonium resonance, other unconventional charmonium states have been discovered. The explanation of these new states, all lying above or close below open-flavor meson-meson thresholds, not fitting in any known conventional theoretical description, is a current challenge in heavy quark physics.

From available results obtained from QCD approaches, in particular lattice QCD, nonrelativistic quark models for the treatment of these new heavy quarkonia states can be built. The resulting quark-antiquark effective potential interaction looks like a conventional Cornell one but modulated by energy thresholds. Previous calculations performed with these new kind of models suggest that they could give account of masses and transition properties below and above thresholds allowing for a universal description of heavy quarkonia [1,2].

The purpose of the research project would be the development of new models and their application to the study of heavy quarkonia spectroscopy as well as of strong, electromagnetic and weak decays. This study is particularly relevant at present given the tremendous amount of data that will be produced by the LHCb collaboration at the LHC in the next few years.

[1] P. González, J.Phys. G 41, 095001 (2014).
[2] P. González, Phys. Rev. D 92, 014017 (2015).

Job position description:
The researcher would join a consolidated Research Team, formed by four permanent scientists and two postdoctoral fellows, and would work in collaboration with different members.

This group has produced in the past 14 Ph.D. thesis, numerous master thesis and graduation thesis and has supervised more than 8 postdoctoral fellows. The researcher would be required to have good knowledge of Quantum Mechanics and Quantum Field Theory, some basic knowledge of Particle Physics and Nuclear Physics Phenomenology and basic knowledge on the Standard Model of the fundamental interactions. It is also important that he has some experience in numerical analysis, computer programming and analytic computer programming.

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