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From Rare Events to Cosmic Correlations: Computational Developments at CAPA

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The Center for Astroparticles and High Energy Physics (CAPA), recently recognized as Research Institute of the University of Zaragoza, is an interdisciplinary research group encompassing high-energy, nuclear and particle physics, as well as astrophysics, cosmology, astroparticles, theoretical physics, and the related technological developments. Progress in these research areas poses new challenges requiring the implementation of cutting-edge computational techniques and the use of specialized software for the analysis, reconstruction, and selection of complex physical events.
This talk will provide an overview of the activities carried out at CAPA in this context, with particular emphasis on the use of machine learning techniques, digital signal processing, and the implementation of advanced algorithms in dedicated hardware. These activities include, among other aspects, trajectory and topology analysis, event classification, and background suppression in rare-event detectors (scintillators, gaseous and liquid TPCs, among others), as well as the application of machine learning to the exploration of correlations in astroparticle experiments aimed at the search for new physics beyond the Standard Model.

Abstract

Primary author(s) : GÓMEZ MALUENDA, Héctor (Universidad de Zaragoza)

Presenter(s) : GÓMEZ MALUENDA, Héctor (Universidad de Zaragoza)

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