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Cosmic-Ray Interactions in Pulsar Magnetospheres

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Gamma-ray observations have established that pulsar magnetospheres are efficient accelerators of electrons and positrons. Analytical models and numerical simulations further suggest that a fraction of a pulsar's rotational energy can be converted into the acceleration of cosmic rays, positioning pulsars as potential contributors to the Galactic cosmic-ray population. However, direct observational evidence of hadronic acceleration within these environments remains elusive. In this talk, we present recent advances toward a self-consistent modeling of the radiation fields in pulsar magnetospheres, with the goal of predicting secondary signals arising from the interactions of accelerated cosmic rays with these fields. We focus in particular on the production of high-energy neutrinos, which are especially compelling in light of recent IceCube observations indicating a high-energy neutrino signal from the Galactic plane. We assess the detectability of these signals with current and upcoming neutrino observatories, highlighting the potential of KM3NeT.

Primary author(s) : GUÉPIN DETRIGNE, Claire (CNRS, LUPM); Dr. DECOENE, Valentin (Subatech, CNRS, Université de Nantes)

Presenter(s) : GUÉPIN DETRIGNE, Claire (CNRS, LUPM)

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