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Chasing the cosmic accelerators with high energy astroparticles

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The advent of time-domain and multimessenger astronomy opens new perspectives to study the most energetic phenomena of our universe, and identify the mysterious sources of ultra-high-energy cosmic rays and high-energy neutrinos. In my thesis, I developed new analytical and numerical tools to study the production of cosmic rays, gamma rays and neutrinos from various populations of energetic sources. A general criteria for the detectability of neutrino flares allow us to identify promising sources for multimessenger emissions, namely pulsars and tidal disruption events. We demonstrate that millisecond pulsars can produce high-energy cosmic rays and, in the Galactic center region, the gamma rays observed by the H.E.S.S. observatory. Moreover, we show that an extragalactic population of tidal disruption events can produce the ultra-high-energy cosmic rays detected by the Pierre Auger observatory. Finally, I contribute to the development of novel methods to detect and reconstruct the properties of ultra-high-energy cosmic rays and neutrinos in the collaborations GRAND and POEMMA.

Language

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