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Limits on photon fluxes from data of the Pierre Auger Observatory and implications on super-heavy dark matter

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The first interactions of photon-induced showers are of electromagnetic nature, and the transfer of energy to the hadron/muon channel is reduced with respect to the bulk of hadron-induced showers. This results in a lower number of secondary muons. Additionally, as the development of photon showers is delayed by the typically small multiplicity of electromagnetic interactions, their maximum of shower development is deeper in the atmosphere than for showers initiated by hadrons. These salient features have enabled searches for photon showers at the Pierre Auger Observatory that will be summarized. They have led to stringent upper limits on photon fluxes over four orders in magnitude in energy. Not only these limits are of considerable astrophysical interest, but they also allow us to constrain beyond-standard-physics scenarios. For instance, dark matter particles could be superheavy, provided their lifetime is much longer than the age of the universe. Constraints on specific extensions of the Standard Model of particle physics that meet the lifetime requirement for a superheavy particle will be presented. They include limits on instanton strength as well as on mixing angle between active and sterile neutrinos.

Primary author: DELIGNY, Olivier (CNRS/IN2P3 - IPN Orsay)

Presenter: DELIGNY, Olivier (CNRS/IN2P3 - IPN Orsay)

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