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Compton-induced cascade γ-rays in radio galaxy NGC 1275.

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Abstract

Among active galactic nuclei (AGNi), blazars are the brightest emitters of high- (HE, $E \geq 100$ \,MeV) to very-high-energy (VHE, $E \geq 100$ \,GeV) γ-rays from their jets. Radio galaxies, being the misaligned parent population of the blazar class, were historically not observed at these frequencies. However, there is a growing number of radio galaxies detected in HE–VHE γ-rays in recent years. In this work, we leverage and refine a Monte-Carlo photon and electron-positron (e$^\pm$) pair tracking code in the AGN environment of the radio galaxy NGC 1275. In the code, we consider the isotropic broad emission line and anisotropic Shakura-Sunyaev (SS) accretion disk radiation fields, with mild magnetic fields in the AGN environment. We find that cascade γ-rays from inverse-Compton scattering by relativistic e$^\pm$ pairs of these external radiation fields can explain the \emph{Fermi} Large Area Telescope's (LAT) and Major Atmospheric Cherenkov Experiment (MACE) observations from the radio galaxy NGC 1275. We present a set of plausible parameters obtained from the code by fitting the source's spectral energy distribution (SED) during flaring events reported in the period December 2022 to January 2023.