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Compton-induced γ-ray cascade emissions in radio galaxy NGC 1275.

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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, advances in experiments and observatories have led to their detections in the HE–VHE γ-ray band. 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 (BLR) 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.

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