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Evidence for inverse Compton emission from globular clusters

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The Fermi-LAT has detected gamma rays from dozens of globular clusters. The millisecond pulsars hosted by the globular clusters are very likely the primary source of them. However, the relative contributions between the curvature radiation from millisecond pulsar magnetospheres and inverse Compton emission from relativistic e± launched into the globular cluster environment have long been unclear. In this contribution, I will present the result for searching inverse Compton emission in 8-year Fermi-LAT data from the directions of 157 Milky Way globular clusters. We find a mildly statistically significant (3.8σ) correlation between the measured globular cluster gamma-ray luminosities and their photon field energy densities. However, this may also be explained by a hidden correlation between the photon field densities and the stellar encounter rates of globular clusters. We also find two components in the gamma-ray spectra of globular clusters: i) an exponentially cut-off power law and ii) a pure power law. We uncover the latter component at a significance of 8.2σ and inverse Compton emission by the relativistic e± injected by millisecond pulsars naturally explains it. We find the luminosity of this power-law component is comparable to, or slightly smaller than, the luminosity of the curved component, suggesting the fraction of millisecond pulsar spin-down luminosity into relativistic e± is similar to the fraction of the spin-down luminosity into prompt magnetospheric radiation.

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