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Modelling the soft-photon energy density of globular clusters

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Abstract content
   (Max 300 words)

Recent observations by e.g. Fermi LAT and H.E.S.S. have revealed globular clusters to be sources of high-energy and very-high-energy gamma rays. It has been suggested that the presence of large numbers of millisecond pulsars (MSPs) within these clusters may be directly or indirectly responsible for these gamma-ray fluxes. The MSPs inject relativistic leptons into the cluster, where they are plausibly reaccelerated in shocks created by collision of stellar winds, before interacting with the soft-photon radiation field set up by the stellar population of the host cluster. Inverse Compton (IC) scattering then produces gamma-ray radiation in the TeV band. In order to calculate the IC-spectrum, however, an accurate profile for the energy density of the soft-photon field is required. We attempted to construct such a profile by deriving a radially-dependent expression for the stellar energy density, and then solving it numerically for different sets of cluster and stellar parameters. As a next step, the average energy density values for different regions of the cluster (demarcated by its core, half-mass, and tidal radii) are determined, which we consequently import into an existing radiation code to predict the TeV gamma-ray spectrum. As an application, we consider the case of Terzan 5, boasting a population of 33 radio MSPs, and compare our predicted spectrum with that recently measured by H.E.S.S. We lastly comment on the possibility of constraining the actual cluster MSP and stellar population sizes, using the combination of H.E.S.S. and Fermi LAT data.

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