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Exploring NGC 3603 non-thermal emission through a realistic modelling of its environment

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Many star-forming regions have been detected in the gamma-ray band in recent years and are gaining a lot of interest as possible contributors to the Galactic hadronic cosmic-ray sea. However, not much emphasis has been put so far in the contribution of cosmic-ray electrons to their gamma-ray emission.

In our presentation we develop a novel approach to investigate the origin of the gamma-ray emission in star-forming regions. We build realistic observationally based models of the gas and radiation distribution on cluster resolution that allow us to obtain accurate results on the morphology of the gamma-ray source. Focusing on the young and massive star cluster NGC 3603 in particular, we introduce these target materials and fields to the CR propagation code PICARD, perform transport simulations and calculate the non-thermal broadband emission. We compare to results from a dedicated Fermi-LAT reanalysis of the source and other available mutiwavelength data. We show that both a purely hadronic and a purely leptonic injection of cosmic rays are disfavoured. A mixture of injected CR electrons and protons is required to explain the origin of the observed non-thermal emission of this system.

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