



Contribution ID: 202

Type: **Poster**

Impact of a discrete distribution of cosmic-ray sources on the Galactic gamma-ray emission at VHE

Friday, 15 December 2023 15:44 (1 minute)

We present our new model for the description of the PeV – TeV Galactic gamma-ray emission assuming discrete distributions of cosmic-ray sources. Based on this model, we investigate the impact of the discreteness of the locations of the cosmic-ray sources and of the diffusion mechanism responsible for the propagation of cosmic rays on the morphology of the VHE Galactic diffuse gamma-ray emission. We notably find that at VHE the gamma-ray flux tends to be more clumpy and deviates from the distribution of the interstellar gas, especially for configurations for which only a small subset of all the cosmic-ray sources are PeVatrons. We also discuss the detectability of hadronic PeVatrons in our Galaxy and elaborate a possible interpretation of their number compatible with the latest observations. Finally, we constrain the fraction of Galactic cosmic-ray sources that are PeVatrons depending on the diffusion mechanism responsible for their propagation.

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Session Classification: Poster