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Simulation of diffusive particle propagation and related TeV γ-ray emission at the Galactic Center

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Observations of the Galactic Center with the H.E.S.S. instrument have led to the detection of an extended region of diffuse TeV γ-ray emission.
The origin of this emission is not yet fully understood, although the spatial correlation between the density distribution of giant molecular clouds located at the center of our Galaxy and the intensity of the observed γ-ray excess points towards a hadronic production scenario.

The energy amount required to accelerate charged hadrons producing a γ-ray emission as observed could have been delivered by a single supernova explosion.
Assuming that highly energetic particles have been released by a single central source, we analyzed if the diffusion of relativistic hadrons is fast enough to produce an extended TeV emission through interactions with ambient matter as observed.

We numerically analyzed charged-particle motion in turbulent magnetic fields with regard to the environmental conditions of the Galactic Center region.
We present diffusion coefficients derived from a statistical analysis of the tracking of ensembles of particles in such a turbulent environment.
The derived diffusion coefficients were used to simulate the diffuse γ-ray emission from the Galactic Center region via a discretization of the diffusion equation.
The results of this modeling are presented and compared to the H.E.S.S. measurement, including both spectral and morphological analysis.

Collaboration

– not specified –

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