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Constraining positron emission from pulsars with AMS-02 data

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The cosmic-ray flux of positrons is measured with high precision by the space-borne particle spectrometers AMS-02. The hypothesis that pulsar wind nebulae (PWNe) can significantly contribute to the excess of the positron (e^+) cosmic-ray flux has been consolidated after the observation of a γ-ray emission at TeV energies of a few degree size around Geminga and Monogem PWNe. In this work we simulate pulsars populations adopting different distributions for the position in the Galaxy, the age, the spin-down period and the surface magnetic field of the sources, to overcome the incompleteness of the ATNF catalogue. We fit the AMS-02 data with the positron flux produced by these simulated populations, in order to constrain the values of the efficiency η and spectral index γ of the injectum spectrum of PWNe and to test different configurations of our Galaxy. We adopt a new parametrization of the two-zone diffusion model for the propagation of e^+ accelerated by the Galactic population of PWNe, with the diffusion around these PWNe suppressed by two orders of magnitude with respect to the average in the Galaxy. The attempt of obtaining information about PWNe from the analysis of the AMS-02 e^+ data, which facilitate the search for point sources or new physics with respect to the matter component, has never been performed with this level of accuracy.

Keywords

AMS-02; Particle acceleration; astrophysical sources; high energy physics; lepton; cosmic ray flux;

Collaboration

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Subcategory

Theoretical Results

Primary author: ORUSA, Luca

Co-authors: DI MAURO, MATTIA (INFN TORINO); MANCONI, Silvia (University of Turin and INFN Turin); Prof. DONATO, Fiorenza

Presenter: ORUSA, Luca

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