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Pulsars do not produce sharp spectral features in the cosmic-ray positron flux

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Pulsars dominate the local cosmic-ray positron flux at high energies by producing electron-positron pairs from their spindown energy. While the AMS-02 experiment, that measures the cosmic-ray flux to great precision, shows that the positron flux is very smooth, simple simulations of pulsar models predict sharp spectral features. In this work, we add several mechanisms to model the local positron flux more realistically. Specifically, we implement a more realistic positron production mechanism of the pulsars, and take into account various effects on the energy losses of the positrons as they propagate through the Galaxy. Our models show that the sharp spectral features predicted by the simple models vanish, which is consistent with the observed smoothness of the local cosmic-ray positron flux. This re-opens the possibility that sharp spectral features in the cosmic-ray positron flux could provide strong evidence of dark matter annihilation.

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