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New determination of the production cross section for secondary positrons and electrons in the Galaxy

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The cosmic-ray fluxes of electrons and positrons ($e^{\pm}$) are measured with high precision by the space-borne particle spectrometer AMS-02. To infer a precise interpretation of the production processes for $e^{\pm}$ in our Galaxy, it is necessary to have an accurate description of the secondary component, produced by the interaction of cosmic-ray proton and helium with the interstellar medium atoms.
We determine new analytical functions of the Lorentz invariant cross section for the production of $\pi^{\pm}$ and $K^{\pm}$ by fitting data from collider experiments. We also evaluate the invariant
cross sections for several other channels, involving for example hyperon decays, contributing at the few % level on the total cross section.
For all these particles, the relevant 2 and 3 body decay channels are implemented, with the polarized $\mu^{\pm}$ decay computed with next-to-leading order corrections.
The cross section for scattering of nuclei heavier than protons is modeled by fitting data on $p + C$ collisions.
The total differential cross section $d\sigma/dT_{e^{\pm}}(p + p \rightarrow e^{\pm} + X)$ is predicted from 10 MeV up to 10 TeV of $e^{\pm}$ energy with an uncertainty of about 5-7 % in the energies relevant for AMS-02 positron flux, thus dramatically reducing the precision of the theoretical model with respect to the state of the art.
Finally, we provide a prediction for the secondary Galactic $e^{\pm}$ source spectrum with an uncertainty of the same level.
As a service for the scientific community, we provide numerical tables and a script to calculate energy-differential cross sections.

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