New cross section determination for secondary cosmic ray electrons and positrons in the light of new data from collider experiments

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During the last decades, the space-based spectrometers like AMS-02 have performed unprecedented precise measurements of the cosmic ray (CR) fluxes. In the lepton component, it is generally established that a large part of $e^{\pm}$ in our Galaxy is produced by the interaction of CRs with the interstellar medium (ISM), conventionally called secondary production. The dominant contribution to the secondary flux comes from the proton-proton (pp) channel, namely CR proton on ISM hydrogen, and either the CR projectile or the ISM target replaced by helium (Hep, pHe, and HeHe). The energy-differential cross sections of $e^{\pm}$, that are mainly generated from the decay of pion ($\pi^{\pm}$) and kaons($K^{\pm}$) produced in these collisions, enter in the secondary source term calculation. In this work we follow the strategy of finding an analytic description of the fully-differential and Lorentz invariant cross section of production of $\pi^{\pm}$ and $K^{\pm}$, performing a fit to cross section data. Then, a Lorentz transformation, an angular integration and the convolution with the $e^{\pm}$ spectrum from $\pi^{\pm}$ and $K^{\pm}$ decays are applied to find the $e^{\pm}$ energy-differential cross section. In the last decades new experimental datasets have become available, for example the NA61/SHINE Collaboration results collected at the CERN Super Proton Synchrotron (SPS). Given the importance of these nuclear data for new measurements in astroparticle physics, it is necessary a re-evaluation of the leptonic production cross sections in pp, Hep, pHe, and HeHe collisions in light of this newly available information. In this paper we engage ourselves in this task, in order to provide the community with an updated parametrization for the inclusive $e^{\pm}$ production cross section. We use for the first time in this field the $e^{\pm}$ spectrum obtained from the muon decay computed till the next to leading order. We present some preliminary results, obtained from the fit to the NA61 π^{+} measures with a tester parametrization.

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