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Constraints on annihilating Dark Matter from reionization and extragalactic gamma background

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The PAMELA, Fermi and HESS experiments (PFH) have shown anomalous excesses in the cosmic positron and electron fluxes. An exciting possibility is that the excesses arises due to annihilating Dark Matter (DM) particles with mass above 700 GeV. We calculate constraints on leptonically annihilating DM using the data of diffuse extragalactic gamma-ray background (EGR) and measurements of the optical depth (OD) to the last-scattering surface. We find that the constraints from OD are able to rule out the PFH favored region fully for the tau channel and almost fully for the \mu channel. Those constraints are quite robust with almost no dependence on low redshift DM clustering boost. The constraints from EGR are sensitive to the assumed halo concentration model and, for the power law model, rule out the PFH favored region for all leptonic annihilation channels. We also find that it is possible to have models that fully ionize the Universe at low redshifts. However, those models produce too large free electron fractions at z > ˜100 and are in conflict with OD. Finally, we discuss about the motivation and the constraints for a more sophisticated annihilation scenario, where DM particles annihilate to intermediate metastable particles, which then decays to lepton pairs.

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