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Rotation Curves and Constraints on Dark Matter Annihilation

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We have focused on dark matter annihilation into electron-positron pairs, neglecting other processes, such as dark matter decay, or other annihilation products. Instead of focusing on a specific dark matter annihilation model, we have adopted a model-independent approach, in which all particles are created with the same initial energy, of the order of the mass of the dark matter particle. The propagation of the electrons and positrons has been determined by the diffusion-loss equation. We have assumed a uniform diffusion coefficient.

We have considered inverse Compton scattering, synchrotron radiation, Coulomb collisions, bremsstrahlung, and the ionization of neutral hydrogen atoms as the main energy loss mechanisms. We have estimated the contribution of dark matter annihilation to the total gas pressure and considered its effect on the rotation curve. By fitting the 26 rotation curves of low surface brightness (LSB) galaxies, we are able to find the constraints on dark matter particles. We have derived limits on the mass of dark matter particles by applying the effect of the pressure from dark matter annihilation into electron-positron pairs to the rotation curves of LSB galaxies. The limits of the mass of dark matter particles are between 1 GeV to 30 GeV.

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