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Heating the dark matter halo with dark radiation from supernovae

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Supernova explosions are extreme cosmic events that may impact not only ordinary matter but also dark matter (DM) halos. In this talk, I explore the possibility that a fraction of supernova energy is released as dark radiation, which could transform a cuspy DM halo into a cored one, potentially explaining observed cores in some dwarf galaxies. Alternatively, limits on DM core sizes provide constraints on the energy channeled into light particles beyond the Standard Model (SM). Based on evaluation of energetics, one finds that even a small fraction of the total SN energy is sufficient to change the overall shape of the DM halo and transform a cuspy halo into a cored one. We evaluate some well motivated benchmark models, e.g. the dark photon and dark Higgs, to demonstrate that significant supernova emissivity of dark radiation and large DM halo opacity are achievable in realistic particle physics model. Interestingly, couplings consistent with SN1987A observations can still have a measurable impact on dwarf galaxy halos.

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