

Limits on heavy neutral leptons, Z' bosons and majorons from high-energy supernova neutrinos

Light hypothetical particles with masses up to $\mathcal{O}(100)$ MeV can be produced in the core of supernovae. Their subsequent decays to neutrinos can produce a flux component with higher energies than the standard flux. We study the impact of heavy neutral leptons, Z' bosons, in particular $U(1)_{L_\mu-L_\tau}$ and $U(1)_{B-L}$ gauge bosons, and majorons coupled to neutrinos flavor-dependently. We obtain new strong limits on these particles from no events of high-energy SN 1987A neutrinos and their future sensitivities from observations of galactic supernova neutrinos.

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