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Probing pseudo-Dirac neutrinos using supernova neutrinos

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Ever since the discovery of neutrinos, we have wondered if neutrinos are their own antiparticles, and whether lepton number is violated or not. One remarkable possibility is that lepton-number violation in the Standard Model is soft. In such scenarios, neutrinos have a pseudo-Dirac nature with a tiny mass difference between active and sterile states, having oscillations driven by this tiny mass difference. Such oscillations can only be visible over very long distances. In this talk, I will discuss how analyzing the neutrino data from SN1987A in the light of active-sterile oscillations can present a mild preference for such oscillations. Notably, the same data is able to exclude some of the tiniest mass differences for neutrinos constrained so far. I will further discuss the prospects of using the ever-present diffuse supernova neutrino background as a laboratory to test the possible, albeit tiny, violation of lepton number.

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