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Strong Supernova 1987A Constraints on Bosons Decaying to Neutrinos

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If existing, feebly interacting particles such as sterile neutrinos, axion-like particles, and others could have been abundantly produced in the core formed during the collapse of Sanduleak in 1987. The duration of the neutrino burst detected at Kamiokande II and at the Irvine–Michigan–Brookhaven (IMB) experiment depended on the cooling speed of the newly formed proto-neutron star at the center of SN 1987A, and hence is often used to constrain these particles. However, particles arising from physics beyond the standard model can be produced inside the core and decay afterwards with large energies. In this talk I will focus on bosons coupling to neutrinos, evoked to open up the parameter space of sterile neutrinos as a dark matter candidate. I will show that the lack of 100-MeV events from SN 1987A implies bounds on the coupling up to one order of magnitude more stringent than both the bounds obtained from Big Bang Nucleosynthesis and from the energy-loss argument.

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