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Axion emission from strange matter in core-collapse SNe

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The duration of the neutrino burst from the supernova event SN 1987A is known to be sensitive to exotic sources of cooling, such as axions radiated from the dense and hot hadronic matter thought to constitute the inner core of the supernova. We perform the first quantitative study of the role of hadronic matter beyond the first generation – in particular strange matter. We do so by consistently including the full baryon and meson octets, and computing axion emissivity induced from baryon-meson to baryon-axion scatterings as well as from baryon decays. We consider a range of supernova thermodynamic conditions, as well as equation-of-state models with different strangeness content. We obtain the first bound on the axial axion-strange-strange coupling, as well as the strongest existing bound on the axion-down-strange counterpart. Our bound on the latter coupling can be as small as O(10^−2) for fa=10^9 GeV.

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