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High-energy Neutrino Emission from Interaction-powered Supernovae

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Over the past decade, a significant number of supernovae exhibiting luminosities that exceed $10^{43}\,\mathrm{erg\,s^{-1}}$ and characterized by narrow hydrogen lines in their spectra have been discovered. These supernovae are believed to be powered by the collision of ejected material with a dense circumstellar medium (CSM). The interaction of the SNe ejecta with the CSM results in a shock wave propagating in the dense circumstellar environment, which can efficiently generate thermal UV/optical emission and accelerate protons up to PeV energies. Such protons can undergo hadronic interactions and produce neutrinos in the $1 - 10^3$ TeV energy range. I will present the connection between the neutrino signal detectable at the IceCube Neutrino Observatory and the photometric properties of the electromagnetic signals observable by optical surveys. Finally, I will discuss how detecting high-energy neutrinos can help constrain the large space of parameters characterizing interacting SNe and will outline the best follow-up strategy for upcoming multi-messenger searches from this class of objects.

Based on T.Pitik, I.Tamborra, M.Lincetto, A.Franckowiak (arXiv:2306.01833)

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