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Multidimensional Simulations of Magnetar Powered Supernovae[1]

KE-JUNG CHEN, National Observatory of Japan — Magnetars are neutron stars with unusually strong magnetic fields, typically greater than 1E13 Gauss (G). Observational evidence suggests that magnetars form in a significant fraction of supernovae. Previous studies have shown that the radiation emitted by a rapidly rotating magnetar embedded in a young supernova can greatly amplify its luminosity. These one-dimensional studies also shown the existence of an instability arising from the piling up of radiatively accelerated matter in a dense, thin shell deep inside the supernova. Here, we examine the problem in two dimensions and find that this shell fragments into a filamenary structure that facilitates mixing. The degree of the mixing depends on the relative energy input by the magnetar and the kinetic energy of the inner ejecta. The light curve and spectrum of the resulting supernova will be appreciably altered.

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Ke-Jung Chen
NAOJ

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