Prospects for X-ray Line Studies of Supernova Radioactivity

Mark Leising(*Clemson University*)

Abstract

Nucleosynthesis theory as developed over the past fifty years is remarkably successful, and deserves more detailed observational constraints. Besides the real-time neutrino signatures of the nuclear reactions, counting new nuclei among the debris of explosions is about the best diagnostic we can hope for. This is the well-documented promise of gamma-ray line astronomy of radioactivity, which is mostly unrealized due to sensitivity limitations of the first-generation instruments flown to date.

An alternative approach to counting newly synthesized nuclei is to look for the characteristic K X-rays following electron-capture decay of proton-rich isotopes synthesized in supernova explosions. There are several promising candidate isotopes at current X-ray spectrometer sensitivities. Among these are explosive Si-burning products ^{53}Mn, ^{55}Fe, and ^{59}Ni. We outline the prospects for detecting these isotopes with *Chandra* and *XMM-Newton* in the interstellar medium and in individual supernova remnants.

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