Contribution ID: **37** Type: **Invited Review**

# The Stellar Precursors of the Solar System? Constraints from quantitative relations between genetic anomalies and NRLEE ejecta

*Monday 9 June 2025 15:40 (30 minutes)*

The stellar precursors of the protoplanetary disk defined the Solar System's composition, a fundamental property that influenced the nature of the subsequent planetary system. The identity of the dominant stellar precursors, however, remains under investigation. Partial constraints have been inferred from nucleosynthetic isotope (i.e., genetic) anomalies in meteorites. Genetic anomalies are part per million-scale isotopic variations of a sample composition from a standard composition. These fine-scale anomalies reflect the heterogeneous distribution of isotopically variable presolar carriers throughout the disk.

Correlated genetic anomalies in neutron-rich iron group species 46Ti, 48Ca, 50Ti, and 54Cr characterize bulk rock meteorite compositions. On the Solar System scale, these genetic anomalies form two near-omnipresent groups, which are defined as the non-carbonaceous (NC)-carbonaceous chondrite (CC) isotopic dichotomy. This dichotomy is widely used as the basis of qualitative and quantitative models of Solar System formation. Using the NC-CC isotopic dichotomy for such reconstructions, however, requires an understanding of the type and stellar origin of presolar carriers whose heterogeneous distribution in the disk resulted in genetic anomalies.

The presolar carriers and stellar precursors that are responsible for the correlated anomalies of 48Ca, 46Ti, 50Ti, and 54Cr in bulk meteorites are yet to be determined. In this contribution, the approach to constraining the identity of these carriers comes from the stellar nucleosynthesis standpoint. The stellar precursors of 48Ca, 46Ti, 50Ti, and 54Cr are identified and then assessed to determine if sufficient quantities were synthesized and added to the disk to generate the observed genetic anomalies in meteorites. Given the special nucleosynthetic requirement that 48Ca be produced in neutron-rich, low-entropy matter expansions during rare astrophysical events in the Galaxy, we focus on this type of stellar precursor. The exact nature of these events is unclear, but they are likely associated with the explosion of a dense white-dwarf star, such as the deflagration of a near Chandrasekhar-mass white dwarf, an electron-capture supernova (ECSN), or a thermonuclear ECSN (t-ECSN). Due to the variety of plausible sites, they are referred to here generically as "NRLEEs"(Neutron-rich, Low-Entropy matter Ejectors).

This study quantitatively assesses the relative abundances of 48Ca, 46Ti, 50Ti, and 54Cr produced in NRLEEs by using a simple one-dimensional model of the explosion of a carbon/oxygen-dense white dwarf star with *s*-process enhanced abundances to illustrate the nucleosynthesis that could occur in NRLEEs. A multicomponent Galactic Chemical Evolution (GCE) model provides a quantitative estimate of the abundance of different dust types (processed, low-mass, SNIa, SNII, NRLEE) and their isotopic compositions in the initial Solar System. To assess if NRLEEs are the source of neutron-rich iron group species in the Solar System, mixing calculations between the average Solar System composition and calculated NRLEE compositions are performed. The results are contrasted with NC-CC meteorite compositions. Preliminary findings will be reported to provide one of the first quantitative assessments of the stellar precursors that underpin the NC-CC isotopic dichotomy and the associated constraints on the dominant stellar precursors of the Solar System.

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