Molybdenum Isotopes in Presolar SiC Grains Unveil Details of *s*-, *r*-, and *p*-Process Nucleosynthesis

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The isotopic compositions of presolar grains that formed around dying stars reflect a combination of: (1) unprocessed matter that formed the grains' parent stars; (2) material newly synthesized in those stars; and (3) material with solar isotopic composition from the protosolar cloud, the host meteorite's parent body, or contamination in the laboratory. Solar System material itself is a complex and slightly variable [1] mixture of material formed in various nucleosynthetic processes.

Molybdenum has seven stable isotopes: *p*-process ^{92}Mo and ^{94}Mo; mixed *s*- and *r*-process ^{95}Mo, ^{97}Mo, and ^{98}Mo; *s*-process-only ^{96}Mo; and *r*-process-only ^{100}Mo. The Chicago Instrument for Laser Ionization (CHILI) [2] allows high-precision Mo isotope analyses of single presolar SiC grains, providing insights into conditions during nucleosynthesis.

Recent studies of Mo isotopes in mainstream [3,4] and types AB1 [5], AB2 [3,4], Y [6], and Z [6] SiC grains show mixing lines in 3-isotope plots of ^{i}Mo/^{96}Mo vs. ^{92}Mo/^{96}Mo between two endmember compositions, one indistinguishable from solar, the other pointing towards pure *s*-process Mo. Mainstream, Y, and Z grains, which all come from low-mass AGB stars, should show mixtures of *s*-process Mo produced in those stars with Mo from the unprocessed stellar envelopes. However, the mixing lines strongly suggest that the various parent stars of the grains all had the same ratio of *p*- to *r*-process Mo, identical to solar. The same is true for AB1 and AB2 grains, whose stellar origins are still a matter of debate, and for the smaller variations in Mo isotopes found in bulk samples and leachates of primitive meteorites [1,7]. It can therefore be concluded that *r*- and *p*-processes must be strongly correlated at least over time and perhaps space in the Galaxy. A dichotomy, as observed between carbonaceous and noncarbonaceous meteorites [8], was not detected in SiC.

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