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Isotopic compositions of trace elements in presolar SiC: new constraints on stellar nucleosynthesis

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The isotopic compositions of trace elements in presolar grains provide unique constraints on stellar nucleosynthesis. The CHicago Instrument for Laser Ionization (CHILI) [1] is a laser resonance ionization mass spectrometer with unprecedented sensitivity and control of isobaric interferences, and 1ne lateral resolution, built primarily for applications in cosmochemistry. CHILI has recently been upgraded to its full designed capability, with the addition of: (1) a motionless-blanking Ga+ gun capable of sputtering with a lateral resolution of a few tens of nm; and (2) a multibounce mirror system that allows photoionization laser beams to pass 14 times through the sputtered cloud of atoms, greatly increasing sensitivity. CHILI has already made signi1cant progress in improving our knowledge of galactic chemical evolution (GCE), asymptotic giant branch (AGB) stars and core-collapse supernovae, through in isotopic compositions of trace elements in presolar SiC grains, all done with laser ablation at a lateral resolution of 1 m and without the multibounce mirror system. Fe and Ni isotopes in mainstream SiC grains from AGB stars show the effects of both GCE and neutron capture [2]. Sr and Ba isotopes in presolar SiC grains of Type X show two different types of isotopic patterns, representing the variety of heavy element nucleosynthesis sites with Type II supernovae [3]. Fe and Ni isotopes in Type X SiC grains show that signi1cant neutron capture effects occur in Type II supernovae [4]. Sr, Mo, and Ba isotopes in presolar SiC grains of Types AB1 and AB2 show that they come from Type II supernovae and J-type carbon stars, respectively [5, 6]. Correlated Sr and Ba, along with Ni isotopes in mainstream presolar SiC grains suggest that low-mass AGB stars have 13C pockets that cover a larger fraction of the helium intershell than was previously recognized [7].

References

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Summary

New measurement of presolar SiC grains from meteorites constrain galactic chemical evolution and heavy element nucleosynthesis in asymptotic giant branch stars and core collapse supernovae

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