NUCLEAR ASTROPHYSICS WITH CHILI

Andrew M. Davis[1,2], Thomas Stephan[1], Michael J. Pellin[1,2,3], Detlef Rost[1], Michael R. Savina[3], Reto Trappitsch[1], Nan Liu[1]

[1] *Department of the Geophysical Sciences*
[2] *Enrico Fermi Institute, University of Chicago, Chicago, IL, USA*
[3] *Materials Science Division, Argonne National Laboratory, Argonne, IL, USA*

We recently completed CHILI (Chicago Instrument for Laser Ionization), a laser resonant ionization mass spectrometer that will be capable of a lateral resolution of 10 nm, a useful yield (atoms detected per atom removed from the sample) of 30–50%, and nearly complete suppression of interfering monatomic and molecular ions [1]. CHILI is equipped with six tunable lasers, allowing simultaneous measurement of the isotopic compositions of three elements. As part of the initial testing of CHILI, we plan a number of measurements that can constrain stellar nucleosynthesis models. (1) Simultaneous Sr, Zr, and Ba isotopic measurements of mainstream SiC grains will allow deeper understanding of observational constraints on the masses and internal ^{13}C distributions of ^{13}C pockets in AGB stars [2]. (2) Simultaneous Cr, Fe, and Ni isotopic measurement of mainstream grains will probe the effects of galactic chemical evolution on the initial isotopic compositions of AGB stars. (3) Simultaneous Ti, Zr, and Mo isotopic measurements of carbide inclusions within presolar graphite will constrain timescales of grain formation around AGB stars and mixing in Type II supernova ejecta. (4) Mapping of primitive meteorites for Sr, Zr, and Mo isotopes might reveal new types of presolar grains, including those responsible for *r*-process enrichments seen in some progressive chemical leaching experiments.

[1] T. Stephan et al., Lunar Planet. Sci. 45, #2242 (2014).
[2] N. Liu et al., Lunar Planet. Sci. 45, #2049 (2014).