CHILI: Isotopic compositions at the sub-micrometer scale without isobaric interferences

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The Chicago Instrument for Laser Ionization (CHILI), a secondary neutral mass spectrometer using laser resonance ionization of sputtered or laser-ablated atoms [1], began routine operation in 2016. We describe some improvements to be made in the next few months, and summarize recent measurements.

CHILI is currently capable of laser ablation analyses at a lateral resolution of ~1 μm, and resolution will improve substantially once the gallium ion gun is modified such that the primary beam can be pulsed without moving (motionless blanking). A multibounce system that sends the photoionization laser beams though the laser- or sputter-desorption cloud several times, significantly increasing sensitivity, will be installed soon. Both modifications should be complete by summer 2017.

The first project done with CHILI was measurement of Sr and Ba isotopes in 22 presolar grains. Subsequent NanoSIMS measurement revealed three of the grains to be from supernovae and two of these had a strange pattern enriched in ^{86}Sr relative to all other Sr isotopes [2]. The first major project done with CHILI was an exploration of Fe and Ni isotopic systematics in mainstream presolar SiC grains [3], where the effects of galactic chemical evolution and of neutron capture processes in AGB stars can be seen. Fe and Ni isotopes were also measured in presolar SiC from supernovae [4]. Sr, Zr, Mo, and Ba were measured in a number of mainstream SiC grains, allowing refinement of nucleosynthesis models [5]. Sr, Mo, and Ba isotopes in AB-type presolar SiC show that these enigmatic grains fall into two populations, from Type II supernovae and from J-stars [6]. Finally, measurement of Sr isotopes in apatite inclusions in Archean zircons implies that felsic crust formed very early in Earth history [7]. Many further applications in cosmochemistry and geochemistry are planned.

[1] Stephan et al. (2016) *Int. J. Mass Spectrom.* **407**, 1–15. [2] Stephan et al. (2017) GCA, in revision. [3] Trappitsch et al. (2017) *GCA*, in revision. [4] Kodolányi et al. (2017) *GCA*, in revision. [5] Stephan et al. (2017) *LPS* **48**, #2513. [6] Liu et al. (2017) this conference. [7] Boehnke et al. (2017) this conference.