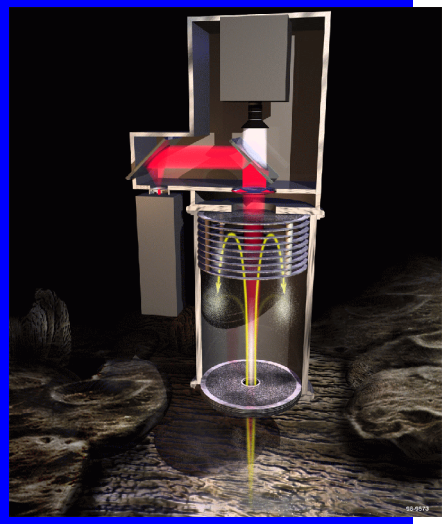
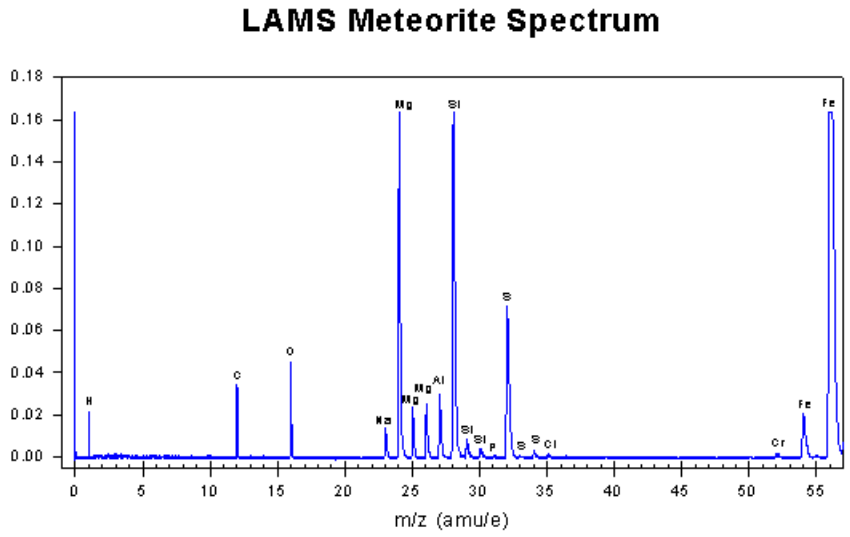
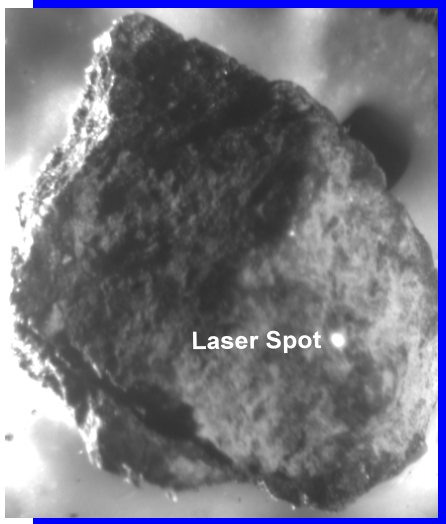
LAMS - Laser Ablation Mass Spectrometer

- In-situ stand-off analysis of planetary and small-body surface composition
- All elements and isotopes (from ^{1}H to ^{238}U) are measured (0.1 - 10 ppm)
- Grain-to-grain (~ 30 µm) and layer-by-layer (< 1 µm) laser probe
- Coaxial micro-imager allows x-y preselection of laser spot

- Mass: 1.5 - 2 kg
- Power: < 1 W standby, 2 - 4 W peak (< 5 s)
- Data: 100 Kbits / spectrum (uncompressed)

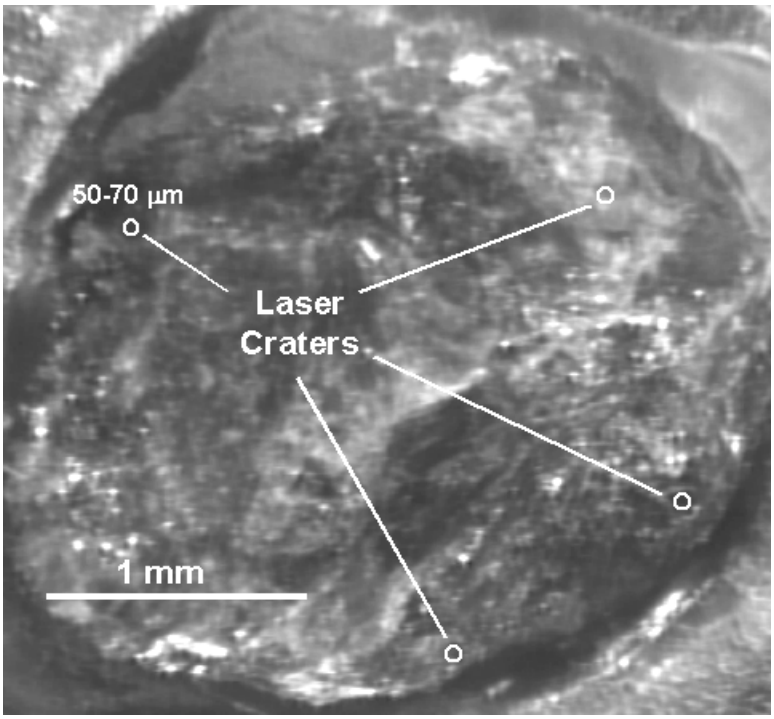






3. TOF-MS with Laser Ablation

Allende Sample



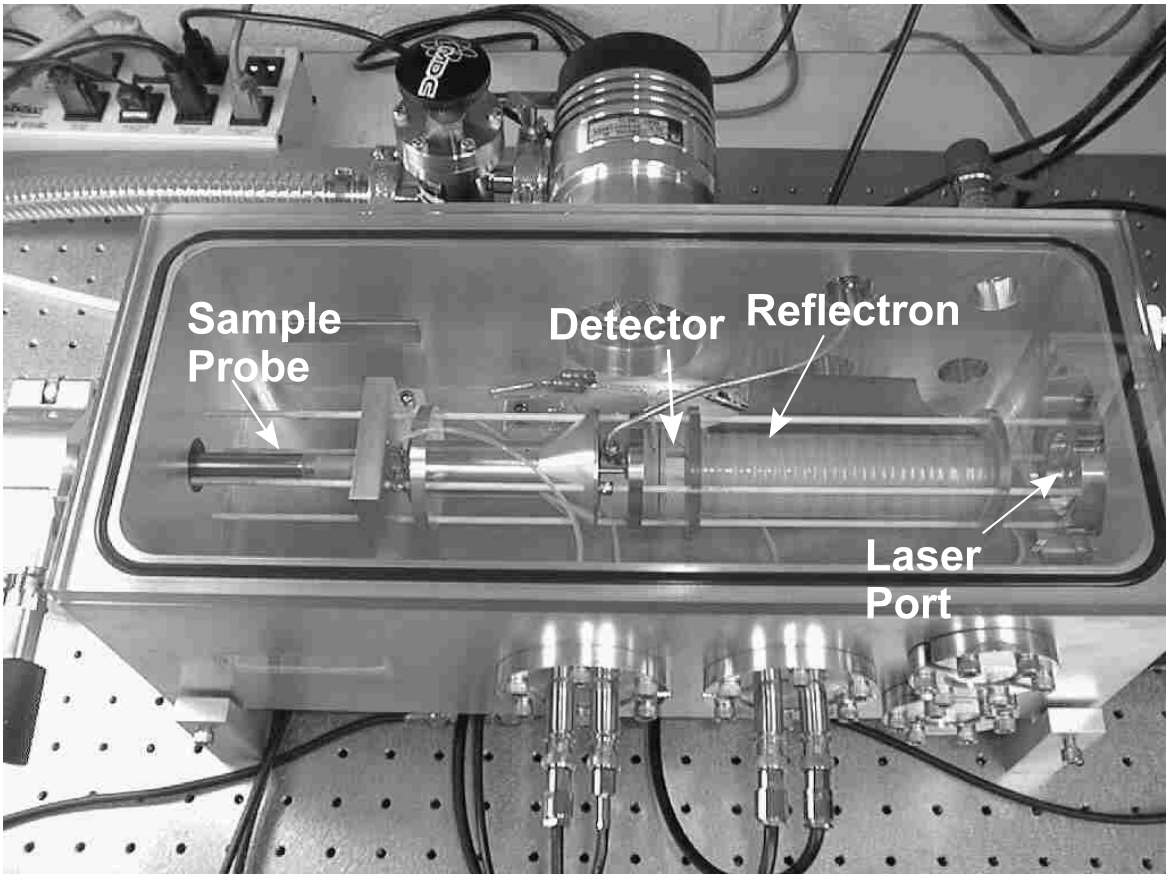
- Bulk Allende composition determined from ~100 laser shots
- Ion kinetic energy distribution depends on laser irradiance, atomic mass, and chemical matrix; sensitivity observed to increase with mass above 100 eV
- Average Na, Mg, Al, K, and Ca ratios to Si consistent with CV type

	Literature Average Bulk[1]			Expt.[2]	Expt.[2]
(atomic)	CI	CM	CV	"Matrix"	"CAI"
Na/Si	0.057	0.038	0.026	0.024	0.039
Mg/Si	1.053	1.046	1.053	1.0	0.9
Al/Si	0.085	0.093	0.111	0.103	0.186
S/Si	0.445	0.186	0.123	0.03	0.08
K/Si	0.004	0.002	0.002	0.001	0.004
Ca/Si	0.061	0.071	0.082	0.087	0.19
Fe/Si	0.860	0.843	0.753	n/c	n/c

1. Lodders, K. and B. Fegley, *The Planetary Scientist's Companion*, Oxford, 1998, p. 314.
2. Experimental results following modified NIST SRM 688 basalt calibration

4. TOF-MS with Laser Desorption

GENERAL FEATURES



- Maintains coaxial design for optimal focusing/imaging
- Incorporates a monolithic *"ideal" reflectron* that corrects TOF for ions of widely different kinetic energies
- Sample positioned a few mm from inlet when using source extraction; can also be used at several cm ("LAMS" mode)
- UV Nd:YAG laser focused to 10-50 μm diameter spot
- Irradiances from desorption (< 10^8 W cm^{-2}) to ablation (>> 10^8 W cm^{-2}) with prompt ionization
- Constructed from only a few, simple, robust components