

A compact two-step laser time-of-flight mass spectrometer for in situ analysis of planetary surfaces

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Two-step laser mass spectrometry (L2MS) has proved to be a powerful tool for the analysis of aromatic organics in icy planetary simulants [1], meteorites [2], asphaltenes on Earth [3], and returned cometary particles from the Stardust mission [4]. L2MS employs two lasers to separate the desorption and ionization processes of laser desorption/ionization into distinct steps. In the first step, an infrared laser desorbs neutrals from a solid sample surface; in the second step, an ultraviolet laser forms molecular ions within the neutral plume through a resonance-enhanced process to minimize fragmentation of complex species. We have recently demonstrated that the L2MS technique is compatible with a compact TOF-MS [5,6] that could form the centerpiece of a future *in situ* landed planetary mission emphasizing surface chemistry or astrobiology. The increased sensitivity and selectivity offered by this technique has been demonstrated in analyses of various planetary analog mixtures and meteorite powders, and representative results of these analyses will be presented.

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