

Development of a miniature ion-trap Fourier-transform mass spectrometer for future space missions

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In recent solar system exploration missions, high-resolution mass spectrometry has played an important role. In Rosetta mission, for example, carried a double focusing mass spectrometer with high resolving power ($m/\Delta m \sim 3,000$). This mass spectrometer conducted a variety of new chemical/isotopic measurements that greatly improved our understanding of the Jupiter-family comets. Such examples show that high-resolution mass spectrometry is a powerful technique for understanding the evolution of planetary bodies. However, most of the conventional high-resolution mass spectrometers (MSs) are large (~ 1 m in linear dimension) and heavy. This limits the opportunity of high-resolution mass spectrometry despite their high performance. The aim of this study is to develop a compact high-resolution MS. Our design is based on OrbitrapTM, which has recently been used in ground facilities. We have previously showed high mass resolution ($m/\Delta m \sim 10,000$) can be achieved with a small size (~ 10 s cm in linear dimension), using numerical simulations. Then, we have been examining the performance of our new MS with test model experiments. In particular, we are currently working on the improvement of an ion resonator part, which directly determines the sensitivity/power consumption of the instrument. In this presentation, we will discuss the details of experimental tests and most recent results.

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