

Development of an Ion Source for Future Solar System Explorations

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Observations by recent lunar explorations have suggested the existence of volatile ice including water in permanently shadowed craters of the moon. However, estimates of volatile constituents have uncertainties depending on the measurement method. Although neutron spectroscopy has been used to indicate water ice on/around the lunar surface, it is not possible to confirm the presence of water since this method detects hydrogen atoms, rather than water molecules. In order to quantify the water ice in the lunar polar region, it is necessary to make direct observations that can identify water molecules. Japan Aerospace Exploration Agency (JAXA) is planning a landing exploration of the lunar polar region in order to elucidate the concentration process and origin of lunar polar water ice and to investigate its availability as resources for the future human lunar activities. In this mission, it is planned to use a rover that carries out in-situ mass spectrometry for water detection. The mass spectrometer is designed to be comprised of an ionization section and a time-of-flight mass analysis section. In this study, we develop an ion source with the reasonable power consumption and high sensitivity for this mission. The dimensions and applied voltages of the ion source have been optimized using numerical calculations. We report the results of the verification test in the laboratory.

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