LASER water analyzer "ADORE" proposed for the LUPEX mission

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Existence of lunar water is now expected at the low temperature zone in the lunar polar area, and international competition of discovery and resource utilization has started. According to JAXA's lunar polar exploration plan, the amount of water in the lunar regolith is about 0.1-0.5 wt%, and we are developing water analyzing system that can be mounted on the lunar rover. With the analyzer package called REIWA, we will recover regolith sample and heat it to obtain water vapor. After that, measurement will be performed by a laser trace-moisture analyzer and a TOF-MASS system.
We have adopted the CRDS (Cavity RingDown Spectroscopy) method as one of the REIWA analyzers, which traps water vapor in a resonator cell using a mirror with a reflectance of 99.99% or more. We have been developing this technology to adopt it for space missions including miniaturization and robustness. This part is abbreviated as "ADORE" for Aquatic Detector using Optical REsonace. Since ADORE observes the vibration of H_2O molecules instead of atomic H, OH groups or their ions, so that it detects real water component. Free or constitution water in minerals might separately be detected by changing the extraction temperature. Currently, less than nano-grams of water molecules in a cell (ca. 15cm^3) can be detected with ADORE.
In addition, ADORE has the ability to perform isotope analysis of lunar water. Isotope measurements are of great scientific interest as they provide information on the origin and migration of water. We will discuss the capability of ADORE and the operations assumed at present.

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