On-site isotope laser spectrometry aiming underground lunar water

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It has been long believed liquid water cannot exist at the Moon's surface. However, it is also true that water is continuously supplied to the moon by meteorites or comets and a few studies indicated the existence of water in the moon[1)]. Actually, lunar volcanic glass showed a trace amount of water [2-3)]. Water may also survive in cold permanently-shadowed craters at poles[4)] or deep underground which is not affected by diurnal variation of solar heat[5)]. Now, lunar water is a big concern among researchers.
It is also important to know the origin of the water on the moon. On-site isotope measurements are essential because contamination of terrestrial water should be avoided.We are planning to fabricate a light-weight laser isotope measurement system about several kg in weight. Light weight DFB laser or Er-doped (Er:ZBLAN) fiber laser are candidates, which emit at desirable absorption bands for water isotope around 2.7 Another concern is a sample cavity which consists of a cell and mirrors. In order to resolve the small amount of isotopes, a long path length about km of laser beam must be achieved. In Mars Science Laboratory by Nasa, Curiosity includes the Laser isotope spectrometer with a Herriot cell, while commercial devices using a cavity enhanced cell with ultra-high reflectivity. Our concept and preliminary experiments will be presented.

1) Feldman et al., *Science* 281. pp.1496 (1998)
2) Saal, et al., *Nature* 454. pp.192 (2008)
3) Saal et al., *Science* 340. pp.1317 (2013)
4) Binder, *Science*, 281. pp.1475 (1998)
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