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VOILA on LUVMI-X: A LIBS Instrument for the Detection of Volatiles at the Lunar South Pole

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The lunar south pole is of great interest for upcoming lunar exploration endeavors due to the detection of large reservoirs of water ice in the pole's permanently shadowed regions [1], which could be utilized to reduce the costs of a sustained presence on the Moon [2]. A strong focus of future robotic exploration missions will therefore be on the detection of water and related volatiles. For this purpose, the project Lunar Volatiles Mobile Instrumentation – Extended (LUVMI-X) is developing an initial system design as well as payload and mobility breadboards for a small, lightweight rover [3]. One of the proposed payloads is the Volatiles Identification by Laser Analysis instrument (VOILA), which uses laser-induced breakdown spectroscopy (LIBS) to analyze the elemental composition of the lunar surface with an emphasis on the detection of hydrogen for the inference of the presence of water. VOILA is a joint project by OHB System AG, Laser Zentrum Hannover e.V., and the German Aerospace Center's Institute of Optical Sensor Systems. It is designed to analyze targets on the lunar surface in front of the LUVMI-X rover at a variable focus between 300 mm to 500 mm, allowing for precise measurements under various measurement conditions. The spectrometer covers the wavelength range from 350 nm to 790 nm, which includes the hydrogen line at 656.3 nm as well as spectral lines of most major rock-forming elements. The breadboard laboratory setup for VOILA was recently completed and first measurements of Moon-relevant samples have been made. Here, we will show the results of these measurements and will discuss their meaning for the further improvement of the instrument design and for its potential use as a volatile-scouting instrument at the lunar south pole.

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