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SELMA mission: revealing the origin of the lunar water

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The low cost (< 50 M€) lunar mission SELMA (Surface, Environment, and Lunar Magnetic Anomalies) investigates the interaction of the neutral and plasma environment with the lunar surface and the impact of this interaction on the surface composition, in the first hand, on the presence of water. The mission focuses on the fundamental question: What is the origin of the water in the lunar soil? The mission also addresses the questions: What are the lunar exosphere content and composition and how does the exosphere interact with the surface? How do the lunar magnetic anomalies interact with the solar wind and affect the surface?

SELMA investigates the origin of the water in the lunar soil via simultaneous measurements of the OH/H2O abundance in the soil, the proton flux deposited to the surface, and transient changes in the exospheric gas content and composition. The water content in the surface is mapped via measurements of the 2700 – 3300 nm OH/H2O/ice absorption lines. The proton flux at the surface is measured remotely via backscattered hydrogen flux (energetic neutral atoms, ENAs). The exospheric gas content and composition and possible transient changes due to micrometeoroid influx or outgassing are monitored by a neutral gas mass spectrometer.

To investigate the lunar exosphere SELMA is equipped with state-of-the-art time-of-flight neutral gas mass spectrometer with unprecedented sensitivity and mass resolution. The plasma environment is monitored by electron and ion analyzers.

The Moon does not have a global magnetic field but possesses local magnetizations. The magnetizations interact with the solar wind plasma creating highly variable mini-magnetospheres affecting, through an as yet unknown mechanism, the surface visible albedo. SELMA studies how the magnetic anomaly interact with the solar wind and surface via simultaneous measurements of 3D ion and electron distribution functions, the local magnetic field, solar wind flux variations on the surface through ENA imaging of the backscattered hydrogen flux, imaging in the visible range, and measuring the surface IR spectrum.

To address its scientific objectives SELMA carries a highly focused suite of instruments including an IR spectrometer, an ENA telescope, an ion and electron spectrometer, a neutral gas mass spectrometer, a magnetometer, and a visible camera. SELMA is a spinning platform to be inserted on a low maintenance quasi-frozen polar orbit of 30 km x 216 km by a dedicated launch and a solid state fuel kick stage. The total dry mass 520 kg (with kick-off motors), the spacecraft mass 87 kg including 14.5 kg of payload.