Instruments which will be used by the Apollo 17 astronauts developed at UCSD

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Instruments which will be used by the Apollo 17 astronauts to measure nuclear reactions involving neutrons on the moon's surface were developed and built at the University of California, San Diego by a scientific group headed by Dr. Kurt Marti, UCSD assistant professor of chemistry.

The UCSD instruments, called detectors, will be inserted into the lunar surface by the astronauts in an eight-foot-long Lunar Neutron Probe (LNP) built at the California Institute of Technology. The astronauts will insert the LNP into the drill hole after retrieving a core of lunar soil during EVA 1 (Extra Vehicular Activity), and recover the probe 40 hours later in EVA 3, shortly before they enter the Lunar Lander.

Lunar neutrons are secondary particles produced by the interaction of high-energy cosmic rays with lunar surface matter. Earlier calculations indicate that neutron particle flow increases with depth below the lunar surface, peaking at a depth of approximately three feet, then gradually decreases thereafter.

Scientists hope that calibration of this neutron density will provide them with an accurate depth-scale for the lunar surface. They may then use data from the LNP (1) to derive the average depth at which a given rock or soil sample has resided before it was moved to the lunar surface, (2) to obtain lunar erosion and soil turnover rates, and (3) to estimate the mixing depth for lunar soil and the thickness of the layer of lunar soil (regolith),

In contrast to erosion on the earth, lunar erosion is extremely slow less than one-tenth of one inch per million years - and is mainly due to extremely slow, less than one tenth of one inch per million years, and is mainly due to the bombardment of micrometeorites.

The UCSD neutron detectors make use of a large neutron resonance absorption of bromine at epithermal energies. The produced radioisotopes of bromine decay in turn into stable isotopes of krypton, a rare gas. After return of the detectors, the extremely small amounts of krypton will be analysed at UCSD in a high sensitivity mass spectrometer which is capable of detecting 105 atoms. The detectors, crystals of potassium bromide, are sealed in nickel containers under very hard vacuum and will determine the neutrons at different positions of the probe. The astronauts will insert the LNP into the drill hole after retrieving an 8 foot long drilled core of lunar soil during EVA I (Extra Vehicular Activity), and recover the probe 40 hours later in EVA 3, shortly before they enter the Lunar Lander.

*Neutrons, protons, and electrons are the "building blocks" of atoms. Neutrons have a mass rather close to the mass of a proton, but, unlike the proton, the neutron has no electrical charge. Neutrons do not interact with electrons that surround the atomic nucleus but do interact with the nucleus itself.

Prepared by Dr. Kurt Marti

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