INVESTIGATION OF SOLAR SYSTEM OBJECTS BY NUCLEAR PHYSICS METHODS

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Abstract

Exploration of the planets must be largely carried out by remote observational techniques. The determination of the elemental composition of a planet allows important constraints to be placed on its origin and evolution. It can be addressed by measuring gamma ray spectra and neutrons from orbiting spacecraft. Gamma ray lines used for most elemental studies are made by inelastic-scattering reactions of neutrons with a few MeV of energy or by capture reactions of neutrons near thermal energies. The neutron spatial and energy distributions were calculated using the LAHET Code System (LCS) for the simulation of cosmic ray interactions with a target body. Measured or evaluated cross sections are used for inelastic or spallation reactions. After the depth-dependent production rates for gamma rays are calculated, we calculate the transport of gamma rays from their source to the detector. Simulated compositions cover a wide range of possible planetary compositions. The effect of thin atmospheres, such as that of Mars, was also studied. Obtained results of simulations were compared with real data from various space missions.