EFFECTS OF METEOROID SHAPE ON THE PRODUCTION RATES OF COSMOGENIC NUCLIDES.

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Introduction: The shape of the meteoroid irradiated in the space can be one of the factors influencing the production of the cosmogenic nuclides. Numerical simulations were done for spherical, cylindrical and elliptical geometries of irradiated object. Simulations show that statistically important differences in particle fluxes dependent on the shape of irradiated object and position of sample within it can be found. Results of simulations were compared with experimental data for St. Severin and other objects that had nospherical shapes in space during their exposure times.

Simulations: The accurate modeling of the production processes is prerequisite for the physical interpretation of measured depth profiles of cosmogenic nuclides. Productions rates of cosmogenic nuclides are dependent on incident particle fluxes, the meteoroid's preatmospheric shape and size, and its bulk chemical composition. Size effects [1] and bulk chemical composition [2] effects were studied in details and therefore we concentrate our attention in this paper on effects of the parent body shape.

In this work the nucleon spectra are calculated by using the LCS/MCNP [3]. Having calculated particle fluxes the production rates of cosmogenic nuclides are calculated by folding these spectra with experimental and theoretical cross sections of nuclear reactions leading to the production of particular nuclide.

The geometries investigated in this work were sphere with radius 27 and 45 cm which is that of a sphere with volume equal to the real St. Severin [5] and Knyahinya, respectiovely. Further ellipsoid with various ratios between semiaxes and with equall mass were also simulated. Model objects were divided into concentric shells with thickness 2.5 cm. In all shells proton and neutron fluxes were calculated. For the sphere particle fluxes were averaged over the whole volume of the shell. In the case of ellipsoid fluxes were calculated for cylinders with radius 1 cm and their axis identical with coordinate system axis. The last division of ellipsoid was motivated by the actual location of measured samples [4].

Conclusions: Production rates for the ellipsoids were lower than those for spheres. The differences between the ellipsoids and sphere varied with the nuclide. The shape of irradiated body influences the number of particles escaping from the investigated body without participating in particle cascade development. This can lead to the change of absolute value and the shape of differential particle fluxes. As in the case of ellipsoid there are some regions with larger and smaller curvature than is the curvature of sphere, there are also different numbers of escaping particles in this regions.

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