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THE CROSS-SECTION OF NUCLEAR-TUNGSTEN INTERACTIONS OBTAINED WITH MEASUREMENTS OF COSMIC RAYS BY PAMELA

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The aim of this work is to study the cross-section of the inelastic interactions of nuclei with tungsten based on the data of PAMELA space experiment [1]. This instrument is a magnetic spectrometer designed to study fluxes of charged particles in cosmic rays, which was launched into the near-Earth orbit aboard the ResursDK1 satellite; data collection continued from 2006 to 2016. PAMELA includes a set of detectors which helps to identify the particles including their magnitude and sign of charge, rigidity, velocity, mass and energy. So, we can select from the PAMELA data a necessary component of cosmic rays with known particles and their energy coming at a known angle. At the same time, another detector - a coordinate-sensitive calorimeter with a tungsten absorber plays a role of target for these particles. This looks like an experiment in particle physics on accelerators with formation of a beam of particles and observation of its interaction in target. Thus, it becomes possible to study the characteristics of nuclear-nuclear interactions with a large number of different nuclei in a beam according to chemical composition of cosmic rays in a wide energy range from hundreds of MeV to ˜TeV. A similar method is used in ground-based observations of ultrahigh-energy cosmic rays; however, in this work, we use the previously proposed method relies on a much larger amount of information about cosmic ray particles due to the precision nature of the PAMELA measurements [2]. In the report, we present the experimental cross sections for the interaction of nuclei from protons to carbon with tungsten nuclei obtained by the described method. Obtained results compared with the cross-sections reconstructed from the simulation data coming from Geant4 software package [3], with measurements at accelerators and existing theoretical models. Results can be used to improve our knowledges about nuclear forces and expand the standard Geant4 hadronic models and other numerical packages describing the interaction of particles with matter.

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