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Constructing formula for total reaction cross sections without adjustable energy-dependent parameters AKIHISA KOHAMA, RIKEN Nishina Center, KEI IIDA, Kochi University, KAZUHIRO OYAMATSU, Aichi Shukutoku University — We review our formula for a proton-nucleus total reaction cross section, $\sigma_{\rm R}$, constructed in the black-sphere approximation, in which a nucleus is viewed as a "black" sphere of radius "a". In this formula, the cross section, πa^2, is expressed as a function of the mass and neutron excess of the target nucleus and the kinetic energy of incident proton, T_p, in a way free from any adjustable T_p-dependent parameter. We deduce the dependence of $\sigma_{\rm R}$ on T_p from a simple argument involving the proton "optical" depth within the framework of the black-sphere approximation of nuclei. We find that, for stable nuclei, this formula remarkably well reproduces the empirical T_p dependence of $\sigma_{\rm R}$ at $T_p = 100$–1000 MeV without introducing any adjustable energy-dependent parameter. We show that, in this formula, the energy dependence of a is determined by that of nucleon-nucleon total cross sections, while the target-mass-number dependence of a is sensitive to the surface thickness of the target. In the future experiments of neutron-rich unstable nuclei, we could expect that the neutron-excess dependence of a would play an important role in deducing the density dependence of nuclear symmetry energy.

Akihisa Kohama
RIKEN Nishina Center

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