UNUSUAL BEHAVIOR OF NUCLEAR CHARGE RADII AND REACTION CROSS SECTION IN *N*=28 REGION

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Systematic investigation of nuclear mean-square charge radii ($<r_c^2>^{1/2}$) of nuclei around *N*=20,28 shell closures is becoming possible due to the availability of radioactive ion beams. Recent measurements of $<r_c^2>^{1/2}$ by laser spectroscopy of isotopic chains of K, Ca and Mn provide interesting insights; the amount of experimental information is as yet limited. The $<r_c^2>^{1/2}$ and reaction cross section (σ_R) are easily correlated and provide valuable information on nuclear properties. Using optical model and investigating *p*-nucleus elastic scattering, σ_R can be obtained and correlated to $<r_c^2>^{1/2}$. The $<r_c^2>^{1/2}$ and nuclear density are calculated in the relativistic self-consistent mean-field framework based on density-dependent (DD) meson-exchange relativistic energy density functional for even isotopes of Ti, Cr, Fe, Ni (*N*=18−36). The calculations agree with available measurements, and results for unstable isotopes are reported. The semimicroscopic *p*-nucleus optical potentials derived by folding target density with extended Jeukenne-Lejeune-Mahaux energy- and DD internucleon interaction are used to calculate cross sections at 65 MeV (Hemalatha *et al.*, Phy. Rev. C92, 024611 (2015)). These calculations reproduce the corresponding experimental values for stable even isotopes, and predictions are presented. A prominent kink at the *N*=28 shell closure is observed in the variation of σ_R, consistent with $<r_c^2>^{1/2}$ systematics in the corresponding isotopic chain. In all isotopic chains, both $<r_c^2>^{1/2}$ and σ_R show a steep increase for isotopes with *N*>28 while in the region *N*<28, the behavior is somewhat unusual. There is a Z dependence below *N*=28 which is not evident for other shell closures (*N*=50,82).