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Experimental Determination of the Ion-Ion Potential in the N=50 target region: a tool to probe ground-state nuclear densities.

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Precise elastic and inelastic differential cross sections have been measured for the $^{16}O + {}^{88}Sr, {}^{90,92}Zr, {}^{92}$Mo systems at sub-barrier energies $43 \leq E_{LAB} \leq 49\ MeV$. From a coupled channel data analysis, the corresponding "experimental" bare potentials have been determined. The comparison of these potentials with those derived from double-folding theoretical calculations and the high energy (96 MeV/nucleon) elastic scattering data analysis indicate that the method is a very sensitive probe of the ground-state nuclear densities in the surface region.

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Photofission cross section of ^{237}Np nucleus with monoenergetic neutron-capture gamma rays

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Measurements of photofission cross sections for ^{237}Np have been carried out, in the energy interval from 5.2 to 10.8 MeV, employing 30 gamma radiation spectra produced by thermal neutron capture at the IPEN-IEA-R1 (2 MW) research reactor [1]. The gamma-ray flux was monitored by a coaxial solid state Ge(Li) detector (EG&G Ortec, 25 cm^3, 5 %), positioned 823 cm from the capture target. The detector calibration, as a function of the gamma-ray energy, was obtained by using a standard gamma beam produced by capture spectrum of nitrogen in a melamine target. The photofission fragments have been detected by Makrofol KG plastic foils (10 mm thickness) irradiated together with the ^{237}Np samples (6 disks) in the form of a sandwich (2π geometry). After an adequate chemical etching (KOH 35 % solution), the fission tracks on the plastic foils were counted employing an automatic discharge chamber. The total efficiency of this technique was determined using a ^{252}Cf calibrated source and the result obtained was 38.8 ± 0.7 %. The set of experimental data obtained for the capture spectra (compound cross section) was unfolded, using an appropriate iterative method [2] in order to obtain the photofission cross section as a function of the excitation energy. In this unfolding method it was taking into consideration, in the iterative correcting process, the contribution of the whole spectrum of all capture targets in the composition of the compound photofission cross section. The deconvoluted photofission cross section and the complete uncertainty covariance matrix are presented and are compared with previous results reported in the literature [3].
An statistical calculation for the photofission cross section as a function of excitation energy was performed in order to compare with the experimental results. In the present case, the Hauser-Feshbach method was adopted, taking in consideration for the fission channel a double humped fission barrier. The deformation energies and corresponding parameters, in the equilibrium deformation of compound and residual (for one neutron emission) nucleus, as well as for the saddle points, were calculated [4] by taking into account the Strutinsky shell corrections [5]. The Pashkevich parametrization [6] has been used to describe the nuclear shape. Single particle spectra for neutrons and protons were calculated for the extreme points of the fission path, using the Woods-Saxon deformed potential, with Chepurnov parameters [7]. The deformation parameters for these points and the single particle orbitals, were used as input in the calculation of the quasi-particle and rotational spectra, and a more realistic level density calculation was performed using a semi-microscopic combined method [8,9].