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Optical model potential parameter optimization for nucleon-40Ca induced reactions: Implications on γ-ray production cross sections for residual Argon nuclei.

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We have optimized the optical model potential (OMP) parameters for nucleons (protons and neutrons) induced reaction on 40Ca using the OPTMAN code [1] available on the RIPL-3 data library [2]. The potentials, geometrical and nuclear deformation parameters were extracted via fitting angular distribution data for protons/neutrons elastic and inelastic scattering (Ep,n = 0 −200 MeV) taken from the EXFOR data library [3]. Our results demonstrate imporvement in the prediction of the angular distribution cross sections compared to the Koning-Delaroche OMP [4]. We have, then, calculated the γ-ray production cross sections of the most intense transitions emitted by 38Ar (Eγ = 2167,47 keV) and 36Ar (Eγ = 1970,38 keV) residual nuclei produced in 40Ca(p,xγ)(38,36)Ar, using both our OMP parameters and TALYS build-in OMP parameters. The results of the calculations were compared with preliminary cross section data extracted in the analysis of 40Ca(p,xγ2168 keV)38Ar, and 40Ca(p,xγ1970 keV)36Ar for incident proton energies ranging from 30 −125 MeV. Theses data were obtained in the analysis of p+40Ca γ-ray spectra recorded in experimental compaigns [5, 6] performed on the AFRODTE array of iThemba LABS (Cape-Town, South Africa) using eight Compton-suppressed HPGe clover detectors. The results and implications are discussed.

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