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1.13 Isospin Dependence of the Proton Optical Potential for Medium Mass Nuclei (A = 90 - 114) *)

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For a systematic study of the proton optical potential we measured the elastic scattering of polarized protons on the four even Zr isotopes, all seven stable Mo isotopes, and on $^{106,\ 110,\ 114}$Cd at E_p = 12 MeV and for $20° \leq \theta_{Lab} \leq 170°$. The measurement was performed with the polarized proton beam of the Erlangen Lamb-shift source. The scattered protons from the isotopically enriched target foils were detected with 15 movable and two fixed detectors, the polarization was switched on and off with a frequency of 10 Hz and measured on line with a ^{4}He-polarimeter. The absolute cross section was normalized to the Rutherford value at E_p = 4 MeV.

Both differential cross section and analyzing power are very well reproduced by an optical model description with real, imaginary and spin orbit terms. For a better comparison the best fit curves for the Mo isotopes are shown in fig. 1, which clearly demonstrates the systematic behaviour of the data for this isotope chain.

For increasing mass first the diffraction pattern of $\sigma(\theta)$ and $A(\theta)$ is shifted to smaller angles corresponding to the increasing nuclear radius and secondly the amplitudes in both observables are damped, which can be explained by an increasing imaginary potential. The A and Z dependence of the real and imaginary potential depth is given by

$$V=V_o+V_1\cdot(N-Z)\cdot A^{-1}+0.4\cdot Z\cdot A^{-1/3};\quad W = W_o+W_1\cdot(N-Z)\cdot A^{-1}$$

where V_1 and W_1 correspond to the real and imaginary isospin potential, respectively. From a fit to the three isotope rows with averaged geometry parameters (r_o=1.19, a_o=0.72; r_I=1.32, a_I=0.68; r_{SO}=1.01, a_{SO}=0.60; values given in fm) the following isospin potential depths have been extracted

	Mo	Zr	Cd
V_1 (MeV)	21.3 ± 4.0	13.4 ± 4.5	24.6 ± 3.1
W_1 (MeV)	42.7 ± 5.0	28.1 ± 6.6	4.6 ± 2.4

These values may be compared with the results of global analyses of Becchetti, Greenlees[1] V_1 = 24 MeV, W_1 = 12 MeV and of Perey[2] V_1 = 27 MeV, W_1 = 48 MeV. A recent analysis of polarization data by Noro et al.[3] however resulted in quite different isospin potentials of different isotope chains in the fp-shell.

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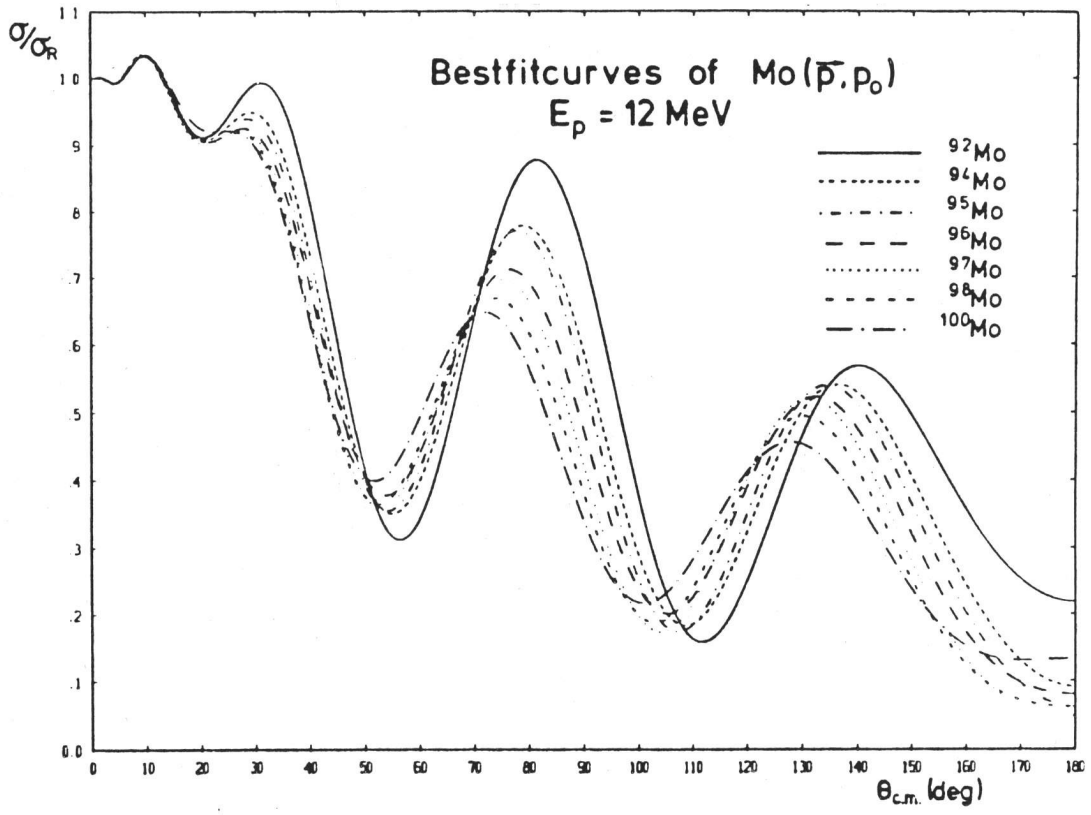
References:
1) F.D. Becchetti and G.W. Greenlees: Phys. Rev. 182(1969)1190
2) F.G. Perey: Phys. Rev. 131(1963)745
3) T. Noro, H. Sakaguchi, M. Nakamura, K. Hatanaka, F. Ohtani, H. Sakamoto, and S. Kobayashi: Nucl. Phys. A366(1981)189



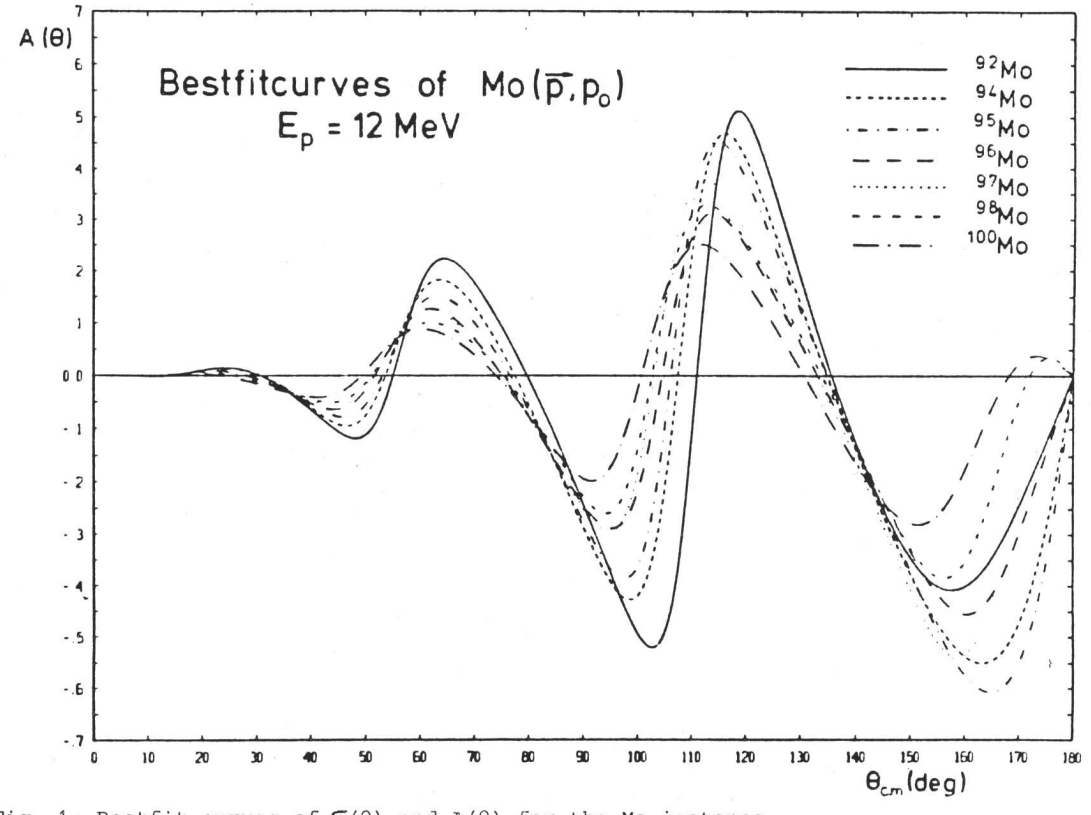


Fig. 1: Bestfit curves of $\sigma(\theta)$ and $A(\theta)$ for the Mo-isotopes.