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4.15 Folding Model for Polarized-Deuteron Scattering at Intermediate Energies

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The purpose of the present paper is to report on our analysis of recent experimental data on elastic scattering of deuteron from ^{40}Ca and ^{58}Ni at T_d=200-700 MeV [1]. We present here results of the single folding potential model for the case of $^{58}Ni+d$ at 400 MeV. The effect of the deuteron breakup is small in this energy region as an actual calculation with the coupled-channels method [2] shows. The folding model, therefore, is expected to be adequate.

In the present analysis nucleon-nucleus optical potentials at 200 MeV, half the incident deuteron energy, are folded with the deuteron ground state matter density. The Schroedinger equation for the center of mass of the deuteron is then solved with the relativistic kinematics [3]. Since no experimental data are available on $p+^{58}Ni$ elastic scattering at this energy, we take the following procedure to determine the corresponding optical potential.

First we search a proton optical potential to fit the data on the $^{40}Ca+p$ scattering at 200 MeV [4]. We then extrapolate it with A and Z of the target nucleus to the case of $^{58}Ni+p$, keeping the depth and geometrical parameters constant. This procedure is expected to be reliable, since it works very well between $^{40}Ca+p$ scattering at 181 MeV and $^{58}Ni+p$ scattering at 178 MeV for both of which experimental data [5] are available to compare the result with. For neutron, the same potential is assumed as for proton except the charge of the projectile.

We use the procedure described above to determine a standard, Woods-Saxon type potential U_p(WS) and one given by Dirac phenomenology in its Schroedinger equation form, U_p(Dirac). We then use them, together with the corresponding neutron potentials, to get the corresponding folding potentials for deuteron, U_d(WS) and U_d(Dirac) respectively.

We calculate the differential cross section σ, the analyzing powers A_y and A_{yy} for $^{58}Ni+d$ at 400 MeV with U_d(WS) and U_d(Dirac). The results are shown in Fig. 1 by the solid and the dashed lines respectively, together with experimental data [1]. It is obvious that the agreement with the data is much better with U_d(Dirac) than with U_d(WS), especially for A_y. Even for σ, U_d(Dirac) gives very good agreement at forward angles up to 15° and reproduces the position of the maxima and minima at larger angles, although not the magnitude, while U_d(WS) fails to do any of those. It turns out that the cause of this difference between the two potentials stems from the large disparity between their real central part, which is much more weakly attractive in U_d(Dirac) than in U_d(WS).

Finally, it is interesting to note that the analysis described above seems to indicate that the *deuteron*-nucleus scattering can be a better tool for probing the *nucleon* optical potential than the nucelon-nucleus scattering itself. In fact the two potentials used in the analysis give the same quality of fit to the nucleon data as seen in Fig. 2. Nevertheless, U_d(Dirac) is definitely superior to U_d(WS).

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References

1) N. van Sen et al., Phys. Letters 156B(1985), 185 .
T. Hasegawa, private communications.

2) M. Yahiro, M. Nakano, Y. Iseri and M. Kamimura, Prog. Theor. Phys. 67(1982), 1467, and references therein.
3) G. S. Blanpied et al., Phys. Rev. C18(1978), 1436.
4) B. C. Clark et al., Phys. Rev. C31(1985), 1975.
5) A. Nadasen et al., Phys. Rev. C23(1981), 1023.
P. Schwandt et al., Phys. Rev. C26(1982), 55.
A. Ingemarsson et al., Nucl. Phys. A322(1979), 285.

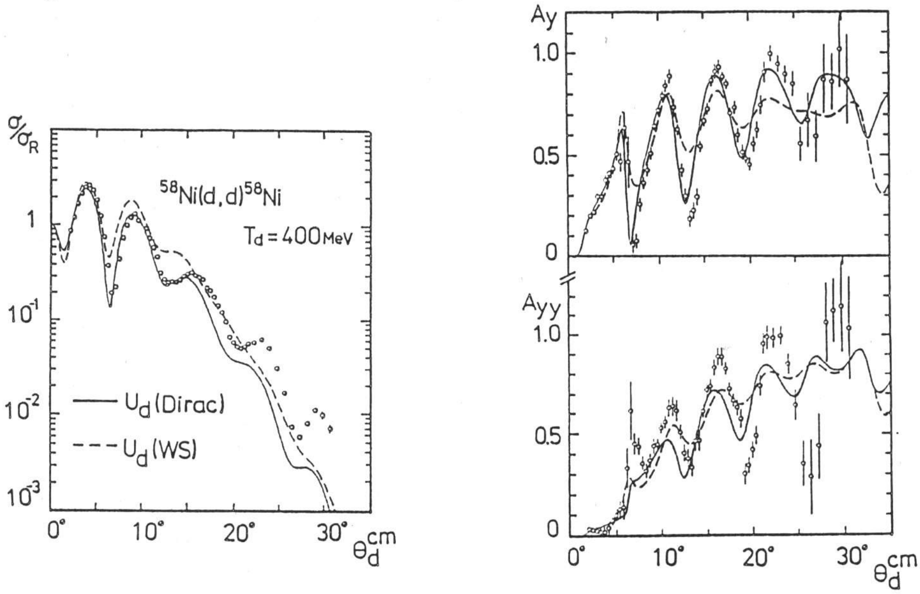

Fig. 1 Comparion of the results of the single-folding model with a nucleon-nucleus potential of Dirac phenomenology (solid lines) and of standard Woods-Saxon type (dashed lines)with experimental data (circles) on the differential cross section, σ, and the analyzing powers, A_y and A_{yy} , in the $^{58}Ni+d$ elastic scattering at 400 MeV.

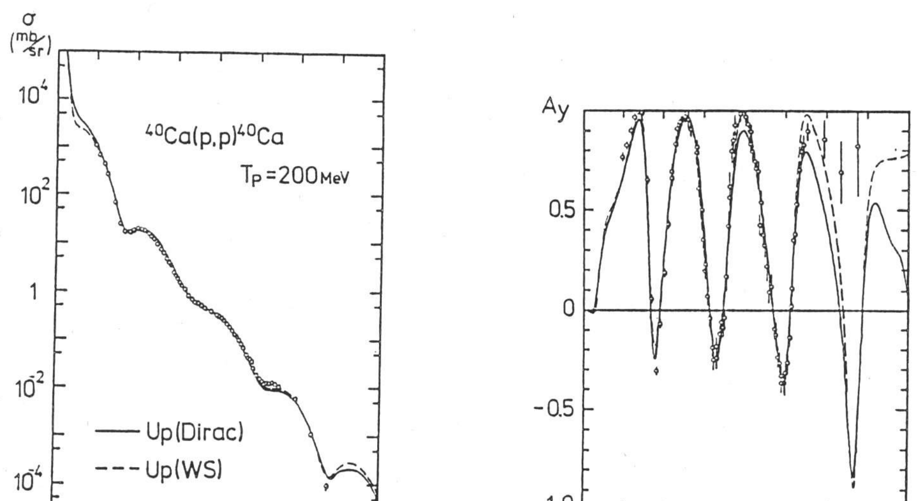

Fig. 2 The best optical model fit to the experimental cross section, σ, and the analyzing power, A_y, (circles) in the $^{40}Ca+p$ elastic scattering at 200 MeV. The solid lines represent the results of the potential of Dirac phenomenology and the dashed lines those of standard Woods-Saxon type.