Proc. Sixth Int. Symp. Polar. Phenom. in Nucl. Phys., Osaka, 1985
J. Phys. Soc. Jpn. 55 (1986) Suppl. p. 598-599

1.23 Elastic and inelastic scattering of 22-MeV polarized protons from the even-even Ge and Se isotopes.

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Elastic and inelastic scattering of 22-MeV polarized protons from the Ge isotopes with A=70,72,74,76 and the Se isotopes with A=76,78,80 are reported for scattering angles ranging from 20 to 165 degrees. The data are compared with predictions of an optical-model potential fitted to the elastic data and with calculations using a deformed optical-model potential.

The purpose of these polarized-proton scattering experiments is to investigate structure effects in the Ge-Se region, a region that resists a complete description[1]. On a previous occasion we have reported on the Zn isotopes, which did not fit completely within the vibrational picture[2]. With this study we aim to test several models for validity in this region. Our Ge data can be compared with the 22-MeV unpolarized-proton scattering data of refs. 3 and 4. For Se work has been published recently with polarized protons of 16 MeV[5] and of 65 MeV[6]. Our study so far does not show a contradiction with these experiments; our approach, however, is different.

Our experiments were performed with the polarized-proton beam facility of the Eindhoven University of Technology AVF cyclotron. Due to the new ANAC ioniser the cyclotron delivered 250 nA of 90% polarized protons. The beam was analyzed to obtain an energy spread of 0.1%, thereby reducing the current on the target to typically 50 nA. The scattered protons were detected by cooled 3-mm Si(Li) detectors. Finally we obtained a typical FWHM of 35 keV in the spectra.

The optical-model fits to the elastic data gave reasonable results. Due to the strong correlation of surface and volume absorption, we fixed the volume absorption to the value of a global potential[7]. Next we tried to find a generalized optical-model potential by performing CC calculations with the code ECIS79[8]. In these calculations the OM parameters are fitted to the ground-state data only but the couplings to the first 2^+ and 3^- states for vibrational nuclei and to the first 2^+ and 4^+ states for rotational nuclei were taken into account with reasonable values of the deformation parameters. In this way the description of the elastic scattering will not deteriorate by the explicit couplings. The OM parameters and deformation parameters obtained were used for further calculations. As an example the analysis for ^{80}Se is presented in figure 1; the other isotopes have been analyzed in the same way.

This work is part of the research programme of the Stichting F.O.M./Z.W.O. and will be published in a forthcoming thesis[9].

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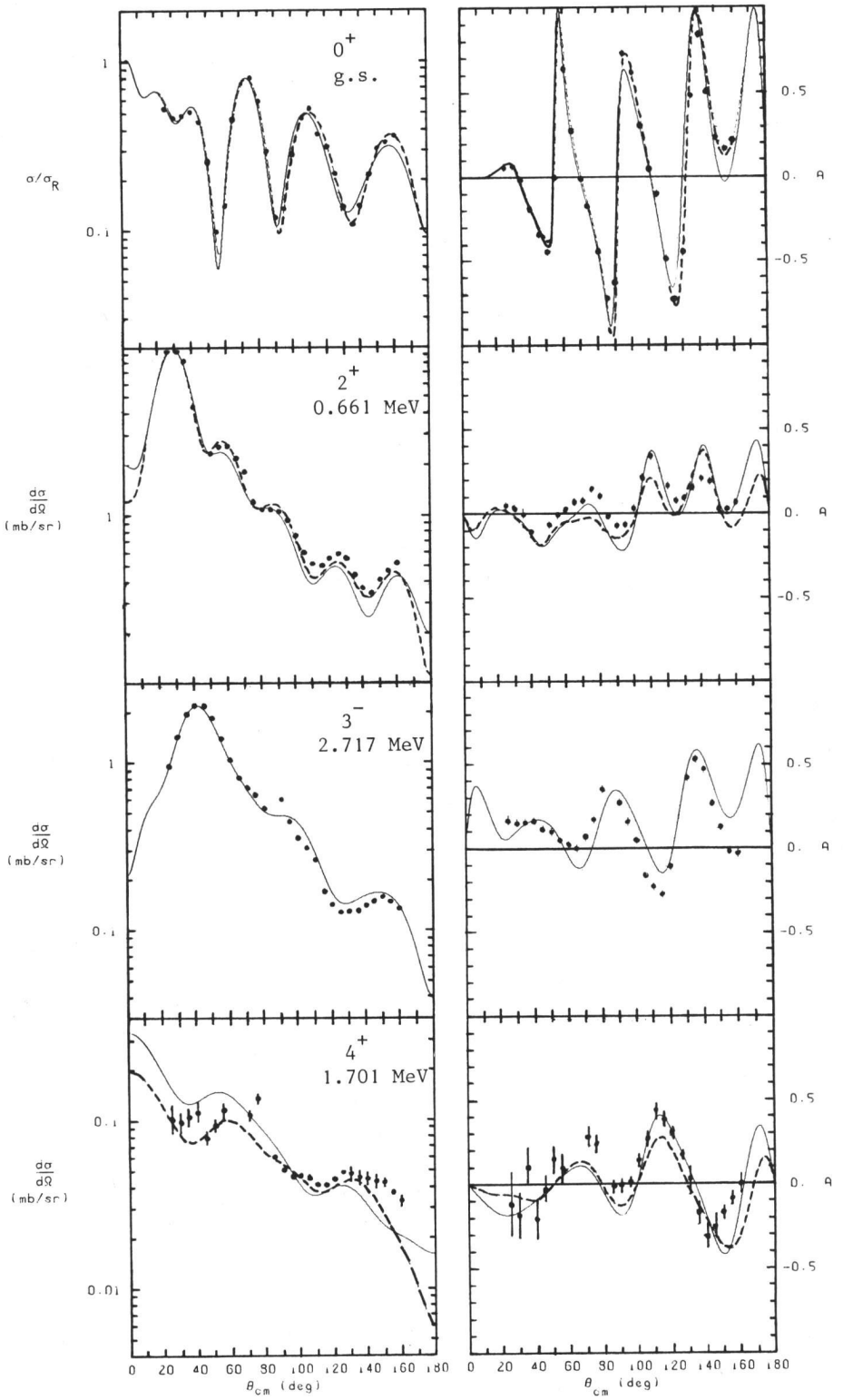

Figure 1: Analysis of ^{80}Se:
full curves harmonic vibrational model (β_2=0.20, β_3=0.15, β_4=−0.065)
dashed curves symmetric rotational model (β_2=0.21, β_4=−0.030)