Proc. Sixth Int. Symp. Polar. Phenom. in Nucl. Phys., Osaka, 1985
J. Phys. Soc. Jpn. 55 (1986) Suppl. p. 590-591

1.19 Energy Dependence of β_2 and β_4 from p-^{28}Si Scattering *)

M. Haller, J. Kiener, W. Kretschmer, H. Löh, A. Rauscher, R. Schmidt, R. Schmitt, T. Schlierf, W. Schuster, R. de Swiniarski +), and D. Vötisch

Physikalisches Institut der Universität Erlangen-Nürnberg,D-8520 Erlangen, Germany

+) Université de Grenoble, Institut des Sciences Nucleaires, 38026, Grenoble, France

The strongly deformed sd-shell nucleus ^{28}Si has been subject of numerous experimental investigations as well with polarized[1-3] as with unpolarized[4-6] nuclear probes. From cross section measurements in the energy region 14 MeV $\lesssim E_{Lab} \lesssim$ 40 MeV a strong energy dependence of the deformation parameters has been deduced by de Leo et al.from proton induced inelastic excitations (Fig.1). The aim of the present investigation was the extraction of β_2 and β_4 from low energy proton scattering.

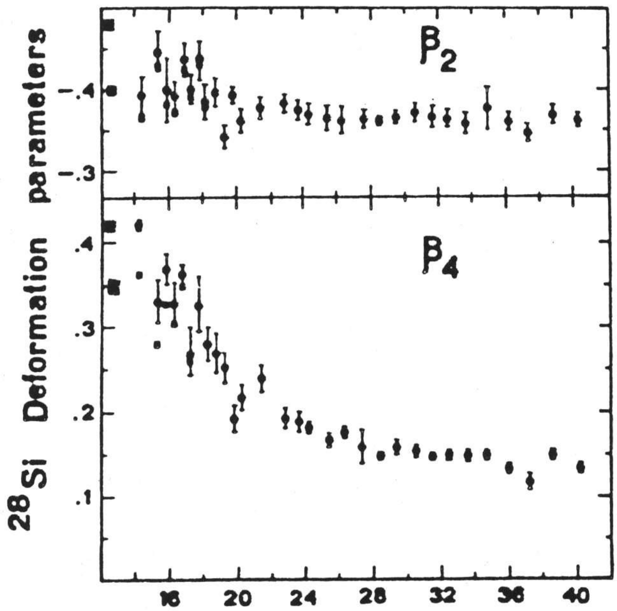

Fig. 1: Engergy dependence of the quadrupole and hexadecapole deformation parameter (ref. 4, ■ this work)

For this purpose differential cross section and analyzing power of the elastic and inelastic scattering of polarized protons on ^{28}Si have been measured for $20° \lesssim \theta_{Lab} \lesssim 170°$ and 10 MeV $\lesssim E_{Lab} \lesssim$ 12.4 MeV. In this energy range both observables showed marked fluctuations and so for a conventional analysis in terms of direct and compound nucleus contributions an artificial energy average over 800 keV has been applied to the data. The optical potential used in the Coupled Channels (CC) calculations was first deduced from a fit to the energy averaged observables $\langle\sigma A\rangle$ and $\sigma^{DI} = \langle\sigma\rangle - \sigma^{CE}$ where the compound-elastic cross section σ^{CE} was estimated by means of a modified Hauser-Feshbach-formalism. The CC-calculations where performed with Raynal's code ECIS in the framework of the rotational model with the coupling 0^+-2^+-4^+. In these calculations the compound contributions were taken into account, the depths of the real and imaginary potential were modified and the deformation parameters β_2 and β_4 were adjusted to the data.

The cross section is well described by the calculations whereas the reproduction of the analyzing power is worse (fig.2), especially at backward angles, which may be attributed to an insufficient energy averaging interval. The deduced deformation parameters listed in Table 1 fit well in the systematic behaviour given by de Leo (see fig. 1). The β_2 values exhibit a 10-30% increase, the β_4 values an increase of a factor 2-3 compared to the corresponding values at higher energies (E_p = 25-40 MeV). The signs of the deformation parameters are clearly determined by our data, since their CC-description badly deteriorates by the use of other sign combinations.

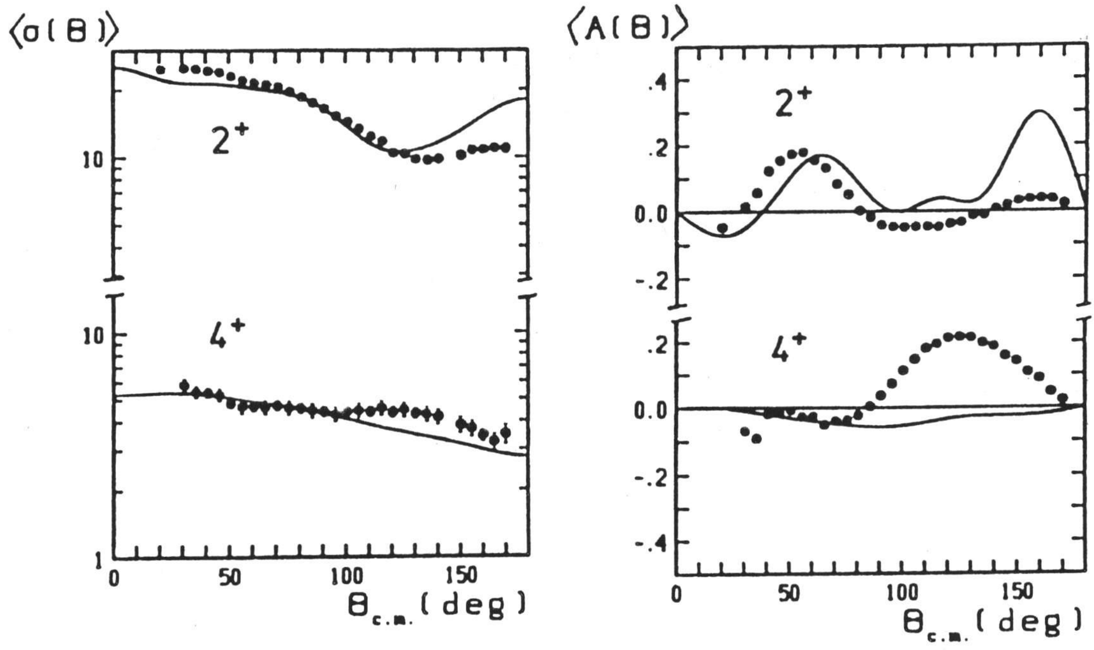

Fig. 2: ⟨σ⟩ and ⟨A⟩ for $^{28}Si(p,p')$ to the lowest 2^+ and 4^+ state, compared with CC-calculations ($\beta_2 = -.48$, $\beta_2^{SO} = -.70$; $\beta_4 = .42$, $\beta_4^{SO} = .60$)

Table 1: Deformation parameters deduced from polarized proton scattering on ^{28}Si

E_p	β_2	β_4
11	-0.48	+0.42
12	-0.40	+0.35

*) Work supported by the DFG and DAAD.

References:

1) R. de Swiniarski, H.E. Conzett, C.R. Lamontagne, B. Frais, and R.J. Slobodrian: Can. J. Phys. 51(1973)1293
2) H. Clement, G. Graw, W. Kretschmer, and W. Stach: J. Phys. Soc. Japan 44, Supp.570 (1978)
3) J. Böttcher et al.: J. Phys. 6: Nucl. Phys. 9(1983)L65
4) R. de Leo, G. D'Erasmo, A. Pantaleo, G.Pasquariello, G. Viesti, M. Pignanelli, and H. von Geramb: Phys. Rev. C19(1979)646
5) F. Vogler, J. Böttcher, W. Eyrich, A. Hofmann, M. Meyer, and U. Scheib. Phys. Rev. C28(1983)1925
6) H. Rebel and G.W. Schweimer: Z. Physik 262(1973)59