Proc. Sixth Int. Symp. Polar. Phenom. in Nucl. Phys., Osaka, 1985
J. Phys. Soc. Jpn. 55 (1986) Suppl. p. 842-843

3.20

Phase-Shift Analysis of π^+-d Elastic Scattering: A Search for Resonances in the Two Baryon System

M. Merdzan [+], W. Grüebler, V. König, J. Ulbricht and P.A. Schmelzbach

Institute for Medium Energy Physics, Swiss Federal Institute of Technology, CH-8093 Zürich, Switzerland

[+]SIN, Swiss Institute for Nuclear Research, CH-5234 Villigen, Switzerland

One of the interesting problems of hadron physics is to clarify the existence of dibaryons. On the basis of the experiments performed at Argonne[1)] three isospin-one dibaryon resonances $^1D_2$(M=2140 MeV), $^3F_3$(M=2200 MeV) and $^1G_4$(M=2430 MeV) have been suggested. The measurements of the vector analyzing power iT_{11}[2)] in πd-elastic scattering showed deviations from the conventional three-body dynamics, while measurements of the tensor polarization t_{20}[3)] at 134 MeV revealed surprisingly rich structure, challenging a phase-shift analysis for these results.

A single-energy phase-shift analysis of π^+d scattering has been performed in the energy range of the measurements of t_{20}[3,4)]. The analysis has been done with a code ONEZERO[5)] modified for the present case. Starting values of the phase-shift search have been the results of the Faddeev calculations of the Lyon group[6)] . The resulting fits for the iT_{11} and t_{20} data are presented in figs. 1 and 2, respectively. The thick solid curves are the Faddeev calculations[6)], the thin and dashed curves are from the present phase-shift analysis. It is very instructive to notice that in spite of oscillations of t_{20} at 134 MeV the fit to iT_{11} data is excellent and behaves smooth over the whole angular range. The fits to the differential cross section data (not shown) are excellent and free from oscillations. In the analysis the phases $^3S_1$, $^3D_1$, $^3D_2$, $^3G_4$ and all partial waves with J>4 were fixed to the Lyon values. Some of the phase-shift behaviour for the solution 1 (thin curves in figs. 1 and 2) as a function of energy is shown in fig. 3 in the Argand plot presentation. The curves with open circles are from ref.[6)]. The dots are from the present investigation. The results can be summarized as follows:

The $^3P_0(0^+)$ phase shows no large deviations from the starting values.

The $^3P_1(1^+)$ phase, which do not occur in pp, πd-pp channels, shows clear resonance behaviour in both solutions.

The $^3P_2(2^+)$ is dominant and stays close to the Lyon values in the first solution (thin solid curves). In the second solution (dashed curves) this phase is fixed to the Lyon values.

$^3D_3(3^-)$ is compatible with original ones.

$^3F_4(4^+)$ is very small (compatible with Lyon value) but with increasing absorption at 134 MeV.

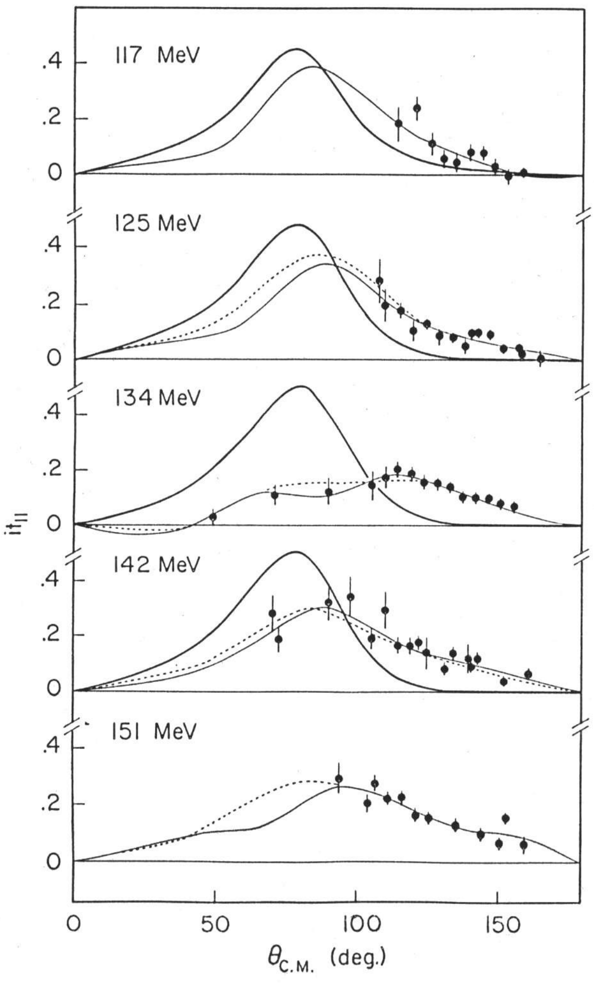

Fig. 1.
Vector analyzing power iT_{11}. Thick solid curves are theoretical predictions of the Lyon group[6)]. Thin solid and dashed curves are results from the present phase-shift analysis. Data are from ref.[2)].

In conclusion the $^3P_1$ phase-shift shows in both solutions a resonant behaviour suggesting a 1^+ resonance in the B=2 system.

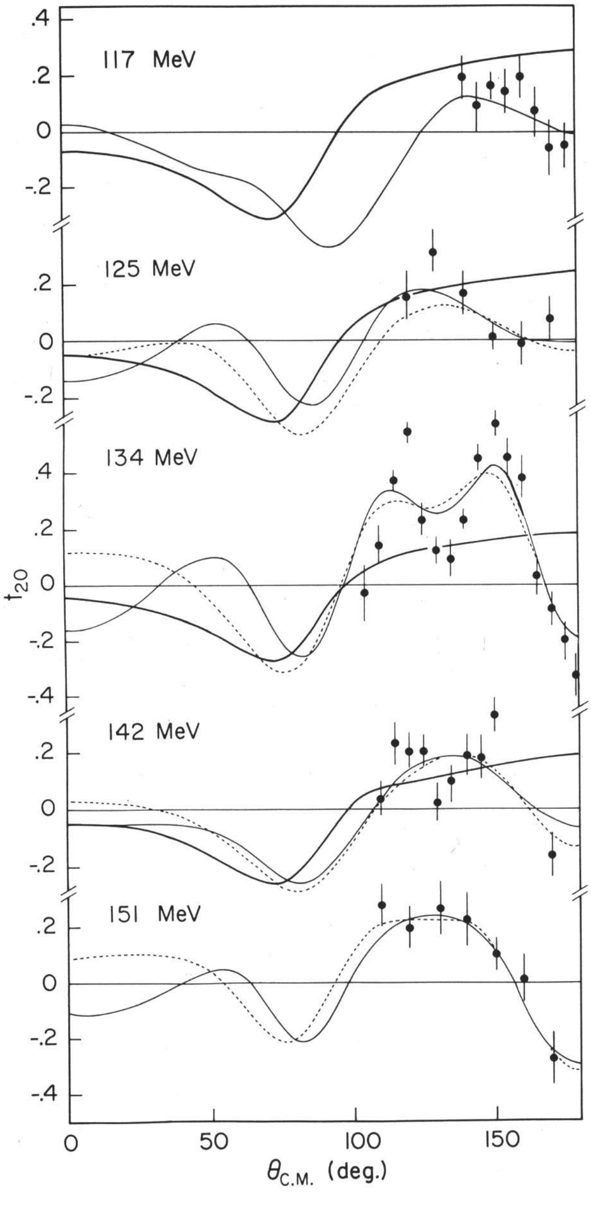

Fig. 2.
Tensor polarization t_{20}.
Notation is the same as in fig. 1. Data are from refs.[3,4].

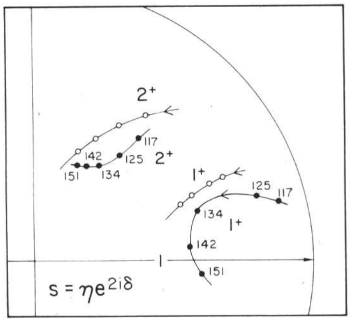

Fig. 3.
Argand diagram for 1^+ and 2^+ partial waves of the first solution (thin solid curves in fig. 1 and 2). Open circles are theoretical values from the Lyon group.

References

1) A. Yokosawa, Phys. Rep. 64 (1980) 47
2) G.R. Smith et al., Phys. Rev. C29 (1984) 2206
3) V. König et al., J. Phys. G: Nucl. Phys. 9 (1983) L211
4) M. Merdzan, thesis to be submitted to the University of Zagreb and to be published
5) B. Jenny et al., Nucl Phys. A397 (1983) 61
6) C. Fayard, private communication