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U. Fasoli, E. A. Silverstein, D. Toniolo and G. Zago: THE ELASTIC SCATTERING OF PROTONS BY Li^6 IN THE ENERGY RANGE 1.3 - 5.6 MeV.

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The most recent scheme of energy levels of Be^7 has been published by Tombrello and Parker[1]. They quote a new level at 9.9 MeV of excitation energy as seen by Harrison and Whitehead[2].

The present experiment gives evidence of a resonance in the excitation curves of the elastic scattering of protons by Li^6 that may be related to the above level.

A proton beam accelerated up to 5.6 MeV with the Van de Graaff accelerator of the University of Padua, and analyzed by a magnet whose resolution was 0.15%, entered a scattering chamber, very similar to that described by Silverstein et al.[3]. The countings were normalized to the same beam charge by a precision integrator of the unscattered beam current collected by means of a Faraday cup.

Scattered protons, He^3 and He^4 particles, coming from the reaction $Li^6(p, He^3)He^4$ were detected by an ORTEC solid state detector, which subtended a solid angle of 2.2×10^{-3} steradian at the target.

The target was made by vacuum evaporation of 99.3% enriched Li^6 metal on a 1000 Å nickel foil. The thickness of the target was equivalent to 30 KeV energy loss for 1.3 MeV protons.

The pulses from the detectors were analyzed by a 512 channel pulse height analyzer. The resolution of the counter and the thickness of the target were such as to allow a clear separation between the peaks of the protons elastically scattered from Li^6 and the peaks due to other particles.

Figure 1 shows the obtained excitation curves; the cross section and the angles are referred to the centre of mass system. The values of the angles correspond to zero's of the Legendre polynomials up to the fourth order, the $168^{\circ}39'$ angle is the largest obtainable by the scattering chamber.

(x) - Now at the Dept. of Physics, University of Wisconsin, U. S. A.

(o) - Work carried out under Contract Euratom-CNEN

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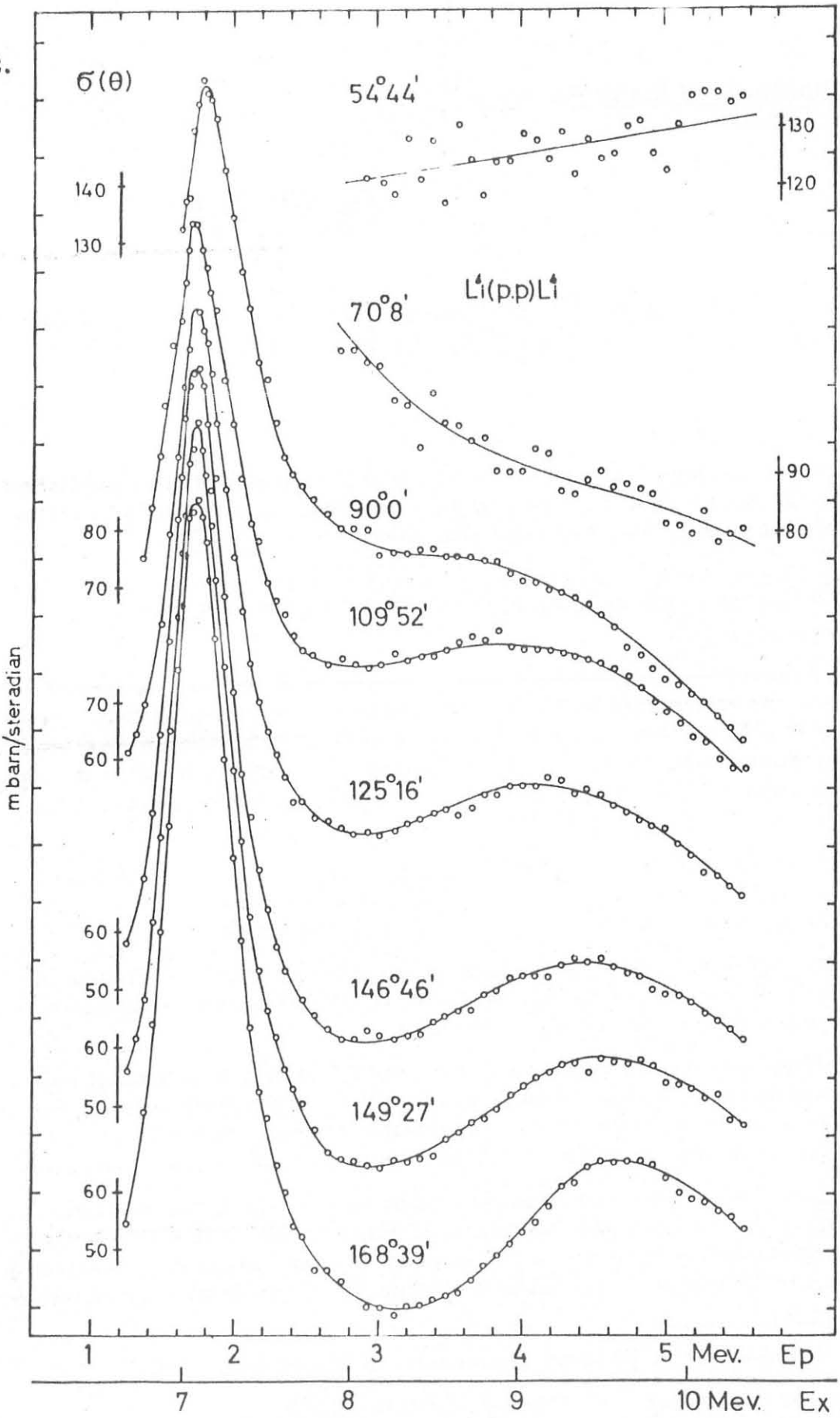

FIG. 1 - Excitation curves of $Li^6(p, p)Li^6$ reaction; the cross section scale and the angles are in the centre of mass system; smooth curves have been drawn through the points; E_x is the excitation energy of Be^7.

Statistical errors varied between 0.5 % and 1.5 %. The mean value of the background correction was 1 %. The errors are slightly larger for the two curves in the forward emisphere.

Correction for the deadtime of the counting chain and for deterioration of the target was not applied because negligible.

The energy scale is estimated to be correct within about 10 KeV.

The present measurements gave only relative values of the cross section. The absolute cross section scale has been evaluated by the reciprocity theorem, normalizing our He^3 yield from the reaction $Li^6(p, He^3)$ He^4[4] to the absolute cross section values of the inverse reaction obtained by Tombrello and Parker[1].

A systematic difference of 17 % has been found between our data and the McCray's[5] data, who performed the same experiment up to 3 MeV of protons energy; the relative values agree well within the statistical errors.

The maximum on the excitation curve at $E_p = 1.85$ MeV is related to the known Be^7 level P 5/2$^-$ at 7.18 MeV of excitation energy. The second broad maximum between 4 and 5 MeV of proton energy may be connected with the level of Be^7 at about 10 MeV of excitation energy, quoted by Tombrello[1].

Figure 2 gives the angular distribution. The curves show that, for energies larger than about 3 MeV, waves with $l = 2$ cannot be neglected.

The analysis of the data is in progress.

We are indebted to Professors A. Rostagni and C. Villi for their support and for helpful discussions.

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(5) - J.A. McCray, private communication.

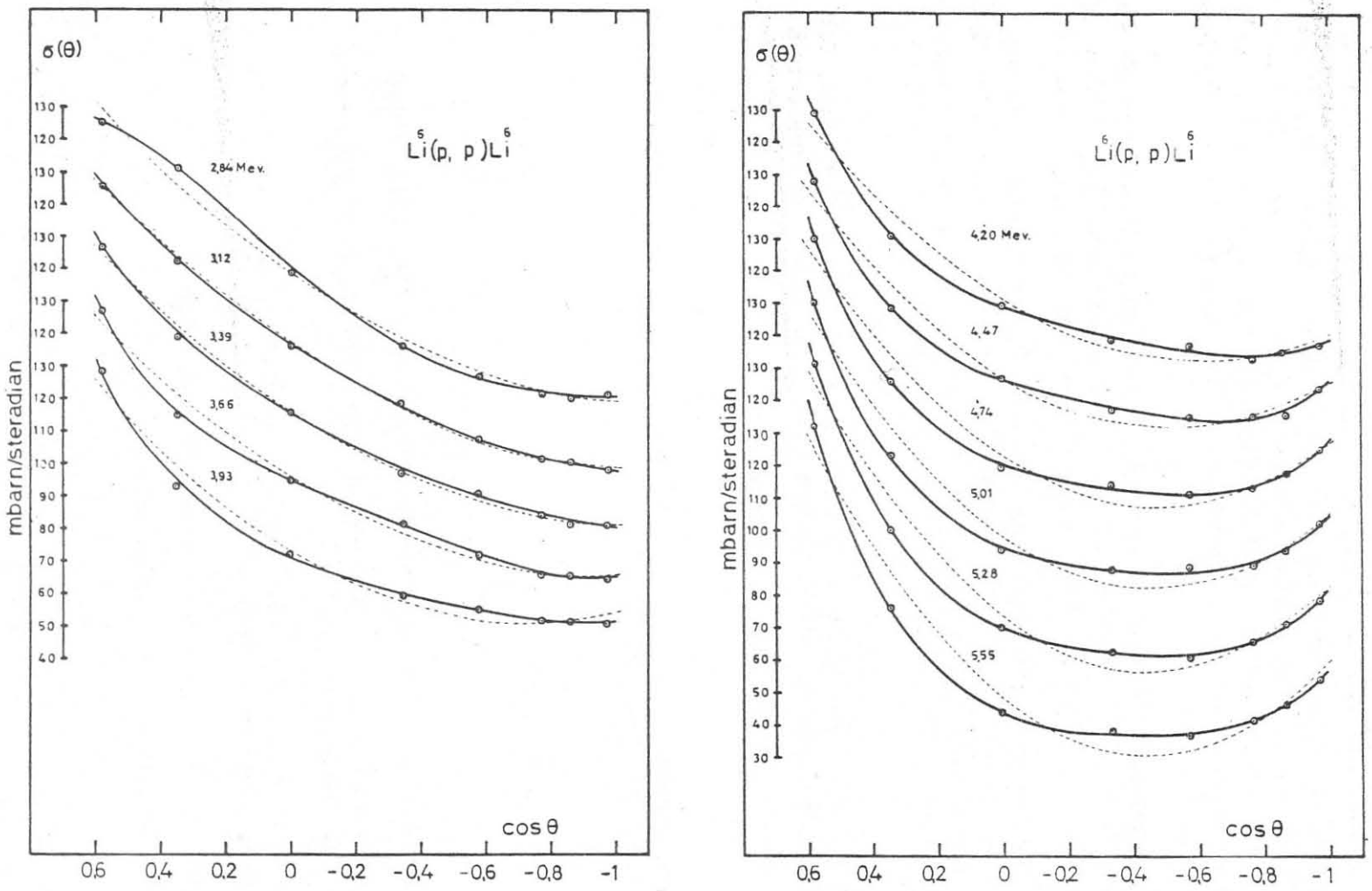

FIG. 2 - Angular distribution in the centre of mass system of the $Li^6(p,p)Li^6$ reaction. The curves have been obtained with the least square method, using second and fourth order polynomials (dotted and continous lines respectively).