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ANGULAR DISTRIBUTION OF THE REACTION $^{9}Be(^{6}Li,^{7}Li)^{8}Be$

by

L. Marquez and C. Redon

CENTRO BRASILEIRO DE PESQUISAS FÍSICAS

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ANGULAR DISTRIBUTION OF THE REACTION $^{9}Be(^{6}Li,^{7}Li)^{8}Be$

L. Marquez (*)
Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro
and
C. Redon
Centre d'Etudes Nucléaires de Saclay

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Abstract:

We have studied the reaction $^{9}Be(^{6}Li,^{7}Li)^{8}Be$ with 2.0 Mev ^{6}Li. The angular distribution of ^{7}Li in the center of mass shows a forward-backward assymmetry with a broad peak at 75°. This indicates direct interaction mechanism. This mechanism could be the transfer of the loose neutron from ^{9}Be to ^{6}Li.

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* Fellow of the Comissão Nacional de Energia Nuclear of Brazil. On leave from the Centro Brasileiro de Pesquisas Físicas at the Centre d'Etudes Nucléaires de Saclay.

INTRODUCTION

The angular distribution of the reaction $^{9}Be(^{7}Li,^{8}Li)^{8}Be$ has been measured by Norbeck et al (1) at energies from 2.0 Mev to 4.0 Mev. They explained their results in terms of a neutron transfer reaction, namely, the transfer of the loose neutron from ^{9}Be to ^{6}Li.

We have reported in a previous paper (2) our results of the observations of gamma rays from the reaction of ^{6}Li on ^{9}Be. We found that the most prominent gamma rays were those from the first excited states of ^{7}Li and ^{10}B.

We report here the results of the measurements of the angular distribution of the ^{7}Li from the reaction $^{9}Be(^{6}Li,^{7}Li)^{8}Be$.

EXPERIMENTAL METHOD

The experiments were done with the 2 Mev Van de Graaff at the Centre d'Etudes Nucléaires de Saclay. The beam of ^{6}Li was produced following the technique of Allison and Littlejohn (3), the beam was stripped, deflected and used as described in our previous experiment (2). We used a Be target that was infinitely thick. However, the reaction cross-section grows approximately exponentially with energy and we have calculated that, for 2.0 Mev incident ^{6}Li, the average energy of the ^{6}Li producing the reaction is 1.81 Mev and its dispersion is 190 Kev.

The target was placed at an angle of 12° or 30° with respect to the incident beam. The outcoming ^{7}Li was detected with a CsI(Tl) counter. We had to put an Al screen in front of the counter to cut the background from the elastic scattering. We used 0.65 mg/cm^2 for angles between 15° and 70° and 1.30 mg/cm^2 for angles between 60° and 110°. The pulses were fed by a preamplifier into a linear amplifier, and sent to a 100 channel analyzer where they were registered. The spectrum obtained at 30° is shown in Figure 1. The first peak comes from the alphas produced in the decay of ^{8}Be and the second peak is from ^{7}Li. The nature of the peaks was verified by range measurements.

We used as monitor the integrated current that fell on the target or the yield of the 717 Kev gamma ray from ^{10}B. The first one gave the most reproducible results.

RESULTS AND DISCUSSION

We show in Figure 2 the angular distribution obtained. The statistical errors were of the order of 2%, however, the points were not reproducible to better than 10%. We think that this was due to chemical and physical changes in the surface of the Be metal as it was irradiated.

We show in Figure 3 the angular distribution in the center of mass system. It shows a forward-backward assymmetry with a broad peak at 75°. The angular distribution of ^{9}Be(^{7}Li,^{8}Li)^{8}Be at 2.0 Mev has a peak in the backward direction, whereas ours is peaked in the forward direction. We do not know if there is a single explanation for both reactions, although it is very probable that both are reactions of neutron transfer involving the loose neutron of ^{9}Be.

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(2) L. Marquez, Journal de Phys. et le Radium (in press).

(3) S. K. Allison and C. S. Littlejohn, Phys. Rev. 104, 959 (1956).

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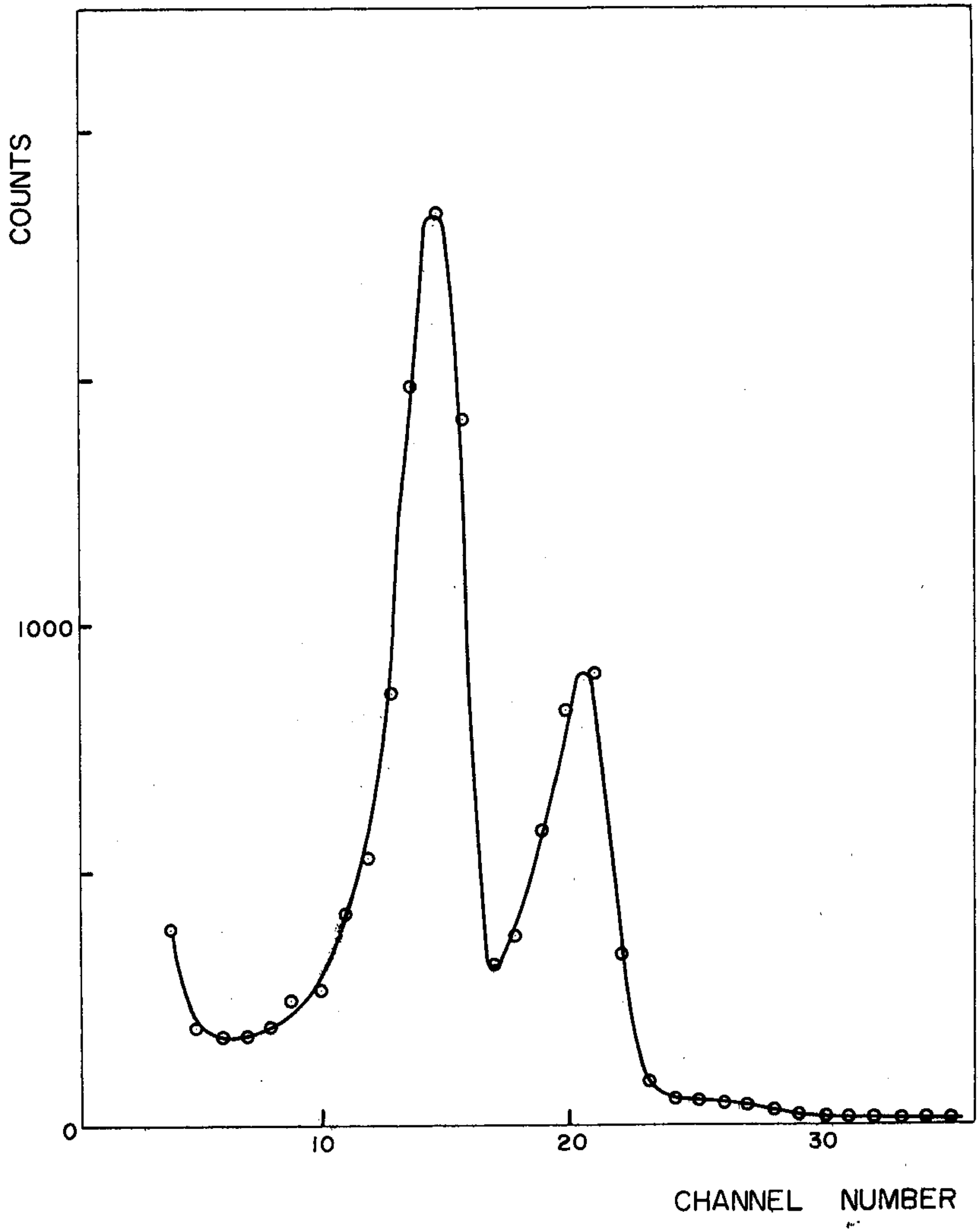

Figure 1. The spectrum of charged particles observed in the CsI(Tl) at 30°. The first peak corresponds to the alphas from the ground state of ^{8}Be. The second peak comes from the ^{7}Li produced in the ground or first excited state. Reactions producing ^{8}Be or ^{7}Li in any other state will not show in our peaks.

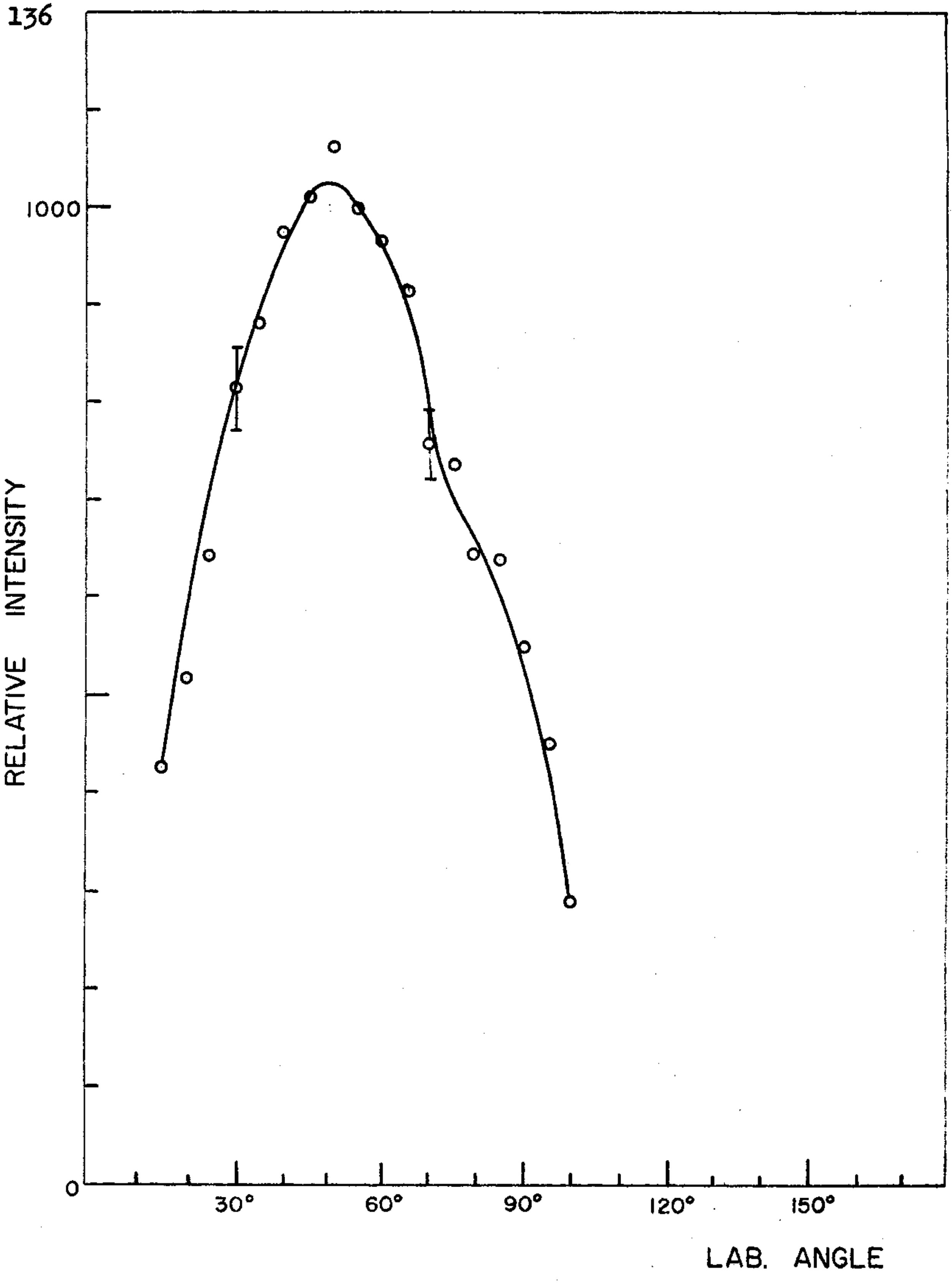

Figure 2. The measured angular distribution in the laboratory.

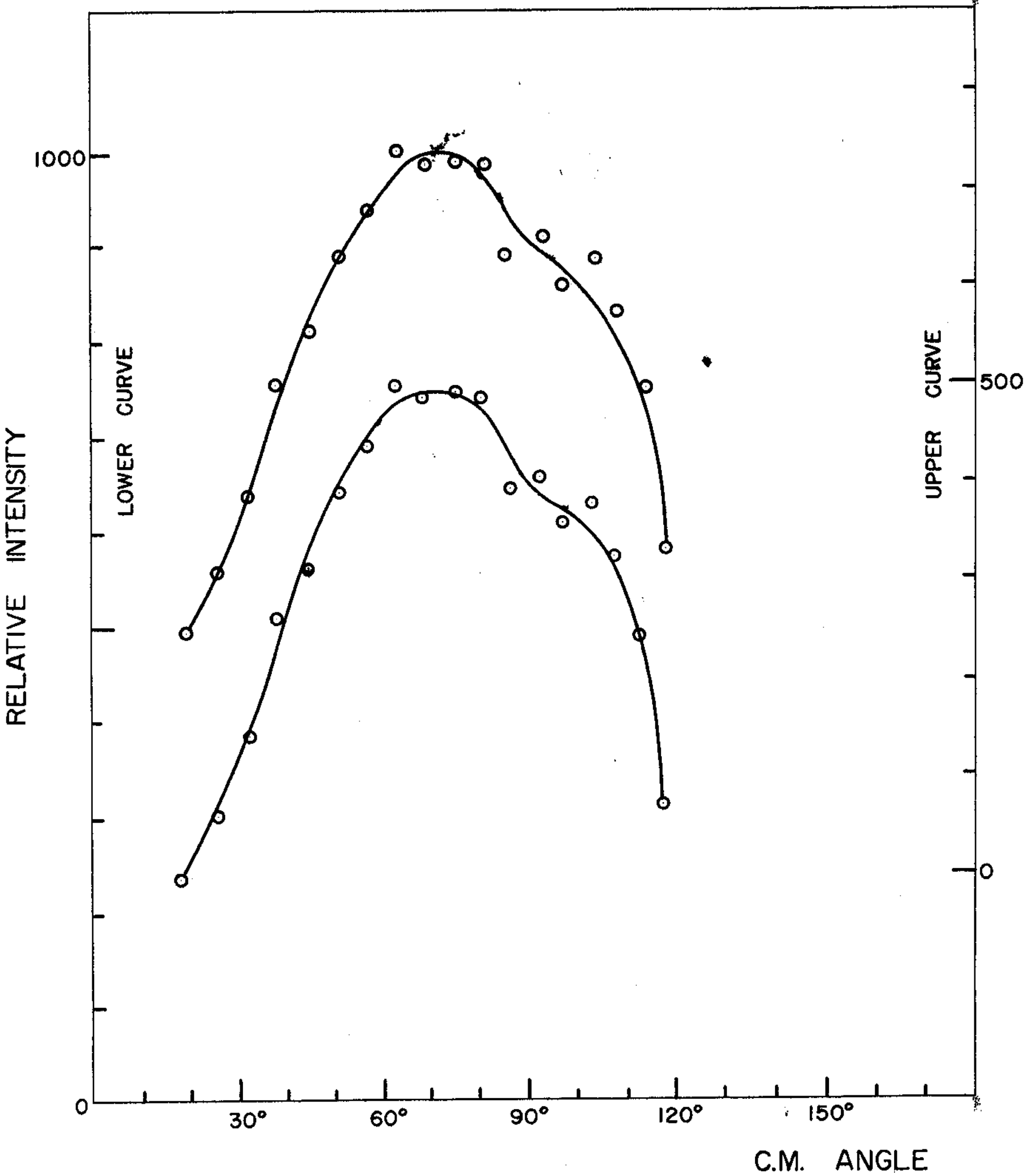

Figure 3. The angular distribution in the center of mass system. The lower curve was calculated assuming that all the ^7Li is formed in the ground state. The upper curve was calculated assuming that all the ^7Li is formed in the first excited state.