## Nuclear Energy Levels in Magnesium

The determination of the excited levels of stable atomic nuclei from scattering experiments was reported by Wilkins and Kuerti[1] and later by Powell, May, Chadwick and Peckavance.[2] In the scattering camera developed by the former authors,[3] a fine beam of high energy particles (protons, deuterons, etc.) from a cyclotron, or other accelerator, is incident on a thin foil at the center of a circular camera and the scattered beam falls obliquely on special photographic plates placed at 5-degree intervals. The plates are then examined in a microscope and the lengths of the individual tracks measured. Track lengths can be converted into energies by well-established relations.

In the case of aluminum, Wilkins and Kuerti[1] reported two peaks in the energy-frequency graph such as shown in Fig. 1 for 6.9-Mev protons. The main peak was interpreted as due to elastically scattered protons and the secondary peak to inelastic scattering. The difference in energy corresponding to these two peaks is about 0.9 Mev. This indicated an excited state level in ${}_{13}Al^{27}$ of 0.9 Mev—in good agreement with the energy of the gamma-ray of excited Al reported by Richardson and also with the differences of the energies of the protons in the $\alpha-p$ reaction on Mg reported by Duncanson and Miller and by Haxel.

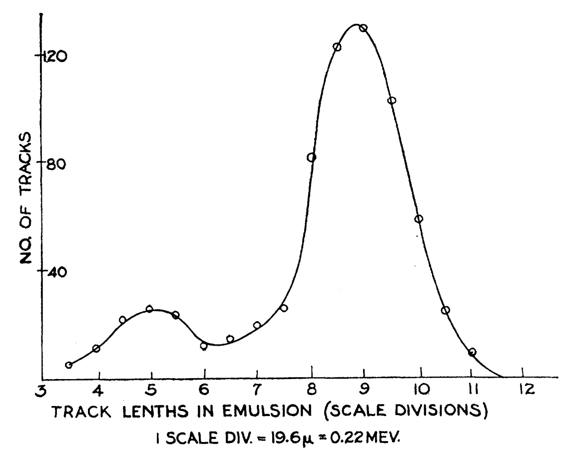


FIG. 1. Scattering of 6.9-Mev protons by aluminum (150°). 1 scale division = 19.6μ = 0.22 Mev.

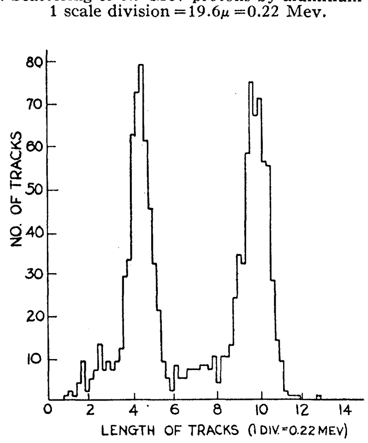


FIG. 2. Scattering of 6.9-Mev protons by magnesium (125°). 1 division = 0.22 Mev.

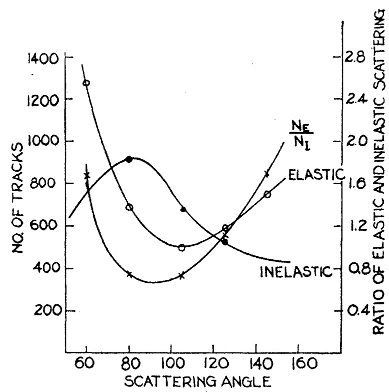


FIG. 3. Scattering of 6.9-Mev protons by magnesium.

In a similar study of the scattering by Mg the angular distribution of the scattered particles has now been investigated. Not only are there elastic and inelastic peaks as for Al but the inelastic fraction varies markedly with the angle of scatter. It is also much larger than for Al.[4] Figure 2 shows the results for 125° and Fig. 3 indicates the absolute and relative variation with angle (normalized for equal exposures).

The separation of the Mg peaks corresponds to an energy difference of about 1.3 Mev. Since three gamma-rays have been attributed to excited ${}_{12}Mg^{24}$, it is possible that other peaks may be found by a repetition of our experiment with fewer stopping foils in the channel between the scattering foil and the plates. An examination of this possibility is in progress. Meanwhile, it may be noted that the excited state level here reported (1.3 Mev) differs from any of the gamma-ray energies reported.

T. R. WILKINS

University of Rochester,
Rochester, New York,

G. WRENSHALL

McMaster University,
Hamilton, Ontario, Canada,
September 30, 1940.

[1] T. R. Wilkins and G. Kuerti, Phys. Rev. **57**, 1082 (1940).
[2] C. F. Powell, A. N. May, J. Chadwick and T. G. Peckavance, Nature **145**, 901 (1940).
[3] T. R. Wilkins and G. Kuerti, Phys. Rev. **55**, 1134 (1939); T. R. Wilkins, J. App. Phys. **11**, 44 (1940).
[4] This is possibly due to the absence of a $p-n$ reaction in $Mg^{24}$ which is mainly responsible for this scattering.

## Erratum: Hydrodynamics and the Morphology of Nebulae

(Phys. Rev. **58**, 478 (1940))

The caption to Fig. 1 in the Letter to the Editor of the above title should read,

"FIG. 1. Average velocity distribution in the stationary state of a rotating nebula."

F. ZWICKY

California Institute of Technology,
Pasadena, California,
September 17, 1940.