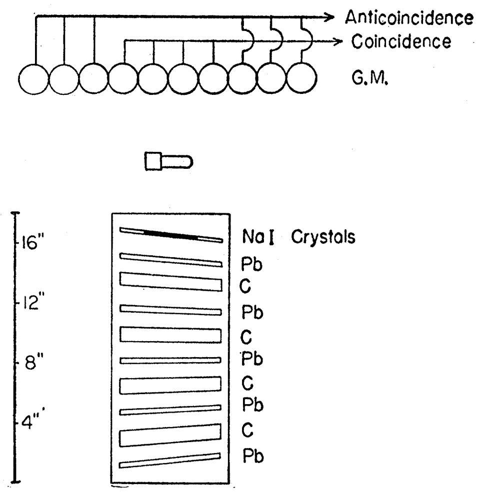

FIG. 1. Experimental disposition; coincidence and anticoincidence Geiger-Mueller counters were used to concentrate on proton-produced events and to cut down air showers.

We have also plotted the points reported by the Bristol Group[4] referring to the charged mesons. The average atomic weight of our crystals almost equals that of the nuclear emulsions. Comparison with the Bristol data[5] on the energy distribution of the π_0 in the air will be discussed in a later paper.

TABLE I. Distribution of nuclear events, N_s, according to the number of shower particles.

No. of shower particles, s:	1	2	3	4	≥ 5
No. of nuclear events, N_s, containing s shower particles:	216	92	45	23	19
No. of nuclear events, N_s, having electromagnetic component:	25	28	29	16	16

2. *Ratio of neutral to charged mesons.* We consider first the events with three or more shower particles. These events show 336 shower particles, and for them we estimate 74 neutral mesons, corresponding to about 22 percent of the shower particles. The shower particles mainly consist of protons and π-mesons, and the π-mesons are about 60 percent of the shower particles.[4]

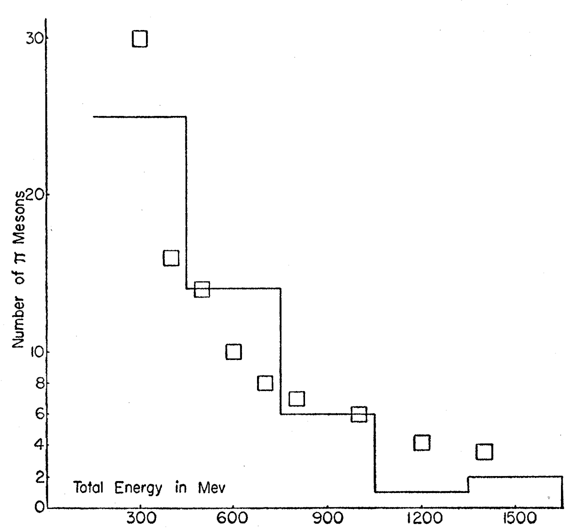

FIG. 2. Differential energy distribution of the π-mesons. Squares: $\pi_+ + \pi_-$; histogram: π_0.

TABLE II. Summary of data on neutral mesons.

Energy of the protons	σ production	Energy distribution	$\pi_0/(\pi_+ + \pi_-)$
0.345 Bev	$\sim 1/200\,\sigma_{geom}$[7]	...	...
0.8–2 Bev	$0.22 \pm 0.06\,\sigma_{geom}$	Compare Fig. 2	0.4 ± 0.1
>2 Bev	$0.7 \pm 0.15\,\sigma_{geom}$		0.37 ± 0.08

This value gives for the ratio of neutral to charged mesons, $R = \pi_0/(\pi_+ + \pi_-) = 0.37 \pm 0.08$, in agreement with the previous observations by Tinlot and Gregory[3] and the earlier results of the Bristol Group.[5]

On the other hand, if we make the corresponding estimate for the events with 1, 2, 3, or 4 shower particles, we find again a similar value, $R = 0.4 \pm 0.1$. This is not in agreement with the recent Bristol value[6] $R = 1 \pm 0.3$ for these events.

3. *Production cross section of the* π_0. We divide the events of Table I into two groups: (a) those with one or two shower particles, or with at least one neutral meson, and (b) those with three or more shower particles.

If we assume that the proton nucleus total cross section for one "nucleus" of sodium iodide is geometrical, σ_{geom}, then we can estimate the cross section $\sigma\pi_0$ for π_0 production for events (a) and (b). For events (a) we find a value $\sigma\pi_0 = 0.22 \pm 0.06\sigma_{geom}$; for events (b) $\sigma\pi_0 = 0.7 \pm 0.15\sigma_{geom}$. Recent results[6] on the correlation between the primary proton energy and the size of the nuclear events indicate that events (a) are mostly produced by protons of energy $\sim 0.8 - 2$ Bev; (b) are by protons of energy ≥ 2 Bev.

In Table II, we summarize the pertinent data on the neutral mesons.

* Assisted by the joint program of the ONR and AEC.

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The Nuclear Gyromagnetic Ratio of V^{50} and Measurements on Rb^{85} and Cl^{35}*

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THE nuclear gyromagnetic ratio of vanadium 50 has been determined in a nuclear induction apparatus similar to that described by Proctor[1] and previously reported.[2] An electronically regulated electromagnet with a gap of $1\frac{3}{4}$ inches produced a field homogeneous to 0.1 gauss over the sample volume. Frequency measurements were made with a Signal Corps BC-221 frequency meter calibrated with harmonics from an external 100 kc, crystal-controlled oscillator, which in turn was compared with *WWV* at 10 Mc.

The sample consisted of 271 mg of electromagnetically enriched vanadium as $VOCl_3$, of which an estimated 25 mg was vanadium 50. This enriched sample was preptred from V_2O_5 and was sealed in a small spherical glass vial which was placed in a test tube and surrounded by a saturated solution of RbCl containing 15 percent D_2O. No magnetic catalyst was added.

The vanadium 50 resonance was first observed near 6 Mc at a field of 14,250 gauss. Frequency measurements were made at nominal fields of 14,250, 11,900, and 10,100 gauss. The frequency ratios for V^{50} relative to Cl^{35}, Rb^{85}, and deuterium gave:

$$\nu(V^{50})/\nu(Cl^{35}) = 1.01758 \pm 0.0001,$$
$$\nu(V^{50})/\nu(Rb^{85}) = 1.03262 \pm 0.0001,$$
$$\nu(V^{50})/\nu(D^2) = 0.649527 \pm 0.00007.$$

The sign of the moment of V^{50} has been determined to be positive by direct comparison with Rb^{85} and Cl^{35} resonances. The observed line widths at 10,100 gauss were 1.75, 2.1, and 0.92 gauss for V^{50}, Rb^{85}, and D^2, respectively. Using a value of 2.79268 $\pm$0.00006 nm[3] for the proton moment, and Levinthal's[4] value for the deuteron-to-proton frequency ratio, and a spin of 1 for the deuteron, the nuclear gyromagnetic ratio for vanadium 50 becomes +0.55690$\pm$0.00006.

Frequency measurements were made at the same nominal fields for Rb^{85}, Cl^{35}, and D^2. The ratios measured with deuterium were converted to those relative to the proton by using Levinthal's deuteron-to-proton frequency ratio of 0.1535059. In Table I, our results are compared with other published values.

TABLE I. Comparison of results.

	Frequency ratio	Method	Reference
$\nu(Rb^{85})/\nu(Cl^{35})$	=0.98545 $\pm$0.00042	Indirect	Bitter[a]
	0.98592 $\pm$0.0008	Indirect	Chambers and Williams[b]
	0.98541 $\pm$0.00015	Direct	This report
$\nu(Rb^{85})/\nu(H^1)$	=0.096574 $\pm$0.00004	Indirect	Bitter[a]
	0.09661 $\pm$0.00004	Direct	Chambers and Williams[b]
	0.0965521 $\pm$0.0000003	Direct	Yasaitas and Smaller[c]
	0.096554 $\pm$0.00001	Indirect	This report
$\nu(Cl^{35})/\nu(H^1)$	=0.097999 $\pm$0.00005	Indirect	Bitter[a]
	0.09799 $\pm$0.00007	Direct	Chambers and Williams[b]
	0.097978 $\pm$0.00009	Direct	Proctor and Yu[d]
	0.097985 $\pm$0.00001	Indirect	This report

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Tin Activation of LiI

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CRYSTALS of LiI with thallium activation have been shown[1] to respond to thermal neutrons.

In the course of testing the effect of various activators in LiI, it was found that a strong luminescence occurred under ultraviolet excitation when LiI was activated by tin. In order to determine its response to slow neutrons, crystals of this phosphor containing about 0.1 mole-percent of SnI_2 were grown from the melt. One of these crystals was selected which was about 1×0.5×0.5 cm in size, irregular in shape, transparent, and ranging in color from faint yellow to nearly colorless. The crystal was ground smooth on one side and optically connected to a 5819 photomultiplier through a 1-inch-diameter by 0.5-inch-long Lucite light piper. White Vaseline was used to join the crystal, Lucite, and photomultiplier. An aluminum can covering the crystal and clamped with an "O" ring to the Lucite served as a reflector and as a means of maintaining the crystal in an atmosphere of dry nitrogen.

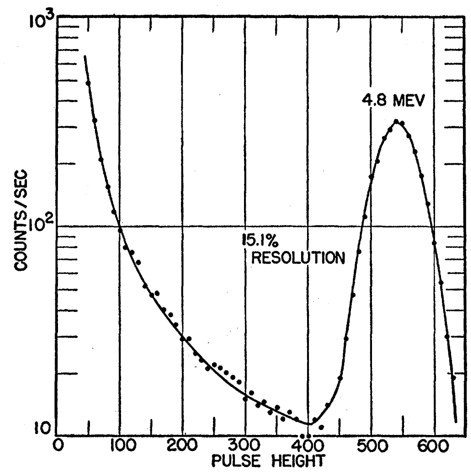

FIG. 1. Slow neutrons on LiI $-SnI_2$.

The crystal was exposed to uncollimated neutrons from an unshielded Po$-$Be source. A flux of slow neutrons was obtained by placing a block of paraffin behind the source. The measured photomultiplier pulse-height spectrum is shown in Fig. 1. Even in the presence of the γ-rays and fast neutrons emanating from the source, and in spite of the irregularity and nonuniformity of the crystal, the pulse-height spectrum exhibits a resolution of 15.1 percent for the monoenergetic excitation of the phosphor from the reaction of the moderate neutrons with the Li^6.

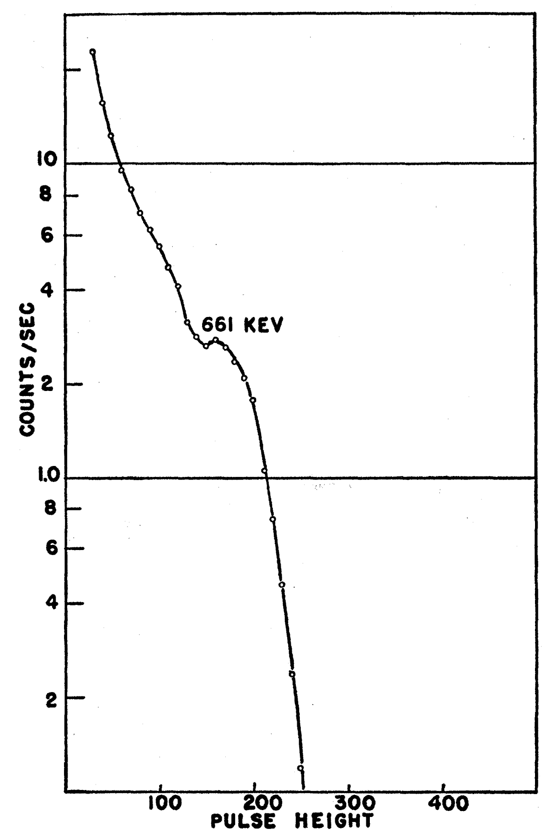

FIG. 2. Cs^{137} γ-rays on LiI $-SnI_2$. The pulse-height scale is twice that of Fig. 1.