TABLE I. Energy levels of singly ionized tellurium, Te II.

Energy (cm^{-1})	Symbol	J	g	Hfs^{125} (cm^{-1})
Odd levels				
$5p^3$:				
0	00^o	3/2		
10222	10^o	3/2		
12423	12^o	5/2		
20546	20^o	1/2		
24032	24^o	3/2		
$5p^26p$:				
93978.00	93^o	1/2(3/2)		
96143.84	96^o	3/2	1.3	
97779.13	97^o	1/2	1.2	
99583.68	99^o	3/2	1.30	−0.064
100111.18	100^o	5/2	1.39	0.00
101220.10	101^o	3/2	1.30	−0.061
101370.01	101^o	1/2	2.29	+0.078
102323.61	102^o	5/2	1.33	−0.256
103104.98	103^o	7/2	1.36	−0.246
103935.04	103^o	3/2	1.74	−0.193
105005.21	105^o	3/2	1.18	
105582.14	105^o	5/2	1.29	−0.223
106118.35	106^o	1/2		
107956.82	107^o	5/2		
112271.53	112^o	3/2	1.12	
112547.95	112^o	3/2,5/2		
?117858.18	?117^o	7/2		
?118804.25	?118^o	3/2,5/2		
Even levels				
Energy (cm^{-1})	Symbol	J	g	Hfs^{125} (cm^{-1})
$5s5p^4$, $5p^26s$, $5p^25d$:				
71191.66	71	5/2	1.70	
74892.51	74	3/2	1.78	0.00
76299.96	76	1/2	2.71	
78447.25	78	1/2	2.4	−0.228
81894.55	81	3/2	1.12	−0.057
82742.49	82	3/2	1.42	−0.083
83576.56	83	1/2	1.07	+0.082
85048.45	85	5/2		−0.093
85158.81	85	3/2	0.8	0.00
85591.02	85′	5/2	1.49	−0.431
86758.94	86	3/2	0.99	+0.026
87403.64	87	5/2		
88923.83	88	5/2		
88960.18	88	3/2	1.14	
$5p^27s$, $5p^26d$:				
117338.75	117	3/2		−0.010
118008.02	118	1/2(3/2)		
118323.96	118′	1/2(3/2)		
120616.23	120	5/2		−0.25
121173.04	121	3/2		
121518.02	121′	3/2	1.24	−0.044
122195.93	122	3/2(5/2)		
123653.66	123	7/2	1.24	
124081.15	124	1/2		
124645.47	124	5/2	1.27	−0.136

The levels $00^o{}_{3/2}$, $10^o{}_{3/2}$, $78_{1/2}$, and $82_{3/2}$ were found by Rao and Sastry[1] from ultraviolet transitions. We are unable to verify the rest of their analysis. We have used the ionization discrimination data of the Blochs,[2,3] which tend to be substantiated by our findings, and we have made tentative use of the ultraviolet wavelengths of the Bloch group.[3,4] Aside from the assignment of configurations or groups of interacting configurations, and J, no quantum numbers are listed here, though some approximate assignments are obvious. In some cases of uncertain J, the less likely value is enclosed in parentheses. The zeros to the right of the decimal point in the energy of level 93^o are arbitrary. The exact values of energy, g-value, and hfs-splitting are subject to slight readjustment in the course of later work. In the "hfs" column, a plus sign means that the energy of the sublevel with $F=J-\frac{1}{2}$ is the lower. The splittings are given only for the isotope 125; those for 123 can be found by dividing by the magnetic moment ratio $\mu^{125}/\mu^{123}=1.208^6$, since both isotopes have the same I-value $\frac{1}{2}$.[5,6]

We are extending the observations in both the infrared and the vacuum ultraviolet, and are systematically searching for more levels. More complete accounts of the general analysis (JCvdB and JEM) will be submitted later to *Physica*, and of the hyperfine structure and isotope shift[5] (JSR and KM) to the *Physical Review*.

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‡ On leave from Institute of Science and Technology, University of Tokyo, Tokyo, Japan.

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Electromagnetic Interactions of μ-Mesons*

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BECAUSE of the finite size of the particles, a deviation from the calculated energy spectrum of electrons knocked on by μ-mesons should occur for collisions with high momentum transfer.[1] A preliminary experiment has been done in an attempt to determine at what electron energy this deviation occurs in order to estimate the size of the charge distributions of the colliding particles.

The collisions were observed in a cloud chamber with carbon plates, and the initiating particles were required to have range between 35 and 37 inches Pb.

The chamber was triggered when counters were struck in rows B, C, and D in anticoincidence with row A of Fig. 1. The counters of row N were connected to neon bulbs to aid in identifying the triggering particle. Other experiments indicate that most of the particles thus selected were μ-mesons.[2,3]

The chamber contained six carbon plates, each 3.16 g/cm², and one lead plate, 15 g/cm². A stereoscopic camera was used. Only pictures with single tracks of counter age with directions such as to strike the counter trays were accepted.

The energy of the knock-on electrons was estimated by the number of carbon plates they traversed. A range-energy curve, obtained by assuming all energy loss to be due to ionization, was corrected for multiple scattering effects and for radiation losses.

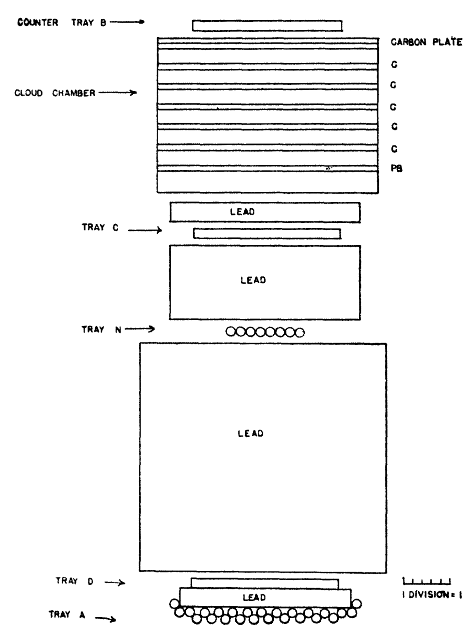

FIG. 1. Experimental arrangement.

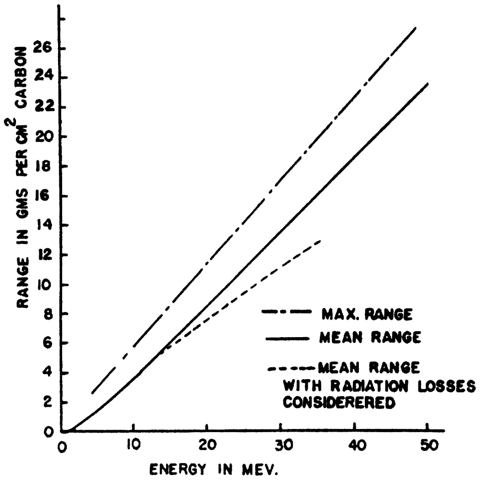

FIG. 2. Range-energy curve.

The correction for the increase of path length caused by multiple scattering was calculated using the approximation that the energy loss per unit path length is constant and equal to 1.8 Mev/g/cm².

$$\text{Effective range} = \int_0^{t_{\text{limit}}} \cos(\alpha)dt \approx \int_0^{t_{\text{limit}}} (1-\tfrac{1}{2}\langle\alpha^2\rangle_{\text{Av}})dt,$$

where $\langle\alpha^2\rangle_{\text{Av}} = 441t/E(E-\epsilon t)$ = mean square scattering angle;[4] t-thickness in radiation lengths; $\epsilon = 1.8\times 52$ Mev/radiation length; t_{limit} is chosen such that $\langle\alpha^2\rangle_{\text{Av}} = 2$; E = total energy in Mev at $t=0$.

Below one-Mev energy the curve was fitted to the expression given by Glendenin.[5] The range-energy curve is shown in Fig. 2.

TABLE I. Number of knock-ons traversing N plates. Total No. of carbon plates traversed = 5439.

Number of electrons observed to traverse	⩾0 plates	⩾1 plates	⩾2 plates	⩾3 plates	⩾4 plates	⩾5 plates
Observed	388	67	19	6	1	1
Calculated	413	65	24	10	4	1.3
Average energy required in Mev	...	16	25	34	43	52

The average radiation loss for each increment of path length was calculated from the formula and curves for average fractional radiation loss per radiation length given by Rossi and Greisen.[6]

The number of traversals of carbon plates by mesons of about 1.2-Bev energy was observed to be 5439. The number of knock-on electrons observed to emerge from one carbon plate and to traverse 0 or more carbon plates, one or more carbon plates, etc., is given in Table I. Beneath the observed number of electrons is the expected number, calculated from the above range curve using a method very similar to one given by Hereford.[7]

The agreement between theory and experiment seems to be good up to momentum transfer of at least 25 Mev/c. This corresponds to a momentum transfer of 5 Mev/c in the center-of-mass system. Thus it appears that the inverse square law holds down to distances of $\hbar/\Delta p = 4\times 10^{-12}$ cm.

Two instances of scattering of the triggering particles in the carbon were observed. However, both were less than 3°. This indicates that the cross section for scattering greater than 4° is less than 3×10^{-27} cm² per carbon nucleus.

* Supported in part by a grant from the Research Corporation.
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Inertia of the Carrier of Electricity in Cadmium

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THERE has been some attempt to obtain a simple explanation for positive Hall coefficients in metals by assuming a positive carrier for the electric current. Since apparatus was available at the General Motors Research Laboratories for measuring inertia effects of moving electricity, it was decided to set up an experiment[1] to determine both the sign and the mass charge ratio of the carrier of electricity in cadmium, a metal having a positive Hall coefficient. This apparatus and the experimental technique used has recently been described in work on the measurement of the gyromagnetic ratio of iron.[2]

In the present experiment a cylindrical coil was wound from a Nylon insulated cadmium wire. This coil was supported as a torsional pendulum with the axis of rotation coinciding with the mechanical axis of the cylinder. Readings were taken of changes in angular momentum along with the corresponding changes in magnetic moment, and the mass charge ratio of the carrier computed from these values.

The results for five different days on which readings were taken, in May, 1950, are as follows (in units of 10^{-9}g per coulomb): -6.4, -6.0, -5.4, -4.5, and -5.3. The average value obtained for the mass-charge ratio of the carrier in cadmium is -5.5×10^{-9} g per coulomb.

These results show conclusively that the carrier of electricity in cadmium is negative and that the mass-charge ratio is approximately the same as that of the electron.

Similar results have recently been reported by Brown and Barnett[3] for Mo and Zn.

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Erratum: Lithium Ammonium Tartrate Monohydrate, a New Ferroelectric Crystal

[Phys. Rev. **82**, 562 (1951)]

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THERE was a typographical error in reference 1. The independent discovery of the ferroelectric behavior of $LiNH_4C_4H_4O_6\cdot H_2O$ and $LiTlC_4H_4O_6\cdot H_2O$ was privately communicated to the author by B. T. Matthias and J. K. Hulm in February, 1951, and was reported in the April 1, 1951, issue of *The Physical Review* [Phys. Rev. **82**, 108 (1951)]. Matthias and Hulm did not state that $LiRbC_4H_4O_6\cdot H_2O$ is ferroelectric.

Nuclear Proton Resonance in Related Liquid Hydrocarbons*

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A PRELIMINARY investigation of the line-width parameter, T_2,[1] for several long-chain hydrocarbons has been made. These measurements were made as part of an extended program to correlate structure with the line-width parameter in related series of hydrocarbons. The measurements were made with a Bloch crossed-coil type nuclear induction apparatus[1] in our new electromagnet with 12-inch diameter pole faces. The operating