referred to in reference 2; therefore, it is felt that the present values of σ_i and σ_d and, hence, of σ_i/σ_d are more nearly correct.

The author wishes to thank T. Holstein for his continued interest and helpful discussions of this problem.

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[4] Using Eq. (5) we find the ambipolar diffusion coefficient of argon ions in helium to be $D_a{}^A p = 905$ (cm²/sec)-(mm Hg). These measurements are discussed in detail in Part II of reference 1.
[5] The gases used were Airco reagent grade helium, neon, and argon (impurity $\sim 1:10^4 - 10^5$). The vacuum system used pumped to 10^{-9} mm Hg and exhibited a rate of rise of gas pressure of $\sim 10^{-10}$ mm/min. See D. Alpert, Rev. Sci. Instr., to be published.

The Energy of the Metastable State of Ba^{135}

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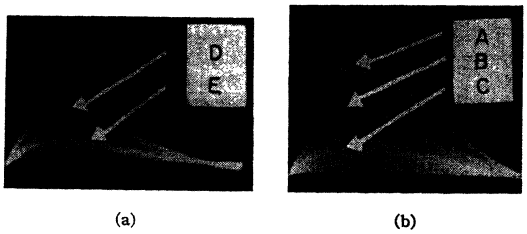
UP to the present time the only information existing in the literature on the radiations from the metastable state of Ba^{135} arises as a result of absorption measurements.[1-3] The energy of the gamma-ray has been reported to be 0.3 Mev and that of the internal conversion electron 0.28 Mev. Ba^{135} lies in that region of the chart of nuclides, running roughly from Ag^{111} to Ba^{137}, in which a large number of isomeric states are found, owing to the fact that the $s_{1/2}$, $d_{3/2}$, and $h_{11/2}$ shells are being filled competitively. Since there appear to be certain regularities in the energy of filling the $h_{11/2}$ shell,[4] it was considered important to obtain an accurate value for the energy of the metastable state of Ba^{135}. The energy of the gamma-ray from Ba^{135} was measured with the help of a scintillation counter and that of the internal conversion electrons in a magnetic lens spectrometer.

The Ba^{135} was made by the bombardment of barium with 11.5-Mev deuterons in the Indiana University cyclotron. After chemical separation for barium the only periods found were the 85-min period of Ba^{139} and the 28.7-hr period of Ba^{135}. The 38.6-hr period of Ba^{133} was not seen.

The gamma-rays were investigated with the help of a scintillation spectrometer consisting of a NaI(Tl) crystal and an RCA 5819 photomultiplier tube. The pulses from the photomultiplier were fed through a cathode follower and then to a linear amplifier. The amplified pulses triggered the sweep of a Tektronix Model 514D oscilloscope. Time exposures[5] of the pulses displayed on the oscilloscope were taken with a camera using Eastman Panchromatic Super XX film. The exposure times varied from 10 seconds to several minutes depending on the intensity of the source.

The instrument was calibrated using the gamma-ray from Cs^{137} at 0.660 Mev and the linearity of the instrument was checked by measuring the 1.12-Mev gamma-ray of Zn^{65}, the 1.33-Mev gamma-ray of Co^{60}, and the two gamma-rays of Os^{185} at 0.878 and 0.648 Mev. The latter two gamma-rays arise from orbital electron capture and were measured in a magnetic lens spectrometer by Bunker, Canada, and Mitchell,[6] and with a scintillation spectrometer using a differential pulse height sorter by Miller and Wilkinson.[7] The photographs in the present experiments show



(a) (b)

FIG. 1. (a) Photoline of the 267-kev gamma-ray in Ba^{135} appears at D, and the corresponding Compton distribution appears at E; (b) the photoline and the Compton distribution for the 660-kev gamma-ray in Cs^{137} appear at A and B, respectively. The line at C is due to backscattering of the 660-kev gamma-ray.

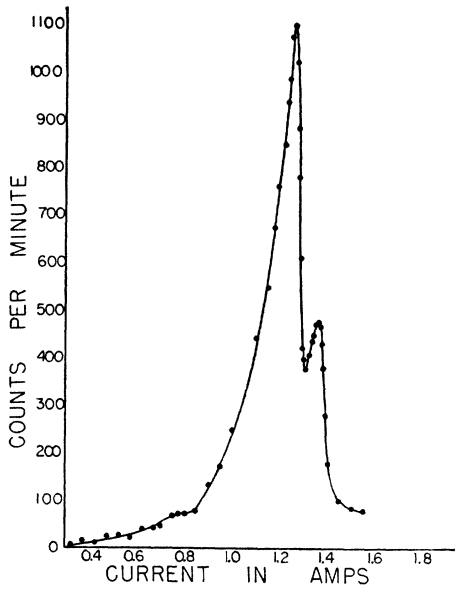


FIG. 2. Internal conversion electrons from Ba^{135}.

strong photo- and Compton peaks for a gamma-ray of 0.620 Mev and a weaker photopeak for a line at 0.870 Mev, together with a strong x-ray line at 60 kev coming about as a result of K-capture.

A photograph showing the results of the Ba^{135} investigation is given in Fig. 1(a) together with a photograph of Cs^{137} [Fig. 1(b)] for comparison. A photopeak and a Compton peak for a line at 0.270 Mev are clearly seen.

A "beta-ray" source of Ba^{135}, rather thick on account of the low intensity, was investigated in the magnetic lens spectrometer. The results are shown in Fig. 2, in which are seen a K- and an L-peak corresponding to the K- and L-conversion for a line of energy 0.267 Mev. The decay of these lines was followed in the spectrograph, and it is certain that they arise from the 28.7-hr Ba^{135}.

The authors wish to thank Professor A. C. G. Mitchell, who suggested this problem, for many helpful suggestions. They are also indebted to Dr. M. B. Sampson and the cyclotron crew for making the bombardments and to Mr. A. Lessor for making the chemical separations.

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On the Structure of Te II*

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OF the spectra of all atoms, those of tellurium are among the least known. On the basis of new measurements of lines from a hollow-cathode source (JSR) and an electrodeless discharge (FAP), vacuum-arc Zeeman-effect data (JCvdB), and new hyperfine structure data (KM and JSR), we have made some progress in finding and interpreting the energy levels in the first spark spectrum, as shown in Table I.

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°	3/2		
10222	10°	3/2		
12423	12°	5/2		
20546	20°	1/2		
24032	24°	3/2		
$5p^26p$:				
93978.00	93°	1/2(3/2)		
96143.84	96°	3/2	1.3	
97779.13	97°	1/2	1.2	
99583.68	99°	3/2	1.30	−0.064
100111.18	100°	5/2	1.39	0.00
101220.10	101°	3/2	1.30	−0.061
101370.01	101°	1/2	2.29	+0.078
102323.61	102°	5/2	1.33	−0.256
103104.98	103°	7/2	1.36	−0.246
103935.04	103°	3/2	1.74	−0.193
105005.21	105°	3/2	1.18	
105582.14	105°	5/2	1.29	−0.223
106118.35	106°	1/2		
107956.82	107°	5/2		
112271.53	112°	3/2	1.12	
112547.95	112°	3/2,5/2		
?117858.18	?117°	7/2		
?118804.25	?118°	3/2,5/2		
Even levels				
$5s5p^4$, $5p^26s$, $5p^25d$:				
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 $00°_{3/2}$, $10°_{3/2}$, $78_{1/2}$, 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° 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 $\mu^{125}/\mu^{123}=1.208$[5], 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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† John Simon Guggenheim Fellow, assisted by a grant from the Research Committee of the University of Wisconsin.
‡ 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.

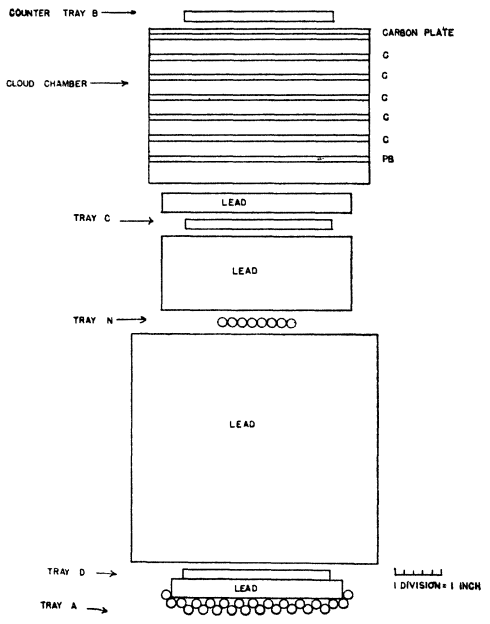

FIG. 1. Experimental arrangement.