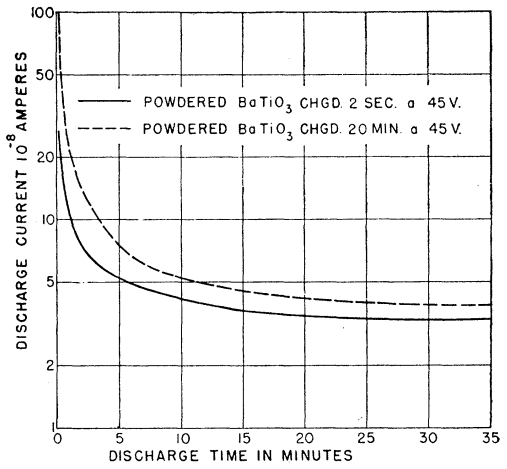

FIG. 1. Discharge characteristics of capacitor with powdered $BaTiO_3$ as dielectric.

a few seconds, an appreciable voltage was present after the short circuit had been removed. This voltage gradually decreases with time, dropping from a value of about 1 volt when the short circuit was removed to a value of about 0.1 volt at the end of 40 minutes. To avoid the possibility of error caused by the vacuum tube voltmeter used for measuring the voltage, a 1047-ohm galvanometer in series with a 300,000-ohm resistor was connected across the capacitor and the current was observed as a function of time. If the capacitor was short circuited for a few seconds during this time, upon removal of the short circuit the current was found to return to approximately its previous value.

These capacitors have a relatively low value of resistance. The resistance as measured with a battery-operated ohmmeter appears to increase from a value of approximately 100,000 ohms to approximately one megohm after two or three minutes. The capacity of these capacitors at 1000 cycles was approximately 10,000 $\mu\mu$f. The charge obtained from these capacitors appears to be greater than that placed on them if the formula $Q=CV$ is used to determine the charge. The use of this formula does not seem to be permitted in this case, however, since the amount of current that can be obtained from the capacitor is much reduced if it is charged from a mica capacitor so that the charge of the barium titanate capacitor is about equal to the value computed by the formula $Q=CV$. Much more charge than that indicated by the formula seems to be placed on the $BaTiO_3$ capacitor. However, the effect of charging the capacitor for a long period of time before disconnecting from the charging source does not seem to have a very great effect, as shown by two curves of current plotted against time (see Fig. 1). The charging times were 2 seconds and 20 minutes. Each of these periods is very long compared to the time constant of the charging circuit which is approximately 10^{-6} sec. A semi-log plot is used to show these data. The curvature of the lines shows clearly that the change of current with time differs from that of a conventional condenser. The results were changed only slightly when different metals were used as condenser plates.

The Molecular Spectrum of Iodine Excited in the Presence of an Inert Gas

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RANK'S recently corrected vibrational formula[1] for the ground state of diatomic iodine (referred to below as II) differs considerably for large v''-values from his earlier formula[2] (to be called I hereafter). This makes necessary a revision of the vibrational analysis of the band systems[3] $D\leftrightarrow X$, $C\rightarrow X$, and $F\rightarrow X$, which, if excited in fluorescence[4] or in emission[5,6] in the presence of an inert gas, involve high-lying vibrational levels $G(v'')$ of the ground state X. System $E\rightarrow B$, which similarly is obtained in the presence of an inert gas,[5] is of course not affected by this revision. The results of our revision for $D\leftrightarrow X$ and $F\rightarrow X$ are presented in Table I, whereas $C\rightarrow X$ will be discussed at the end of this letter.

The revised constants of the vibrational levels of the state F are not significantly different from the ones obtained[6] with Rank's formula I. At the highest v''-values, however, which now run up to 75, our new vibrational analysis differs considerably from the one given by Venkateswarlu. In addition, the fit to the observed data obtained with Rank's earlier formula I is not nearly as good as the one we obtained using Rank's newer formula II, with the proviso that the constant $t_e\omega_e=1.60\times10^{-7}$ given by Rank[2] be replaced by 1.45×10^{-7} cm^{-1}. This changes $z_e\omega_e$ from 5.25×10^{-6} to 5.29×10^{-6}, $z_o\omega_o=5.65\times10^{-6}$ remaining unchanged.

We find Venkateswarlu's analysis of system $D\leftrightarrow X$ untenable, since his high $G''(v)$ values running up to $G''(76)=11{,}500$ cm^{-1} are hardly compatible with the fact that the bands of system $D\leftrightarrow X$ can also be observed in absorption by iodine vapor in a 26-cm tube at 1000°C and 1 atmos.[7] Furthermore, the intensity distribution expected on the basis of his assignment is quite different from the one observed. Indeed, our revision using formula II, including the small modification of the constant $t_e\omega_e$ mentioned above, reveals that the previous analysis by Elliott[4] was very nearly correct. Our revised formula lowers Elliott's v''

TABLE I. Revised[a] vibrational constants of I_2.

State[b]	T_e	ω_e	$x_e\omega_e$	$y_e\omega_e$	$z_e\omega_e$	$t_e\omega_e$	Obs. trans.	$\nu_{0,0}$
$X\Sigma_g^+$	0	214.248	0.6074	−0.00130	-5.529×10^{-6} [c]	-1.45×10^{-7} [c]		
$D\Sigma_u^+$	33,346.6	104.0	0.2				$D\leftrightarrow X$	33,291.6
$F(^3\Pi_u)$	47,208.25	96.7[d]	0.49				$F\rightarrow X$	47,147.5

[a] States $A(^3\Pi_{1,u})$, $B(^3\Pi_{0,u}^+)$, and $E(^1\Sigma_g^+)$ are as given by Herzberg. (Through an error, Herzberg gives T_e of state E as 41,407 instead of 41,411 cm^{-1}.) State $C(^3\Sigma_{1,u}^+)$, called E by Venkateswarlu, needs revision to be adapted to Rank's formula II. However, the present interpretation of the observed system is not necessarily correct (see reference 6 in text). The vibrational analysis and interpretation of the many systems with $\nu>50{,}000$ cm^{-1} must still be regarded as uncertain.
[b] Designation used by Herzberg.
[c] Rank's values are: $z_e\omega_e=-5.25\times10^{-6}$ and $t_e\omega_e=-1.60\times10^{-7}$ cm^{-1}.
[d] Herzberg erroneously gives for ω_e the ω_o value (96.21 cm^{-1}).

numbering by 2 units, thus reducing the highest observed $G''(v)$ value to $G''(26)=5115$ cm^{-1}. It includes, in the region λ3454–3237A, all of the 37 fluorescence bands observed by Elliott as well as nearly 90 additional emission bands obtained by Venkateswarlu, with the exception of eight presumably rather weak bands none of which were observed in fluorescence or absorption. Below λ3237A, however, more and more bands appear which do not fit into our Deslandres table, and are assumed to belong to another system.

The vibrational analysis of system $C\rightarrow X$, given by Venkateswarlu[6] using Rank's formula I, need not undergo a very significant change to be brought in accord with Rank's formula II. We should like, however, to emphasize the fact mentioned by Elliott[4] that this small system centered at λ2767A (together with two other diffuse bands at 2829 and 2878A) can be excited with active nitrogen but not in fluorescence with light of λ1854A. The most likely explanation[8] of this fact is that the upper state lies higher than 54,000 cm^{-1} and combines with a state lying above the ground state, for instance with the term $B^3\Pi_{0u}{}^+$. For this reason no constants for state C were included in the table.

A detailed paper containing the observed data of the systems $F\rightarrow X$ and $E\rightarrow B$ will appear later in the *Helvetica Physica Acta*.

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[3] This designation is the one used by G. Herzberg, *Spectra of Diatomic Molecules* (D. Van Nostrand Company, Inc., New York, 1950), p. 541, and differs from the one used by Venkateswarlu.
[4] A. Elliott, Proc. Roy. Soc. (London) **A174**, 273 (1940).
[5] J. Waser and K. Wieland, Nature **160**, 643 (1947).
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[8] It is difficult to check this suggestion from the data published by Venkateswarlu without having a reproduction of the spectrum showing the intensity distribution of the bands.

The Radioactive Decay of Hg^{197} and Hg^{203}†

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ON bombarding gold with protons or deuterons a radioactive isotope of mercury-197 had been found[1,2] which decayed showing half-lives of about 25 hr and 65 hr. It had been assumed that 'K'-electron capture occurred in each activity, with no isomeric transition in mercury. All of the observed gamma-emissions were supposed to follow in the resulting gold nuclei. Gamma-energies of 77, 135, 165, and 273 kev were reported. An excited level in gold-197 with a half-life of 7.5 sec, first found by Wiedenbeck by gamma-excitation, was again observed in the mercury decay. Coincidence experiments had shown[3,4] the 135 and 165-kev gammas to be in cascade with a positive angular correlation existing between them.

It is now possible by spectrometric studies of sources irradiated in the Argonne heavy-water reactor to express more exactly the energies of the gamma-rays and to show the presence of one gamma-ray not previously observed. Moreover, the conversion electrons of two strong gamma-rays, 134.3 and 165.4 kev, are found to satisfy the work functions characteristic of mercury rather than of gold as had been reported, and are hence associated with an isomeric transition before K-capture. A continued sequence of spectrograms was taken to show precisely which electron conversion lines died out with a half-life of 25 hours and which persisted with a longer half-life. Only those electron lines associated with the 134.3- and the 165.4-kev gammas decayed with the 25-hr half-life. The energies of the electron lines, together with their interpretations, are shown collectively in Table I. Arbitrary numbers in the order of increasing energy are assigned to the gamma rays and shown as superscripts in column 2.

TABLE I. Conversion electron energies and their interpretation.

Electron energy (kev)	Interpretation	Energy sum (kev)	Gamma energy (kev)	Ratio K/L
50.9	K^2(Hg)	134.1	···	···
52.0	$A(\alpha_2-L_I)$	66.9	66.9	···
54.1	$A(\alpha_1-L_I)$	68.7	···	···
56.5	$A(\alpha_1-L_{III})$	68.7	68.7	···
63.3	$L_I{}^1$(Au)	77.6	···	···
63.9	$L_{II}{}^1$(Au)	77.6	···	···
65.6	$L_{III}{}^1$(Au)	77.5	···	···
74.2	M^1(Au)	77.6	···	···
76.8	N^1(Au)	77.6	77.6	$L_I/M=4$
82.3	K^3(Hg)	165.4	···	···
110.8	K^4(Au)	191.5	···	···
119.7	$L_{I,II}{}^2$(Hg)	134.5	···	···
122.0	$L_{III}{}^2$(Hg)	134.3	···	···
131.2	M^2(Hg)	134.9	···	···
133.2	N^2(Hg)	134.0	134.3	<0.1
150.6	$L_{I,II}{}^3$(Hg)	165.4	···	···
152.7	$L_{III}{}^3$(Hg)	165.3	···	···
161.6	M^3(Hg)	165.5	···	···
164.2	N^3(Hg)	165.0	165.4	~0.25
177.1	$L_I{}^4$(Au)	191.2	191.4	~9
194.0	K^5(Tl)	279.5	···	···
264.2	$L_I{}^5$(Tl)	279.5	···	···
275.6	M_I(Tl)	279.3	279.5	~10

Mercury-203 was also produced in the reactor from an enriched (97.3 percent) isotope of mercury-202. On following its decay over several octaves a half-life of 47.9±0.2 days is observed. A single gamma is emitted whose energy is found to be 279.5 kev. This activity was always present in the shorter-lived mercury specimens. Its strong electron lines in thallium are so situated as to almost exactly mask any weaker conversion lines because of a transition in gold of 273 kev, had such electron lines been present in the 25-hour activity as reported by Huber *et al.*

A half-life of 66.4 hours is found for the intermediate period, from observations extending over a month, with corrections for the presence of the 47.9-day activity. No attempt was made to check the reported half-life of 25 hr.

A proposed level scheme is shown in Fig. 1. The order of the 134.3–165.4 kev sequence is proposed from their relative K/L ratios. Deutsch had observed a delay of 1×10^{-8} sec in a coincidence study of the conversion electrons for the two gammas. The electron lines associated with the 77.6-kev gamma-ray are very strong both by conversion and photoelectrically in lead. The K series α_1, α_2 x-ray lines of gold are fairly strong as shown by

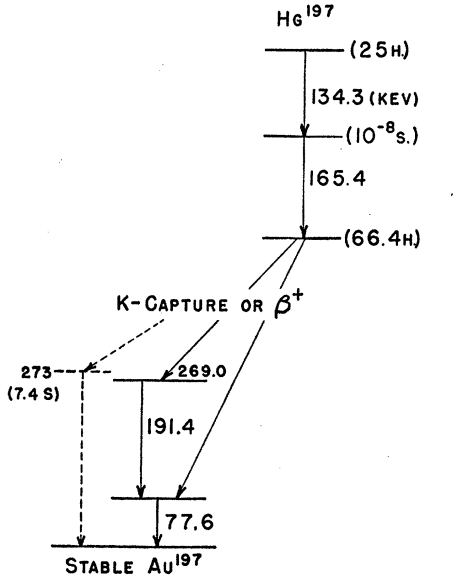

FIG. 1. Proposed nuclear level scheme.