

LETTERS TO THE EDITOR

A NOTE ON THE NUCLEAR STRUCTURE
PARAMETER AND PERCENTAGE E_2
ADMIXTURE FOR THE 57.60 KeV
TRANSITION IN ^{127}I

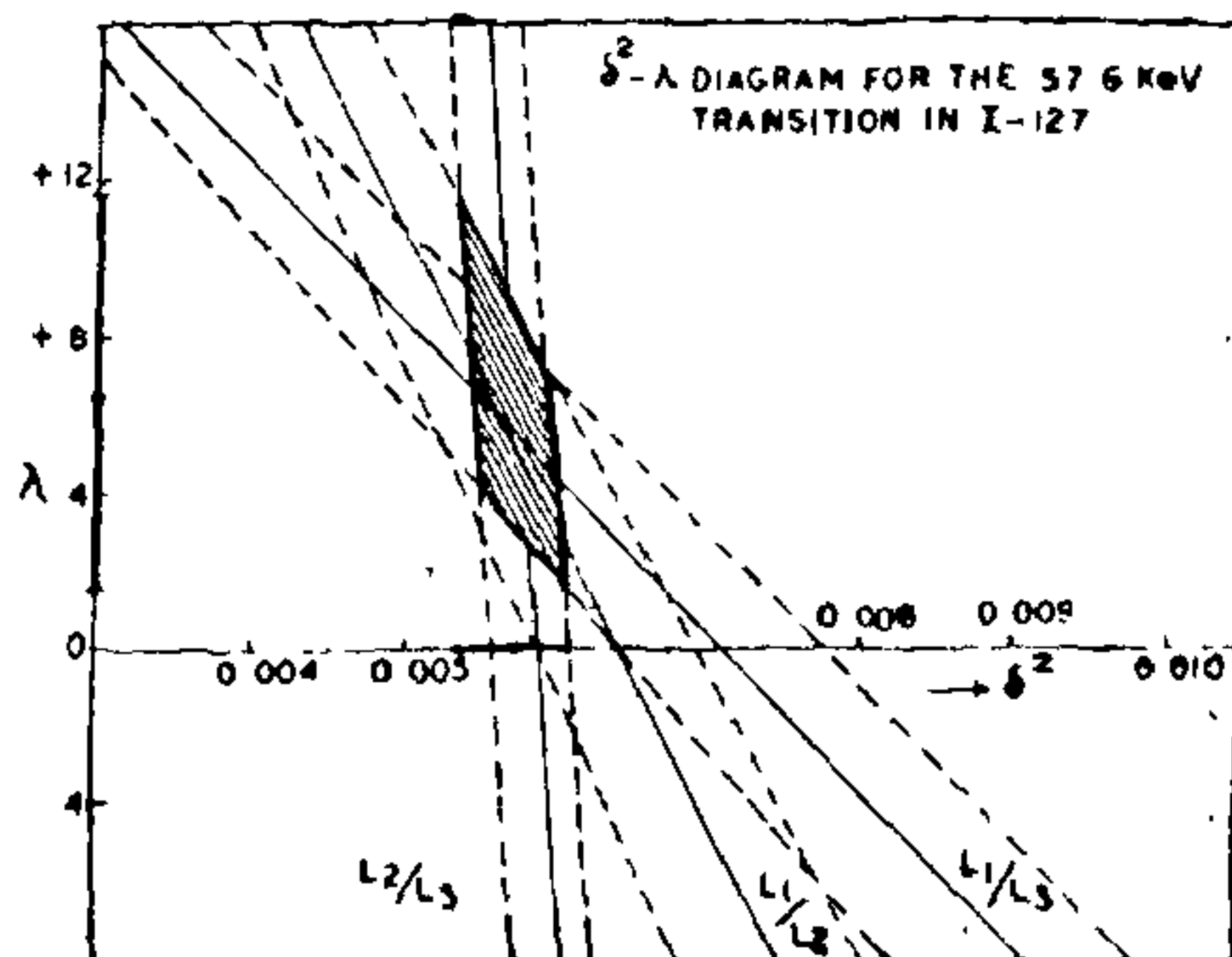
THE penetration effect which arises from the penetration of the atomic electrons into the nuclear volume introduces new matrix elements into the conversion electron ejection different from that due to gamma-ray emission. The ratio of this new matrix element to the normal gamma-ray matrix element is defined as the penetration parameter λ . For $\lambda \neq 1$, nuclear structure dependent factors will appear in the internal conversion process. The structure effects should be large especially for 1-forbidden M_1 transitions which should have a vanishing gamma matrix element.

The 57.60 KeV transition between $g_{7/2}$ and $d_{5/2}$ states is an l -forbidden M_1 transition with very small E_2 admixture. Upto the date the penetration parameter and the M_1 - E_2 mixing ratio have been determined from internal conversion coefficients and particle gamma-ray correlations comparing with the theoretical tabulations of Sliv and Band¹. But the 1-sub-shell ratios can be measured with an accuracy of 1%. Therefore having in mind the great sensitivity of the ratios to small admixtures the E_2 admixture can be determined with great accuracy. The availability of the recent results of conversion coefficients of Hager and Seltzer² and their penetration functions³ from a new realistic self-consistent field calculations which takes into account the finite nuclear size, hole and exchange effects will be of great use in the present analysis to compare the experimental 1-sub-shell intensity ratios to obtain a more accurate results for the M_1 - E_2 mixing ratio (δ^2) and a more precise range for the nuclear structure parameter λ .

By knowing at least two conversion intensity ratios for a given predominantly M_1 transition the penetration parameter λ and the percentage E_2 admixture (δ^2) can be determined using the relation :

$$\delta^2 = \frac{1}{\left(\frac{L_i}{L_k}\right)_{\text{exp}} L_k(E_2) - L_i(E_2)} \times \left[L_i(M_1) - \left(\frac{L_i}{L_k}\right)_{\text{theo}} L_k(M_1) \right] + \lambda \left\{ L_i(M_1) B_1(L_i) - \left(\frac{L_i}{L_k}\right)_{\text{theo}} L_k(M_1) B_1(L_k) \right\}$$

where $B_1(L_{ik})$ are the penetration functions tabulated by Hager and Seltzer and $L_{ik}(M_1, E_2)$ are theoretical values for conversion coefficients.



FIG

Figure 1 shows the $\delta^2 - \lambda$ diagram which is used to determine the values of the penetration parameter for M_1 conversion and percentage E_2 admixture for the 57.6 KeV transition. In the same diagram, relative experimental ratio for 1-sub-shell ratios are presented together with statistical errors. (Two statistical error bands around mean value.) The overlapping area is shadowed on the figure and used to determine the experimental region for the values of $\lambda - \delta^2$. The most probable pair of values for these quantities in each case is determined by a centre of gravity of the shaded area.

TABLE I

		δ^2		λ	
S. Jha	Geiger	Present work	Present work	Present work	Present work
0.6 ± 0.6	0.7 ± 0.1	0.58	$+0.03$ -0.04	6.2	$+4.6$ -4.4

Table I gives the δ^2 values of Jha⁴, Geiger *et al.*⁵ and the present work. The errors associated with the δ^2 of the present work is very small. This indicates the multipolarity of the 57.6 KeV transition in ^{127}I as

$$\left(99.42 \begin{matrix} + 00.3 \\ - 00.4 \end{matrix} \right) \% M_1 + \left(0.58 \begin{matrix} + 00.3 \\ - 00.4 \end{matrix} \right) \% E_2$$

The penetration parameter from Table I clearly indicates the penetration effects in the internal conversion process of the 57.6 Kev transition in ^{127}I and the ratio of the penetration matrix element to the gamma-ray matrix element is 6 ± 4 . The range associated with the penetration parameter is somewhat high and this may be due to the large errors associated with the experimental sub-shell intensity ratios.

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2. Hager, R. and Seltzer, E., *Nuc. Data*, 1968, 4 A, 1.
3. — and —, *Ibid.*, 1969, 6 A, 1.
4. Jha, S. and Leonard, *Phys. Rev.*, 1964, 136 B, 1585.
5. Geiger, J. S., Graham, R. L., Bergstrom, I. and Brown, F., *Nuc. Phys.*, 1965, 68, 352.

PREPARATION OF NEW DERIVATIVES OF $\text{Ph}_3\text{PAuCo}(\text{CO})_4$ WITH SOME BIDENTATE LIGANDS

THIS article is a continuation of work which we have recently published¹. In that paper we discussed the kinetic investigations of the reaction of $\text{Ph}_3\text{PAuCo}(\text{CO})_4$ with triphenylphosphine in chloroform as a solvent. We have also reported the

reaction of $\text{Ph}_3\text{PAuCo}(\text{CO})_4$ with *bis*(diphenylphosphino)ethane, in which we isolated a new compound and proposed an ionic structure for the same.

Now we have reacted $\text{Ph}_3\text{PAuCo}(\text{CO})_4$ with some new bidentate ligands and have isolated new derivatives. The ligands that we have used are (a) *bis*-(diphenylphosphino)methane, (b) *bis*-(diphenyl arsino)ethane, (c) *bis*-(diphenyl arsino)methane, (d) *bis*-(diphenyl stibino)ethane, and (e) *bis*-(diphenyl stibino)methane.

The elemental analysis and the C=O stretching frequencies in chloroform and acetonitrile solutions are given in Table I.

The experimental procedure for the preparation of the complexes is the same as previously described¹. Except for the compound 'A' in the table, all others were obtained as very fine crystalline compounds and therefore they had to be centrifuged and then recrystallized from a chloroform petroleum spirit mixture.

From Table I it is quite interesting to note that the C=O stretching frequencies of all the derivatives in both chloroform and acetonitrile solutions are nearly identical.

We had proposed that this C=O stretching absorption was due to the presence of the species $\text{Co}(\text{CO})_4^-$ in the solution of the compound. If this assumption is correct then this C=O stretching absorption will not be much affected by the nature of the incoming ligand. The results in the table strengthen the nature and the structure of the com-

TABLE I

Name of the compound		Elemental analysis		C=O Stretching frequencies, cm^{-1}	
		% C	% H	CHCl_3	CH_3CN
A	$[\text{Ph}_3\text{PAu-bis}(\text{diphenyl phosphino})\text{ethane}]^+ [\text{Co}(\text{CO})_4]^-$	Calcd. Found	56.03 56.4	3.79 3.8	1890 1892
B	$[\text{Ph}_3\text{PAu-bis}(\text{diphenylphosphino})\text{methane}]^+ [\text{Co}(\text{CO})_4]^-$	Calcd. Found	55.63 55.49	3.65 3.61	1890 1891
C	$[\text{Ph}_3\text{PAu-bis}(\text{diphenyl arsino})\text{ethane}]^+ [\text{Co}(\text{CO})_4]^-$	Calcd. Found	51.62 51.50	3.49 3.50	1890 1892
D	$[\text{Ph}_3\text{PAu-bis}(\text{diphenyl arsino})\text{methane}]^+ [\text{Co}(\text{CO})_4]^-$	Calcd. Found	51.18 51.20	3.35 3.21	1890 1892
E	$[\text{Ph}_3\text{PAu-bis}(\text{diphenyl stibino})\text{ethane}]^+ [\text{Co}(\text{CO})_4]^-$	Calcd. Found	47.60 47.51	3.22 3.10	1890 1891
F	$[\text{Ph}_3\text{PAu-bis}(\text{diphenyl stibino})\text{methane}]^+ [\text{Co}(\text{CO})_4]^-$	Calcd. Found	47.17 47.27	3.09 3.13	1890 1891