

TABLE I

Solvent	$\lambda_a$ (nm)	$\lambda_f$ (nm)	$\bar{\nu}_a$ $\text{cm}^{-1}$	$\bar{\nu}_f$ $\text{cm}^{-1}$	$\bar{\nu}_a - \bar{\nu}_f$ $\text{cm}^{-1}$	$\frac{\bar{\nu}_a + \bar{\nu}_f}{2}$ $\text{cm}^{-1}$	$F_1(D, n)$	$F_2(D, n)$
1. Water	484	524	20661	19084	1527	19872.5	0.91	0.68
2. <i>n</i> -butanol	482	514	20747	19455	1292	20101.0	0.77	0.65
3. Methanol	482	518	20747	19305	1442	20026.0	0.85	0.65
4. Iso amyl alcohol	486	518	20576	19305	1271	19940.5	0.73	0.64
5. Formamide	484	525	20661	19078	1583	19854.5	0.89	0.75
6. Acetone	493	522	20408	19157	1256	19782.5	0.79	0.64
7. Acetic anhydride	492	526	20325	19011	1314	19668.0	0.78	0.75
8. Ethanol	480	516	20833	19380	1453	20106.5	0.82	0.66

electron charge distribution of a  $\pi \rightarrow \pi^*$  excited state is more extended than that of the ground state, the excited state is more polarizable. Change to a polar from a non-polar media increases the solvent interaction with both states but the corresponding decrease in energy is greater for the excited state resulting in a red shift. On the other hand, a  $n \rightarrow \pi^*$  transition gives rise to a blue shift. From Table I it is clear that in the present case as the dipole moment of the solvent increases the  $\bar{\nu}_f$  shifts towards red side. This indicates a  $\pi \rightarrow \pi^*$  transition and is in conformity with such a transition in other dye molecules.

Present investigations of fluorescence of acridine orange, in addition to the conformation of theoretical

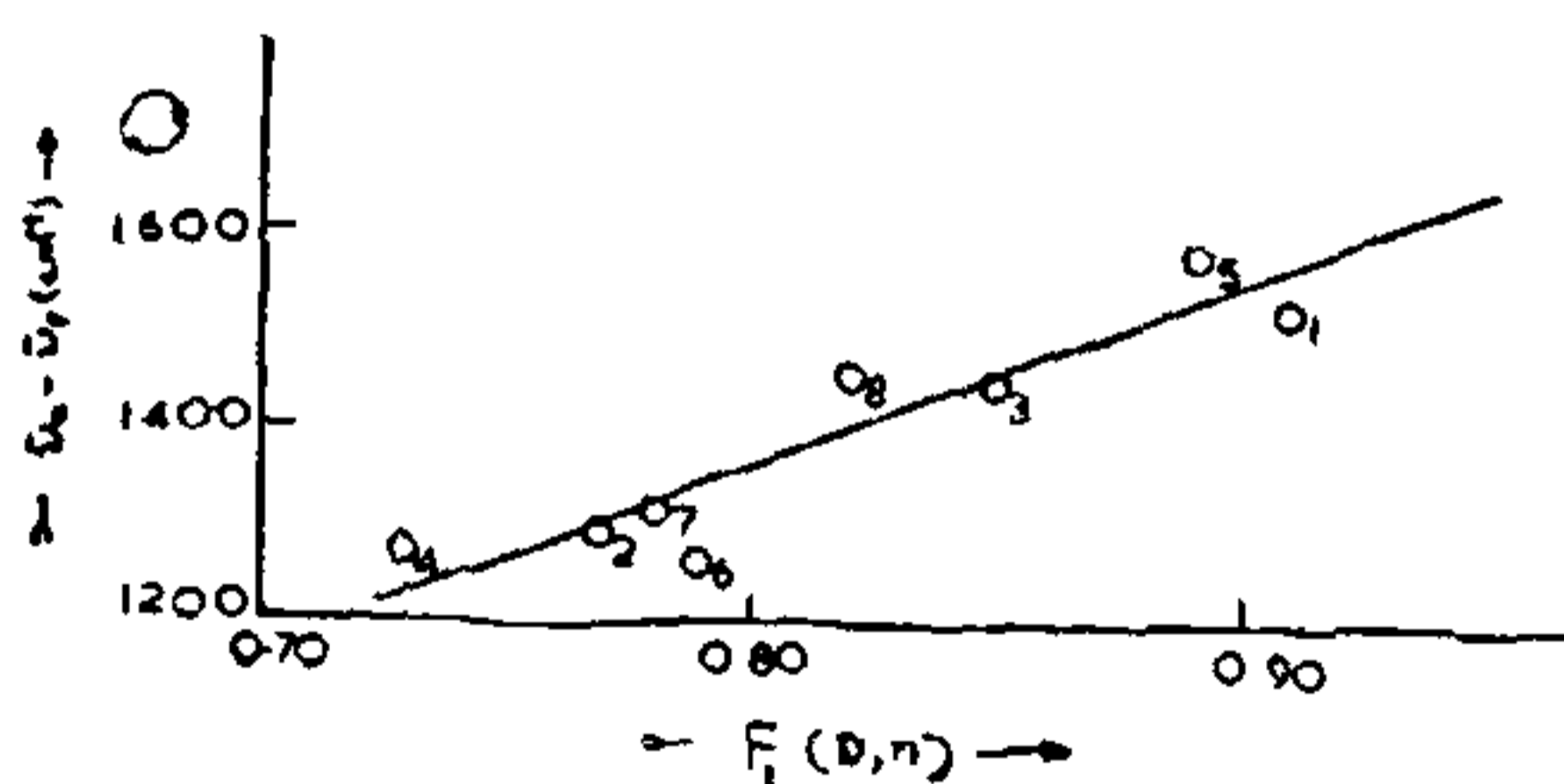


FIG. 1

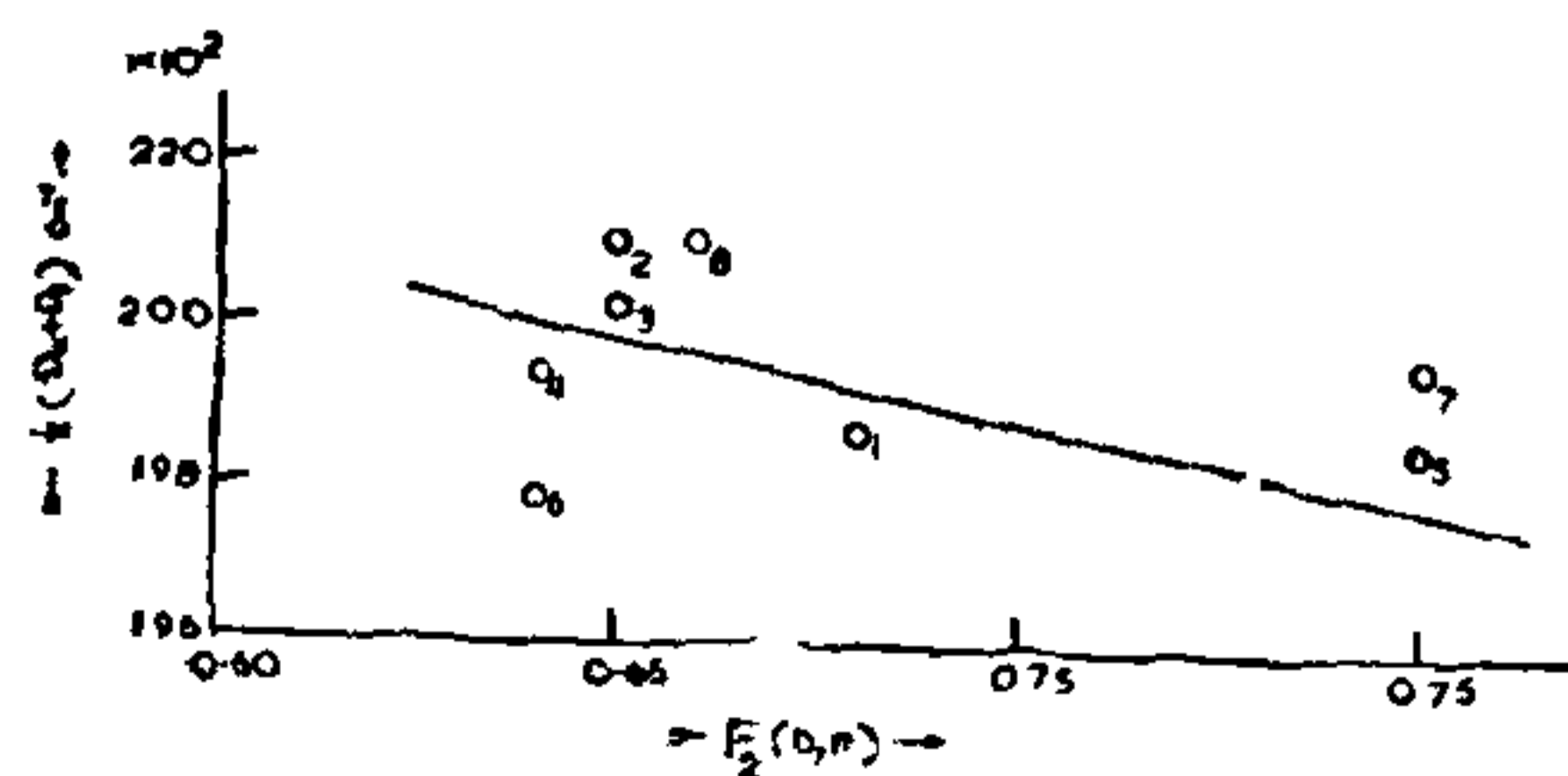


FIG. 2

prediction on solvent effect, leads to the following information :

- (a) The dipole moment of the acridine molecule increases on excitation.
- (b) The excited state dipole moment  $\mu_e \sim 33 \mu_D$ .
- The absorption and emission in acridine molecule results due to  $\pi \rightarrow \pi^*$  transition.

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## THE SUPERCONDUCTIVITY OF $\text{YRh}_4\text{B}_4$ —AN ENIGMA

S. N. EKBOTE AND A. V. NARLIKAR

National Physical Laboratory, Hillside Road  
New Delhi 110 012, India

The reentrant behaviour of  $\text{ErRh}_4\text{B}_4$  type ternary borides has created a considerable interest in these materials and there have been extensive studies of superconductivity and magnetic order in this class of rhodium-boride compounds containing a rare earth element with a localized magnetic moment. Recently

the NMR and magnetization measurements of Tse *et al.*<sup>4</sup> in  $Y_{1-x}Er_xRh_4B_4$  indicated a strong conduction electrons-local moment interaction with only a weak depression of  $T_c$ . Furthermore, they could find an appearance of large hyperfine interactions below  $T_c$  indicating a grossly uncompensated conduction electron spin state within the superconducting state. They tried to discuss their results in terms of both itinerant electron antiferromagnetism and non-s-wave Cooper pairing, but none of these approaches could explain satisfactorily their observations.

In this note we would like to point out that the results of Tse *et al.* can be readily understood in terms of our model<sup>2-7</sup> of superconductivity involving the exchange interactions in the conduction band for the formation of electron pairs. The above findings together with the CESR results of Schultz *et al.*<sup>8</sup> on Al and Ekbote *et al.*<sup>2-7</sup> on A-15s, when comparatively analysed become very important as these materials represent three different classes of superconductors.

The comparative study of CESR of Al and A-15s has been given in previous paper<sup>7</sup>. However for the sake of comparison these results are shown in Fig. 1 in which the observed behaviour of the spin echo signal of  $^{11}B$  in  $YRh_4B_4$  and  $Y_{1-x}Er_xRh_4B_4$  samples is also depicted. The observations of Tse *et al.* on  $YRh_4B_4$  and  $Y_{1-x}Er_xRh_4B_4$  may be summarized as follows:

- (1) There is a sharp loss of the intensity of the nuclear spin echo signal of  $^{11}B$  at  $T_c$  (Fig. 1c).
- (2) There is a considerable increase in the static

magnetic susceptibility on lowering the temperature down to  $T_c$ . (3) They found the field dependence of  $T_c$  to be identical to that of  $T_N$ , the 'apparent' antiferromagnetic transition temperature of the itinerant electrons. Tse *et al.* tried to explain these observations first on the basis of *p*-wave pairing and subsequently by considering the coexistence of itinerant electron antiferromagnetism and superconductivity. They found that while the former was unable to explain the results the latter could account for a number of their findings.

In the light of the reported CESR and spin wave studies of A-15s and of Al discussed above the results of Tse *et al.*, need to be re-examined in a different perspective. Tse *et al.* have questioned their own suggestion of the possible presence of itinerant electron antiferromagnetism below  $T_c$  apparently only because they could not find the expected behaviour of the nuclear relaxation time  $T_1$  near  $T_N$ . In our opinion this need not be taken too seriously as it is almost certain that the behaviour of  $T_1$  alone cannot be the deciding criterion for the itinerant electron antiferromagnetism. It is worth pointing out that even in the case of  $CrB_2$ <sup>9</sup> where the loss of the nuclear spin echo signal has been taken to be indicative of itinerant electron antiferromagnetic state the nuclear lattice relaxation is found to differ in several ways from the expected behaviour for weak itinerant electron ferro and antiferromagnetic states. The vanishing of the spin echo signal in  $YRh_4B_4$  and  $Y_{1-x}Er_xRh_4B_4$  below  $T_c$  is an important finding which confirms the forma-

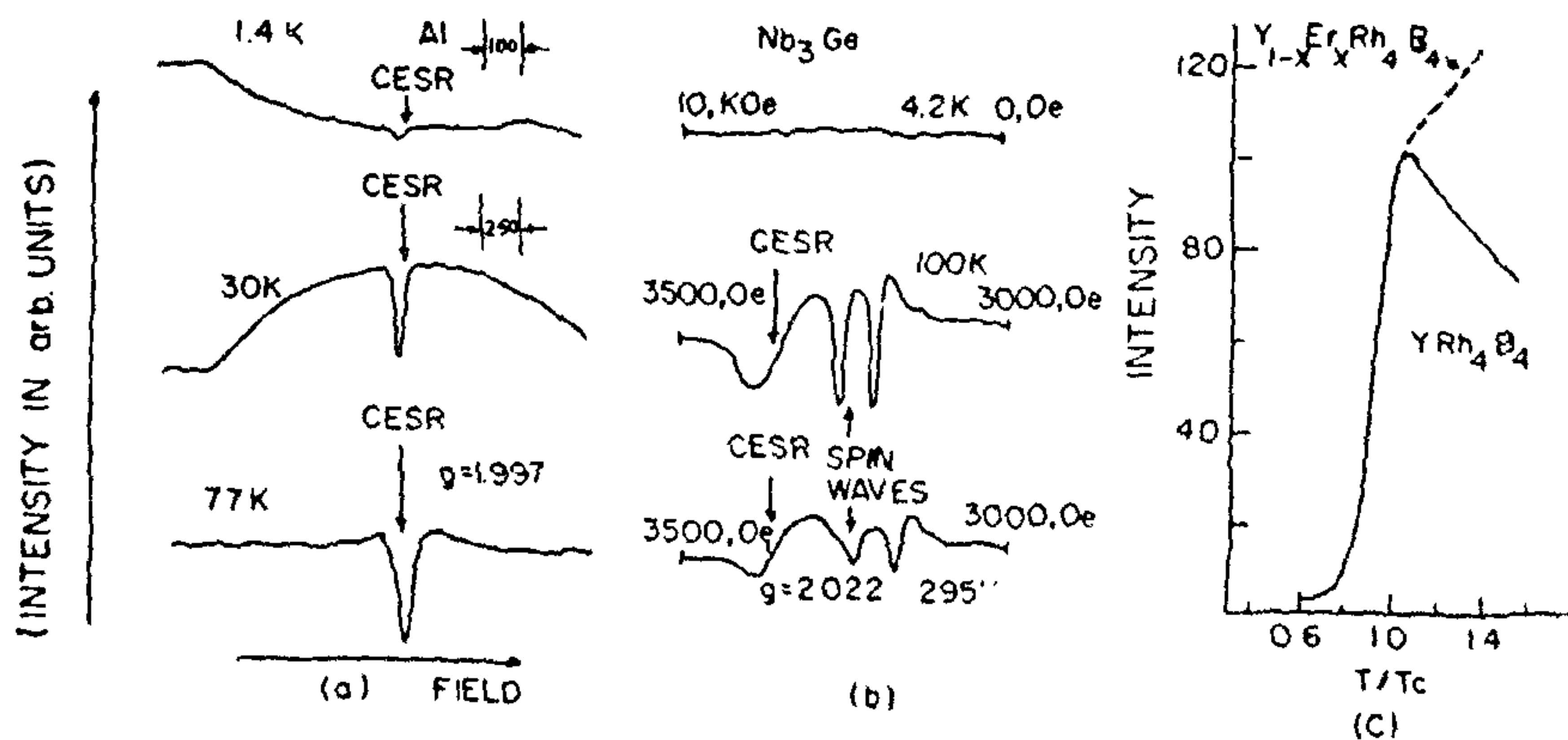


FIG. 1. (a) CESR of Al. (b) CESR of  $Nb_3Ge$ . Near vanishing of CESR in Al in forced normal state and vanishing in  $Nb_3Ge$  in superconducting state is a manifestation of an ordered antiferromagnetic state in conduction band. See ref. 7. (c) Loss of spin echo signal in  $YRh_4B_4$  and  $Y_{1-x}Er_xRh_4B_4$  of  $^{11}B$  showing existence of itinerant electron antiferromagnetic state.



tion of itinerant electron antiferromagnetic state in the conduction band. But, the conjecture of Tse *et al.* that there is a coexistence of superconductivity and itinerant electron antiferromagnetism, we feel, puts forth a dilemma. How the same electrons at the Fermi surface could possibly give rise to two different phenomena in the same temperature range? We must however hasten to point out that this should not be confused with the coexistence<sup>10,11</sup> of superconductivity and spiral magnetic order where the latter is due to the localised and not itinerant electron magnetic moments. The above question becomes all the more relevant when we consider the observed data of Tse *et al.* It is most revealing that they find  $T_c$  not just coinciding with  $T_N$  but that their variations with the imposed field to be identical. This leads to the obvious conclusion that  $T_c$  and  $T_N$  are one and the same and thus the superconducting state is not different from itinerant electron antiferromagnetic state.

Thus, the CESR results of Al and the nuclear spin echo studies of  $YRh_4B_4$  and  $Y_{1-x}Er_xRh_4B_4$  together support strongly our model of occurrence of superconductivity through antiferromagnetic exchange interactions in the conduction band. As previously discussed<sup>7</sup> there is no direct experimental credence for phonon mechanism and the validity of McMillan equation has also been questioned<sup>12,13</sup> which could support BCS through  $G(\omega) = \alpha^2 F(\omega)$  relation. Moreover,  $G(\omega) = \alpha^2 F(\omega)$  simply shows a change of phonon energy in superconducting state which can be due to the formation of any ordered state by some other mechanism also. In fact, according to Ginzburg<sup>14</sup> to have an attractive interaction between two electrons which can give rise to a condensed state phonon mediation is not necessary. Recently using our experimental data and model Kruger<sup>15</sup> has in fact theoretically argued that a metal is a superconductor if and only if there exists a certain exchange interaction of antiferromagnetic type within its conduction band.

To conclude, the reported studies on three widely different superconducting systems give a strong credence to our contention that superconductivity is an ordered magnetic state in the conduction band resulting from exchange interactions.

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## SYNTHESIS OF SOME N<sup>1</sup>-ARYL/ HETEROARYL-2, 2-DISUBSTITUTED AZOMETHINES AS POTENTIAL FUNGICIDES

S. GIRI\*, R. K. KHARE\*\* AND K. K. SINGH

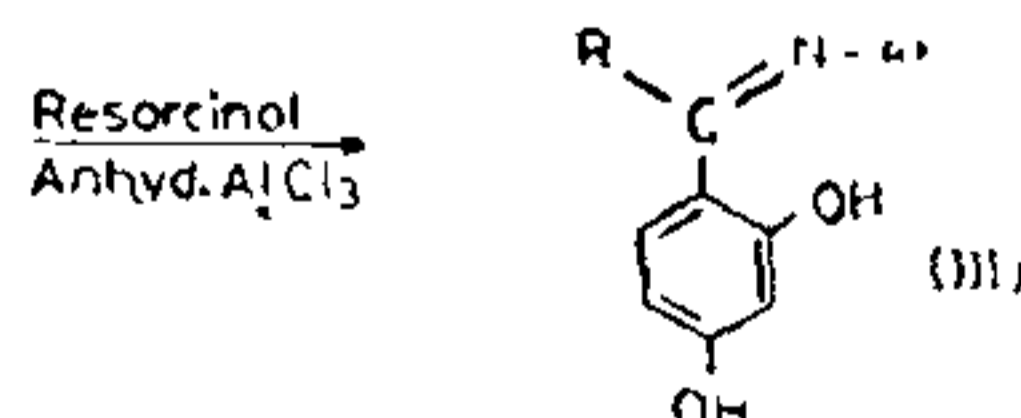
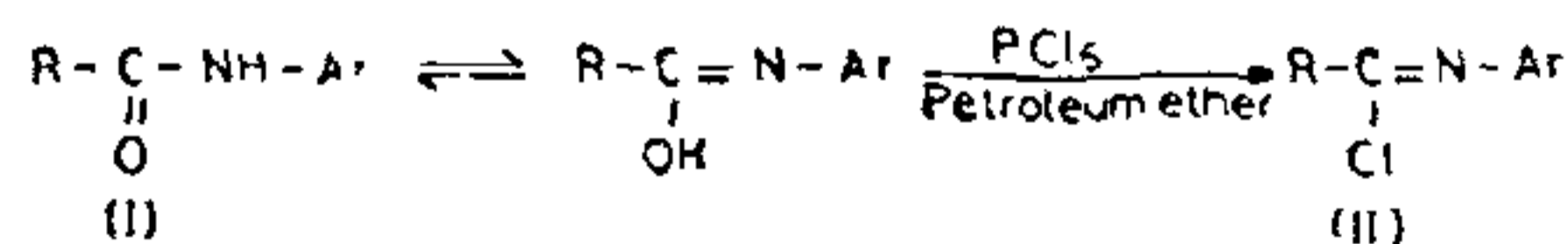
Chemistry Department  
University of Gorakhpur  
Gorakhpur, India

\* For correspondence.

\*\* Department of Chemistry, M. G. Degree College,  
Gorakhpur 273 001, India.

### Introduction

It has been suggested that compounds like 8-hydroxy-quinoline<sup>1,2</sup> and 4-hydroxyacridine<sup>3</sup> are fungitoxic as they are suitable ligands to chelate the essential metals involved in fungal metabolism. Should this assumption be correct, an azomethine of the structure (III) might possibly work as a ligand and be endowed with fungicidal power. Visualising this



III, (a) R = benzyl, Ar = 2-ClPh; (b) R = benzyl, Ar = 2-tolyl; (c) R = benzyl, Ar = 4-Phthiazoyl; (d) R = benzyl, Ar = 4-(4'-tolyl) thiazole-2-; (e) R = Ph, Ar = Ph; (f) R = Ph, Ar = 3-ClPh; (g) R = Ph, Ar = 2,4-diClPh; (h) R = Ph, Ar = 3,4-diMePh. Ph = phenyl.