From these data we obtain:

$$\tau \cdot \Delta(1/\tau) = 6 \cdot 10^{-3},$$

$La_{0.994}Tb_{0.006}Al_2$

$$T_c = 2.130\ \mathrm{K}; \quad Z = 0.35; \quad \Delta T_c = -0.145\ \mathrm{K};$$

$$\left(T_c/T_{c0} - x\,\frac{\partial(T_c/T_{c0})}{\partial x}\right) \cdot \Delta T_{c0} = +4\ \mathrm{mK};$$

$$x\,\frac{\partial T_c}{\partial x} \cdot \tau\Delta(1/\tau) = 7\ \mathrm{mK}.$$

In the table we have listed our theoretical result of T_c/T_{c0} and $T_c - T_{c0}$ for $La_{0.994}Tb_{0.006}Al_2$ for two values of the groundstate separation and different values of the LLW parameter X_L. The experimentally determined value of 11 mK for the first two terms of the r.h.s. of Eq. (10) has been added. These results have to be compared with the experimental values of $T_c/T_{c0} = 0.650$ and $\Delta T_c - \Delta T_{c0} = 29$ mK. It can be noticed that for a large number of level schemes, characterized by the parameter X_L, both the experimental values of T_c/T_{c0} and $\Delta T_c - \Delta T_{c0}$ are in agreement with the assumption of a groundstate separation between 1 and 2 T_{c0}. This is true even in the case when the groundstate of Tb ions is magnetic ($\Gamma_5^{(1)}$). A magnetic groundstate, however, can be ruled out from measurements of the susceptibility [8] and also from measurements of the concentration dependence of T_c for samples with higher concentrations of Tb ions [2]. Large deviations of the calculated values from the experimental values of $(\Delta T_c - \Delta T_{c0})$ occur near crossing points of the lowest energy levels, for example at $X_L = 0.6$ ($W > 0$) and $X_L = 0.8$ ($W < 0$).

Table 1. Calculated values of T_c/T_{c0} and $\Delta T_c - \Delta T_{c0}$ at 10 kbar for two values of the ground-state separation δ. The uncertainty in the values of $\Delta T_c - \Delta T_{c0}$ amounts to ± 2 mK

	Ground State	T_c/T_{c0}		$\Delta T_c - \Delta T_{c0}$ [mK] at $p = 10$ kbar	
		$\delta/T_{c0} = 1$	$\delta/T_{c0} = 2$	$\delta/T_{c0} = 1$	$\delta/T_{c0} = 2$
$W < 0$					
$X_L = 1$	Γ_3	0.645	0.664	26	36
0.8	Γ_2	0.646	0.672	42	74
0.6	Γ_2	0.647	0.667	26	48
0.4	Γ_2	0.648	0.666	26	51
0.2	Γ_2	0.648	0.666	25	40
0	Γ_2	0.648	0.667	25	40
−0.2	Γ_2	0.650	0.665	29	36
−0.4	Γ_2	0.644	0.669	32	57
−0.6	Γ_1	0.643	0.665	25	38
−0.8	Γ_1	0.644	0.664	24	36
$W > 0$					
$X_L = 1$	Γ_1	0.644	0.664	23	36
0.8	Γ_1	0.641	0.665	23	35
0.6	Γ_1	0.650	0.654	1	−6
0.4	$\Gamma_5^{(1)}$	0.641	0.649	22	29
0.2	$\Gamma_5^{(1)}$	0.641	0.649	19	25
0	$\Gamma_5^{(1)}$	0.642	0.650	21	28
−0.2	$\Gamma_5^{(1)}$	0.644	0.648	23	30
−0.4	$\Gamma_5^{(1)}$	0.642	0.650	27	32
−0.6	Γ_3	0.644	0.665	21	26
−0.8	Γ_3	0.644	0.664	26	37

5. Conclusions

We have shown that the pressure dependence of the superconducting transition temperature of $La_{1-x}Tb_xAl_2$ can be described quantitatively by a theory which takes into account the crystal field splitting of magnetic impurities. The results are consistent with earlier experiments on the concentration dependence $T_c(x)$. The variation of T_c under pressure depends essentially on the change of the energy splitting δ between ground state and first excited state. The results turned out to be rather insensitive to the details of the level scheme, as in the case of the concentration dependence $T_c(x)$. Therefore, the original idea to determine the crystal field parameters from these experiments, could not be realized.

For a quantitative analysis of the experimental results, not only the change in the crystal field splitting is essential but also the following points are important and must be taken into account:

1. As the pairbreaking effect depends on the ratio δ/T_{c0}, the large decrease of the superconducting transition temperature T_{c0} of $LaAl_2$ with pressure enhances the effect due to the crystal field splitting.
2. From the experiments with $LaGdAl_2$, where crystal field splitting is absent, it can be concluded, that also the scattering rate of the conduction electrons τ^{-1} is changed under pressure. The value of $\Delta\tau^{-1}/\tau^{-1}$ was used for the analysis of the results on $LaTbAl_2$ and can be useful for similar experiments with other crystal field split impurities in $LaAl_2$.

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