$$\delta\left(\frac{\partial V}{\partial T}\right)_p = -\frac{dp_c}{dT_c}\,\delta\left(\frac{\partial V}{\partial p}\right)_T$$

(cf.[1]) and, on the other hand, $(\partial V/\partial T)_p \to 0$ as $T \to 0$. Therefore $\partial p_c/\partial T_c = 0$ when $T_c \to 0$ only when the compressibility discontinuity $\delta(\partial V/\partial p)_T$ at the transition is not equal to zero.

In the BCS microtheory of superconductivity the gap is

$$\Delta(p_c, 0) = 3.52\,KT_c(p_c) = 4\hbar\omega_c \exp[-1/N(0)V]$$

$$\equiv f(p_c)\exp[-1/\varphi(p_c)],$$

but an actual analysis of the dependence of T_c on p_c has not yet, to our knowledge, been carried out. One may think that in the absence of any phase transition of other type the gap closes up [i.e., $\Delta(p_{c0}, 0) = 0$, $T_c(p_{c0}) = 0$] at some finite pressure p_{c0}. If in the pressure region close to p_{c0} we use the formula given above for $\Delta(p_c, 0)$ (cf. also[8]), then $\varphi(p_{c0}) = 0$ and probably $\varphi(p_c) \propto (p_{c0} - p_c)$. It is obvious that $dT_c/dp_c = 0$ at $T_c = 0$ and the gap $\Delta(p_c, 0)$ depends exponentially on the difference $(p_{c0} - p)$. Thus for superconductors at $T = 0$ and in several other cases,[9] we do not have a second-order transition. However, at any temperature $T \neq 0$ the results of the microtheory represent the model based on the expansion (1). In fact, according to the BCS theory, near the critical temperature we can write

$$\Delta(p, T) = 6.12\,kT_c(p)\,[1 - T/T_c(p)]^{1/2}.$$

To fix the temperature T we shall denote it by $T_c(p_c)$. Then we obtain immediately, by expanding the radicand as a series in $(p_c - p)$, a formula of type (2).

At the same time it is understood that the phenomenological approach is more widely applicable in the sense that it is not connected with the use of any special model. In particular, in the anisotropic case, when the gap width depends on direction, it is necessary to replace $|\Delta|$ by $|\Psi|$ in the expansion (1), but as before $|\Psi| \propto \sqrt{p_c - p}$ and $H_{cb} \propto (p_c - p)$. It is also easy to use the expansion (1) assuming that α and β depend on the stress tensor σ_{ij} or the deformation tensor u_{ij}. Within the framework of the theory of Landau and the present author and its generalization to the anisotropic case,[10] it is natural also to consider the dependence on pressure (or on σ_{ij}) of such quantities as the depth of penetration of the field, surface energy at the boundary between the normal and superconducting phases, etc.

It is worth noting that in the case of ferroelectrics and ferromagnetics the effect of pressure on a second-order transition has already been considered earlier,[11,12] although in a form somewhat different from that used above.

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