amount to ~0.05 eV) at the Fermi quasilevels. This estimate agrees well with the experimental value of τ_{eh}, although formula (3) is based on the Boltzmann kinetic equation, whose validity creterion $W_k \gg h/\tau$ is not satisfied in our case (W_k - kinetic energy of the carriers).

It should be noted that in the case of intense excitation of the semiconductors by light from a powerful laser ($I \approx 5 \times 10^{25}$ quanta/cm^{2}sec), a sharp increase was observed in their reflection coefficient in the visible part of the spectrum, too [1,5,6]. It was assumed in the cited papers that this effect is due to the high density Δn of the non-equilibrium carriers produced by the photoexcitation. However, as shown in the present paper (and also in [1]), the attained nonequilibrium-carrier density is insufficient for this purpose. An increase of R in the visible region is possible only as a result of the sharp increase (by two orders of magnitude) of the density of the free equilibrium carriers when the surface layer of the crystal is molten. It is no accident that this increase is always accompanied by damage to the surface.

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INTERACTION OF ELECTRONS WITH PARAMAGNETIC IMPURITIES IN SUPERCONDUCTORS

S. L. Ginzburg
A. F. Ioffe Physico-technical Institute, USSR Academy of Sciences

Submitted 24 October 1967
ZhETF Pis'ma 7, No. 3, 96-98 (5 February 1968)

The problem of the scattering of an electron in a superconductor by a paramagnetic impurity is solved by a dispersion method that employs the unitarity relations and the analytic properties of the scattering amplitude. Such an approach to the problem was already used by Maki [1]. He, in particular, formulated the unitarity conditions. However, as noted by Maki himself, the expressions obtained by him for the scattering amplitudes have incorrect analytic properties (energy pole on the physical sheet). In the present paper we derive an expression for the scattering amplitudes for the particular case of unity spin and zero non-exchange part of the interaction. The obtained solution satisfies the unitarity conditions, has correct analytic properties with respect to the energy, and goes over to the expression for the scattering amplitudes in the normal metal if $|\omega| \gg \Delta$ (ω is the energy reckoned from the Fermi surface and Δ is the gap). With the aid of this expression it is possible to calculate the temperature of the transition into the superconducting state and the gap at zero temperature for a superconductor with a low density of paramagnetic impurities.

It turns out that when the exchange part of the interaction between the electron and the impurity has a negative sign and a certain large characteristic energy ϵ_0 ($\epsilon_0 \gg \Delta$) the transition temperature and the gap increase when the impurities are introduced, rather than decrease as usual [2]. This phenomenon is essentially due to the same cause as the resistance maximum of a normal metal at zero temperature, namely, the maximum absolute value possible, from the point of view of the unitarity condition, of the non-exchange scattering amplitude on the Fermi surface in the normal metal (for details see [3]). The derivation of the presented solution and the generalization to the case of arbitrary impurity spin will be published in a detailed article. In the case when the non-exchange part of the interaction is equal to zero, there are four independent scattering amplitudes, $t_{\pm}$ and $\tau_{\pm}$, for which unitarity conditions (1) exist.

It is easy to verify that at zero temperature and at an impurity spin S = 1 these unitarity conditions are satisfied by the functions

$$t_{\pm} = \tau_{\pm}\Phi_{\pm} - \frac{1}{2ig_{\pm}},$$

$$\tau_{\pm} = \frac{1}{2ig_{\pm}}\frac{\Phi_{\pm}}{\Phi_{\pm}^2 - 1}D(\omega),$$

$$\Phi_{\pm} = -\frac{i}{\pi h}\frac{p_0}{g_{\pm}} + \frac{i}{\pi}\ln\frac{\omega + \sqrt{\omega^2 - \Delta^2}}{\Delta} + \frac{1}{2}, \tag{1}$$

$$g_{\pm} = p_0\frac{\omega \pm \Delta}{\sqrt{\omega^2 - \Delta^2}},$$

$$h = g\left(1 - g\ln\frac{\Delta}{2E_F}\right)^{-1}.$$

Here p_0 is the Fermi momentum.

The constant g which enters in these expressions can be connected with the quantity b, which characterizes the exchange part of the interaction [3]. If we consider the region of large ω, where the formulas should go over into the ordinary formulas of perturbation theory, then it turns out that $g = 2p_0b\pi^{-1}$.

We shall henceforth assume that $|g| \ll 1$. The function D(ω) outside the gap region is unimodular. Its concrete form is quite complicated and will be presented in the detailed article. In this note we confine ourselves to an indication that when $g < 0$ and $\Delta \ll \epsilon_0 = E_F\exp(-|g|^{-1})$ we have $D \approx -1$; this value of D is necessary in order that our formulas go over, as $\Delta \to 0$, to the corresponding expressions for the scattering amplitude in the normal metal when $g < 0$ [3].

When $g < 0$ and $\Delta \ll \epsilon_0$ we have

$$t_{\pm} = i\left(g_{\pm}^{-1} - \frac{\pi^2 h^2}{2p_0^2}g_{\pm}\right).$$

Using this expression and performing calculations perfectly analogous to those given in [2], we obtain the following expressions for the gap in the case of low impurity concentrations

$$\Delta = \Delta_0 - \frac{\pi\Gamma}{4}; \quad \Gamma = -\frac{2\pi n}{m}\frac{\bar{v}^2 h^2}{p_0}. \tag{2}$$

where Δ_0 is the gap in the absence of impurities. In [2] Γ is positive. In our case $\Gamma < 0$ and therefore the gap increases when the impurities are introduced. Γ is negative because in (1) $D = -1$ when $\omega \sim \Delta$, which in turn, as already noted, is in essence a reflection of the fact that when $g < 0$ the scattering amplitude in the normal metal is maximal when $\omega = 0$. Since we are considering the case $\Delta \ll \epsilon_0$, where ϵ_0 is the characteristic energy starting with which phenomena connected with the Kondo effect [3] come into play, the presence of superconductivity should not affect the existence of this maximum. It turns out in exactly the same manner that in this case the temperature of the transition to the superconducting state also increases. We note also that when $g > 0$ the results obtained by the method indicated above coincide with the corresponding results of [2].

In conclusion, the author is grateful to S. V. Maleev for a large number of interesting discussions.

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TRIANGULAR DIAGRAM IN THE DECAY $Y_0(1520) \to \Lambda\pi\pi$ AND THE DETERMINATION OF THE PION SCATTERING LENGTH

V. V. Anisovich, E. M. Levin, and A. K. Likhoded
A. F. Ioffe Physico-technical Institute, USSR Academy of Sciences
Submitted 10 November 1967
ZhETF Pis'ma 7, No. 3, 99-101 (5 February 1968)

A study of the $Y_0(1520) \to \Lambda\pi\pi$ decay affords a good opportunity of determining the value of a_0 (the scattering length of pions with zero isospin). This decay proceeds in the main in two stages: $Y_0(1520) \to Y_1(1385) + \pi \to \Lambda\pi\pi$ [1]. Therefore the contribution of the triangular diagram (Fig. 1a) to it should be appreciable if the value of a_0 is not small [2-5].

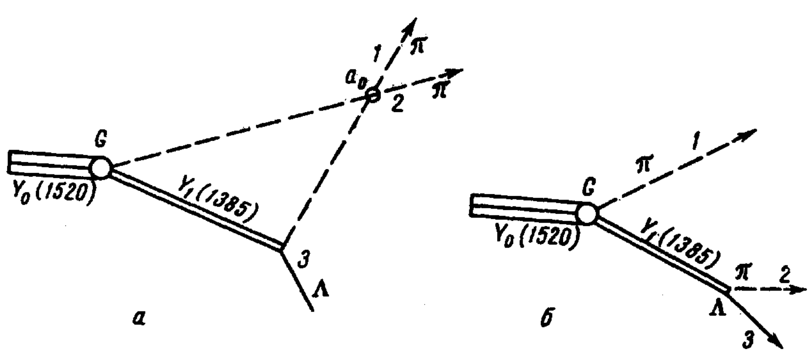

Fig. 1