m is the electron mass, M_N is the nucleon mass, E and ω are the energies of the initial antineutrinos and final electrons, and ζ is double the initial-electron spin projection on the direction of the incident antineutrino beam.

Thus, measurements of the number of recoil electrons at ζ = 1, 0, and -1 will make it possible to choose unambiguously the model of the $\bar{\nu}e$ scattering.

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FLUCTUATION CONDUCTIVITY OF TUNNEL JUNCTIONS

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The influence of fluctuation pairs on the conductivity of a superconductor above the critical temperature in weak fields was first investigated by Aslamazov and Larkin [1]. The nonlinear dependence of the conductivity on the field was investigated by Schmidt [2] and by Gor'kov [3]. The influence of fluctuations on the conductivity in thin films was first observed by Glover [4].

We have investigated the influence of fluctuations on the tunnel current in MIM and SIM junctions. In first order in the fluctuations, the diagram contributing to the tunnel current is shown in the figure (cf. [3]). The solid lines are the Green's functions, the dashed lines represent averaging over the impurities, and the wavy line is the Cooper vertex. The tunnel current is given by the formula (see [5])

$$IR_0 = -\frac{1}{2\pi^2}\int_{-\infty}^{\infty}\left(\mathrm{th}\frac{\epsilon - V}{2T} - \mathrm{th}\frac{\epsilon}{2T}\right)\mathrm{Im}\,G_1^R(\epsilon)\,\mathrm{Im}\,G_2^R(\epsilon - V), \qquad (1)$$

where V is the potential difference on the barrier, R_0 is the resistance of the junction in the normal state, $G_{\vec{p}}^R(\varepsilon) = \int d\xi G^R(\varepsilon p)$ is the Green's function integrated over the energy $\xi = v_0(|\vec{p}| - p_0)$. Since the current (1) is expressed in terms of retarded Green's functions, we must continue the diagram analytically (see the figure) to real frequencies. The analytic continuation is by the method developed by Keldysh [6]. Without presenting the cumbersome calculations connected with the analytic continuation (they will be presented in a detailed article), we write down the final result for a retarded Green's function

$$G^R(\epsilon) = \int d\xi\, G^R(\epsilon p) = -i\pi +$$

$$+ \pi T \int \frac{d\omega\, dq}{(2\pi)^4} \frac{1}{\omega} [K^A(\omega q) - K^R(\omega q)](\epsilon - \omega/2 + i/\tau_s)^{-2}. \tag{2}$$

The second term in this formula corresponds to the diagram in the figure. The frequency of the Cooper pair is assumed to be small. τ_s is the time between collisions with electron spin flip. We note here that if $1/\tau_s \gg T - T_c$, then the fluctuations have no noticeable influence on the tunnel current. We therefore confine ourselves to a discussion of samples with ordinary impurities. In this case the Cooper vertex function takes the form

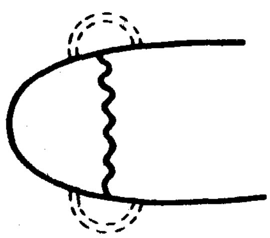
$$K^R(\omega q) = \frac{2\pi^2}{m p_0}\left[\frac{i\pi\omega}{8T} - \frac{T - T_c}{T} - \frac{\pi P}{8T} q^2\right]^{-1}, \tag{3}$$

where $P = v_0^2\tau/3$, and τ is the time between collisions, which coincides with the transport time if the electron-impurity interaction potential has the form of a delta function.

Finally, we get

$$\operatorname{Im} G^R(\epsilon) = -\pi - \frac{4\sqrt{2}\pi T^2}{\pi p_0 P^{3/2}} \frac{1}{\epsilon^2}\left[\Gamma^{1/2} - \frac{[(\epsilon^2 + \Gamma^2)^{1/2} + \Gamma]^{3/2}}{2\sqrt{2}(\epsilon^2 + \Gamma^2)^{1/2}}\right], \tag{4}$$

where $\Gamma = 4/\pi(T - T_c)$.



Substituting (4) in (1), we can calculate the current in an MIM junction. Without presenting the cumbersome formula resulting from such a substitution, we proceed to consider the particular case when the temperatures of the junction of both metals are equal. The dependence of the tunnel current on the applied voltage is a complicated one. It is relatively easy to calculate $(dj/dV)_{(V=0)} = 1/R$. The calculation yields

$$1/R = (1/R_0)\left[1 + 0{,}2\frac{1}{(\epsilon_F \tau)^3}\frac{T}{\epsilon_F}\left(\frac{T}{T - T_c}\right)^2\right]. \tag{5}$$

We see from the resultant expression that the second, fluctuating term in the right-hand side of (5) becomes comparable, in the case of extremely contaminated metals, $\epsilon_F\tau \sim 1$, with the first term when $(T - T_c)/T \sim 10^{-2}$. We note that we are considering a case when there is bulky metal on both sides of the junction.

The resistance of the contact between metals with different junction temperatures $T_{c_1} < T_{c_2}$, takes the following form at temperatures $T > T_{c_2}$:

$$1/R = (1/R_0)\left[1 + 0{,}03\frac{1}{(\epsilon_F \tau)^{3/2}}\left(\frac{T}{\epsilon_F}\right)^{1/2}\left(\frac{T}{T - T_{c_2}}\right)^{1/2}\right]. \tag{6}$$

Let us consider the tunnel current in an SIM junction at temperatures $T > T_c$ (T_c is the critical temperature of the metal M in this junction). Using the expression for the density of state of the electrons in the superconductor (cf., e.g., [5]), we can write the tunnel current in the form

$$jR_0 = -\frac{1}{2}\int_{-\infty}^{\infty}\left(\mathrm{th}\frac{\epsilon - V}{2T} - \mathrm{th}\frac{\epsilon}{2T}\right)\frac{|\epsilon|\,\theta(|\epsilon| - \Delta)}{(\epsilon^2 - \Delta^2)^{1/2}} \times$$

$$\times\left\{1 + \frac{4\sqrt{2}T^2}{mp_0 P^{3/2}}\frac{1}{(\epsilon - V)^2}\left[\Gamma^{1/2} - \frac{[((\epsilon - V)^2 + \Gamma^2)^{1/2} + \Gamma]^{3/2}}{2\sqrt{2}((\epsilon - V)^2 + \Gamma^2)^{1/2}}\right]\right\} \qquad (7)$$

This integral can be calculated only in particular cases, making a detailed comparison of (7) with experiment [7] difficult. It is readily seen, however, that for an applied potential $V < \Delta$ the fluctuation correction to the current is negligibly small. A fluctuation current begins to appear when V becomes equal to Δ ($\Delta - V \sim T - T_c$); this is in qualitative agreement with experiment [7]. The fluctuation correction to the tunnel current at $V = \Delta$ is proportional to $T/(T - T_c)$.

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CONTRIBUTION TO THE NONLINEAR THEORY OF EXCITATION OF A MONOCHROMATIC PLASMA WAVE BY AN ELECTRON BEAM

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It is well known that when a monochromatic wave interacts with a plasma the capture of the resonant plasma particles in the potential well produced by the wave leads to oscillations of the wave amplitude with a characteristic time on the order of the period of the particle oscillations in the well, $\tau_0 = k^{-1}(e\phi_0/m)^{-1}$ (k - wave number, ϕ_0 - amplitude of potential in the wave). The oscillations are attenuated as a result of the phase "mixing" of the captured particles, due to the dependence of the period of their oscillations in the well on the energy. These features of the interaction of the monochromatic wave with a plasma were explained by Mazitov [1] and O'Neil [2], who investigated the absorption of a wave with a sufficiently small decrement $\gamma_L\tau_0 << 1$. In this case it was possible to obtain an approximate analytic solution of the problem by considering the motion of resonant particles in a field of given