$$\frac{\Gamma-\Gamma_0}{\Gamma_\Phi} = \frac{H_0}{H_{c2}} + \frac{l\Phi_0}{V\epsilon_0 H_{c2}}(\omega^2 - \omega_0^2).$$

From the physical point of view, the additional absorption is due to the repulsion of the free vortices from the pinned ones, which increases the oscillation amplitude of the free vortices relative to the superconductor and correspondingly increases the loss to viscous motion of the vortex filaments.

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INFLUENCE OF HIGH-FREQUENCY FIELD ON THE TUNNEL EFFECT

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Submitted 30 October 1972
ZhETF Pis. Red. 17, No. 1, 35 - 37 (5 January 1973)

Let a superconducting film of thickness $d \gg \zeta_0, \lambda$ (ζ_0 and λ are the coherence length and the field penetration depth, respectively) form a tunnel junction with some superconductor, and let an alternating magnetic field $H_0 \cos\omega$ be applied to the external surface of the film. At small ω the field does not penetrate into the junction under such conditions, and the film superconductivity parameter Δ is equal to its equilibrium value Δ_0 in the region of the junction. If $\omega = \Delta_0$, however, the situation may be somewhat different. It is shown in [1] that the superconductivity parameter of a bulky type-I superconductor is changed by the action of the alternating field of frequency Δ_0 up to distances on the order of the mean free path ℓ from the surface, in accordance with the formula

$$\frac{\Delta(r,t)}{\Delta_0} = 1 - \frac{e^2H_0^2}{2c^2q_0^4}\ln\frac{\ell}{r}\cos 2\Delta_0 t \equiv 1 - g(r)\cos 2\Delta_0 t \tag{1}$$

with $\zeta_0 < r < \ell$; q_0 is the characteristic Pippard momentum [2]. It is assumed that in the absence of the field the superconductivity parameter has the same value near the surface as in the interior of the superconductor. Therefore, if the thickness $d \approx \ell \gg \zeta_0$ and $\omega = \Delta_0$, then the tunnel current is modulated at a frequency $2\Delta_0$, even though the alternating field does not penetrate directly into the junction. This is precisely the effect considered here.

As is well known, the tunnel current is expressed in terms of temporal Green's functions integrated with respect to the energy (cf., e.g., [3], formula (6)). The high-frequency electric field does not act directly on one of the superconductors of the junction, the equilibrium value of the gap is Δ_0', and the change of the Green's functions of the film in the region of the junction, due to the alternating $\Delta(d, t)$, can be easily obtained from [1]

$$\delta F(t, t_1) = \delta F^*(t, t_1) = \sin\Delta_0 (t + t_1) \sin\Delta_0 (t - t_1) \int d\eta_p \frac{g(d)\Delta_0}{4\epsilon_p} \times$$
$$\times \exp[-i\epsilon_p(t - t_1)], \quad t > t_1$$
$$\delta G(t, t_1) = \cos\Delta_0 (t + t_1) \sin\Delta_0 (t_1 - t) \int d\eta_p \frac{g(d)\Delta_0}{4\epsilon_p} \times \tag{2}$$
$$\times \exp[-i\epsilon_p (t - t_1) \operatorname{sign}(t - t_1)],$$

where $\epsilon_p^2 = \eta_p^2 + \Delta_0^2$, $\eta_p = p^2/2m - \mu$, and μ is the chemical potential. Using (2), we obtain the additional current $\delta J = \delta J_1 + \delta J_2$ through the junction:

$$\delta J_1 = \frac{g(d)}{8eR} \{ [I_2(v) - I_2(-v) - I_2(v + 2\omega) + I_2(-v - 2\omega)] \times$$
$$\times \cos(2\omega t + 2vt - \phi) + [I_1(v + 2\omega) - I_1(v)] \sin(2\omega t + 2vt - \phi) + \omega \to -\omega \},$$
$$\delta J_2 = \frac{g(d)}{16eR\Delta_0'} \left\{ \left[vI_2(v) - (v + 2\omega) I_2(v + 2\omega) \right] \frac{\sin 2\omega t}{\omega} + \omega \to -\omega \right\},$$

where R is the resistance of the junction in the normal state, v is the potential difference across the junction, ϕ is the phase difference between the superconductors (we have written out explicitly the depencence of the phase difference on v), an expression for I_1 is given in [3] (formula (23)), and

$$I_2(v) = \frac{2\Delta_0\Delta_0'}{\sqrt{v^2 - (\Delta_0 - \Delta_0')^2}} K\left(\sqrt{\frac{v^2 - (\Delta_0 + \Delta_0')^2}{v^2 - (\Delta_0 - \Delta_0')^2}}\right) \theta(v - |\Delta_0 + \Delta_0'|).$$

It is seen from (3) that an alternating tunnel current of frequency $2\Delta_0$ and $2|\Delta_0 \pm v|$ sets in. We note that the current δJ_1 is connected with simultaneous pair tunneling through the barrier. This is clearly seen from the time dependence of δJ_1 as a function of v, whereas δJ_2 is in essence a single-particle current. The current δJ_1 experiences a jump not only at $v = \Delta_0 + \Delta_0'$, but also at $v = \Delta_0' - \Delta_0$, whereas the tunnel current in the absence of a field experiences no jump at this value of the potential difference $(\Delta_0' - \Delta_0)$. We note that these jumps are due to the same cause as the jumps of the Josephson current at $v = \Delta_0 + \Delta_0'$.

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CORRELATIONS IN THE MULTIPERIPHERAL MODEL AND RESONANT PARTICLE PRODUCTION

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Submitted 3 November 1972
ZhETF Pis. Red. 17, No. 1, 37 - 41 (5 January 1973)

The dynamics of multiple particle production has been attracting particular interest of late. The presently employed models can be divided into two groups: