L.129 TUNNEL EFFECTS CAUSED BY STANDING WAVES IN METALS.

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A study has been carried out on the influence of hydrostatic pressures up to 10 kbar and of magnetic fields up to 70 kOe at oscillation in tunnel conductivity of aluminium-insulator-lead junctions caused by standing waves in lead films.

Oscillating parts of conductivity had maximums at certain bias U, U=Uq which is accounted for by coordination[1] of standing wave energy levels in different crystallites of the film at energies Eq, Eq-Ef=Uq(e=1, Ek - Fermi energy).

The realization of this effect is complicated with some difficulties since electron wave length in a metal is comparable with the lattice spacing and since perfect single crystals of small dimensions are necessary for standing waves to exist. However, we managed to observe this phenomenon in many samples of the tunnel conductivity derivative I"(U) at the hydrostatic compression (P).

The experiments have been performed at 4.2 K. The lead films had texture [111] and thickness ~ 250Å. Through the shift under pressure of the zero I"(U) corresponding to the greatest maximum of the oscillating part of conductivity, magnitude η is determined as below:

$$\eta = dUq/dp = d(E(Kq)-E_f)/dp,$$

$$Kq = K(1/2,\ 1/2,\ 1/2).$$

Momentum K values are given in terms of π/a, a - lead lattice constant. The obtained value of $\eta = 4 \pm 0.2$ meV/kbar is in satisfactory agreement with calculations of the band structure parameters of lead, done nonrelativistically, which proves a connection between the observed phenomenon and the metal band structure. (Value dE_f/dp is taken from Ref.[2])