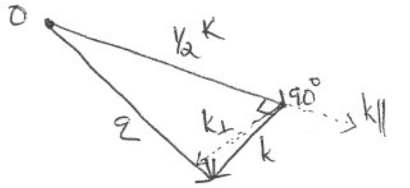
CHAPTER 9

9.1

a)



$$\mathcal{E} = \mathcal{E}^{\circ}_{K/2} + \frac{\hbar^2 k^2}{2m} \pm \left(4 \mathcal{E}^{\circ}_{K/2} \frac{\hbar^2}{2m} k_{\parallel}^2 + |U_K|^2\right)^{1/2}.$$

we can make this equation into the form,

$$\mathcal{E}_F = \mathcal{E}^{\circ}_{K/2} - |U_K| + \Delta \qquad (1)$$

when $\Delta < 0$, Fermi surface does not intersect Bragg plane.

$k_{\parallel} = 0$ on the Bragg plane.

$$\mathcal{E} = \mathcal{E}^{\circ}_{K/2} + \frac{\hbar^2 k^2}{2m} \pm |U_K|$$

when $\mathcal{E} = \mathcal{E}_F$, $k = \rho_1$

$$\mathcal{E}_F = \mathcal{E}^{\circ}_{K/2} - |U_K| + \frac{\hbar^2 \rho_1^2}{2m} \qquad (2)$$

Comparing (1) and (2),

$$\rho_1 = \sqrt{\frac{2m\Delta}{\hbar^2}}$$

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b). now $\Delta > |2U_K|$.

consider the equation,

$$\varepsilon = \varepsilon^{\circ}_{K/2} + \frac{\hbar^2 k^2}{2m} \pm \left(4\varepsilon^{\circ}_{K/2}\frac{\hbar^2}{2m}k_{\parallel}^2 + |U_K|^2\right)^{1/2}.$$

now at $\varepsilon = \varepsilon_F$

$$\varepsilon_F - \varepsilon^{\circ}_{K/2} = \frac{\hbar^2 k_F^2}{2m} \pm |U_K|$$

$k_F = \rho_1$, $\quad \varepsilon_F - \varepsilon^{\circ}_{K/2} = \frac{\hbar^2 \rho_1^2}{2m} - |U_K| \quad$ — ①

$k_F = \rho_2 \quad \varepsilon_F - \varepsilon^{\circ}_{K/2} = \frac{\hbar^2 \rho_2^2}{2m} + |U_K| \quad$ — ②

equating ① & ②

$$\frac{\hbar^2}{2m}\left(\rho_2^2 - \rho_1^2\right) = 2|U_K|$$

$$\pi\left(\rho_2^2 - \rho_1^2\right) = \frac{4m}{\hbar^2}\pi\,|U_K|$$