Fig. 6. Location of the extended saddle point singularities in the (k_x, k_y) plane for $YBa_2Cu_3O_{7-\delta}$

Fig. 7. The function $\varepsilon(k_x, k_y)$ near the singularity

Such singularities were found in $YBa_2Cu_3O_{6.9}$, $YBa_2Cu_4O_8$ and $Bi_2Sr_2CaCu_2O_{8+\delta}$ This discovery was confirmed later by the Srtanford group (Shen, Dessau et al.) [11] and by numerical determinations of the band structure in the same substances as well as in $HgBa_2CuO_{4+\delta}$ and $HgBa_2CaCu_2O_{6+\delta}$ [12]

Even a simple saddle point leads to the increase of the density of states, and to enhancement of superconductivity [13]. The extended saddle point means actually that the substance is not only quasi-2D, but quasi-1D with the density of states in a rather wide energy range given by the formula

$$\nu(\varepsilon) = \frac{P_{y0}(2m_x)^{1/2}}{(2\pi)^2\, d\, (\varepsilon - \varepsilon_o)^{1/2}}\ , \qquad (12)$$

where P_{y0} is the extension of the singularity (we assume here that it goes along k_y), m_x is the effective mass for k_x, d is the period along the c-axis, ε_o the energy of the singularity. Substitution into the self-consistency equation of the BCS theory gives in the limiting cases: