From (5) and (6) it can be seen that, if $\lambda_2>0$, the equilibrium solution is even, and, if $\lambda_2<0$, it is odd. This occurs at all temperatures, where superconductivity exists. From the definitions (10) it follows that the phonons dominate in the interaction, if

$$g\kappa^2/(n-1) \gg 2UP_{y0}/d \tag{8}$$

Under this condition λ_2 can have either sign. It is negative, if

$$U > g\,[\kappa^2/(2p_0^2)]^n \tag{9}$$

The main conclusion is the division of layered cuprates in two very distinct groups. Strong anisotropy, originating from extended saddle point singularities and a long screening radius, makes it plausible that the order parameter becomes odd, whereas weak anisotropy leads to an even order parameter. Since the quasi-1D energy spectrum leads to a singularity in the density of states only from one side, it is likely to be absent in the n-type cuprates, as NCCO . This can be the origin of their lower T_c and of the even order parameter.

5. Scattering from impurities

A strong proof of the odd order parameter is the action of impurities [13]. Regular substitutional impurities are most likely ionized, and being small-angle scatterers, they do not influence T_c substantially. Of course, there is also some large-angle scattering but it has a small probability. The usual estimates lead to the conclusion that the critical temperature is influenced only if $\tau\varepsilon_F \sim 1$, which could be considered in favor of s-pairing. The fault of such an estimate is that a much larger τ should be taken, namely, that of large angle scattering, and it could fit the condition $\tau\Delta \sim 1$. In the experiment [14], defects were created in YBCO by electron bombardment. The electron energy was chosen so that the oxygen atoms were displaced but not knocked out; this produced dipolar defects causing large-angle scattering. They were very effective in suppression of the critical temperature. At the same time the copper atoms were not involved, and this excluded magnetic defects.

The observed dependence of T_c on the concentration of these defects fits the prediction for an odd order parameter:

$$T_{co} \approx \begin{cases} T_{co}^{(clean)}[1-\pi/(2T_{co}^{(clean)}\tau)], & (\pi T_{co}^{(clean)}\tau)^{-1} \ll 1 \\ (2\sqrt{6}/\pi)\,[\tau_c^{-1}(\tau_c^{-1}-\tau^{-1})]^{1/2}, & (\tau_c^{-1}-\tau^{-1}) \ll \tau_c^{-1} \end{cases} , \tag{10}$$

where τ^{-1} is the scattering probability proportional to the residual resistance in the normal state, and

$$\tau_c^{-1} = (\pi/4\gamma)T_{co}^{(clean)} \tag{11}$$

is the critical value, where T_{co} vanishes.

In reality, however, this does not happen, because the metal can undergo a phase transition into the even phase. This was not observed in the experiment [14] in the accessible temperature interval, however there exist other ways to suppress the d-wave order parameter, and at least in one of such experiments performed by the group of L. Greene a "subdominant" s-wave order parameter was indeed observed [15].

6. Negative isitope effect on copper

Rather close considerations can explain the negative isotope effect on copper, discovered by the Franck's group [16]. It was found that in underdoped samples of YBCO the substitution $^{63}Cu \rightarrow {}^{65}Cu$ causes a change of T_c corresponding to a negative isotope effect, namely, a larger copper isotope mass leads to an increase of the critical temperature. There exist some other examples of a negative isotope effect, e. g., resulting from a substitution of hydrogen by deuterium in solid solutions. The distinction of the present case is that the same substances have a positive isotope effect for the oxygen substitution ^{16}O - ^{18}O. The