Here we are interested in Δ at the Fermi surface, and hence we put $\xi=0$. The interaction (31) enters the BCS self-consistency relation, and hence we have

$$\frac{1}{\lambda}=\frac{1}{2}\int_{-\mu_1}^{\infty}\frac{d\xi\,\mu_1^{1/2}}{(\xi+\mu_1)^{1/2}}\;\frac{\omega_o^2}{\omega_o^2+\xi^2}\;\frac{th[(\xi^2+\Delta^2)^{1/2}/2T]}{(\xi^2+\Delta^2)^{1/2}}\,, \tag{32}$$

where λ has the same meaning as before (eq. (21)).

At $T=T_C$ $\Delta=0$. Performing the integrations we will assume that $T_C \ll \mu_1$, ω_o. The result will be

$$\frac{1}{\lambda}=ln\frac{8\gamma\mu_1}{\pi T_c}-f(x)\quad, \tag{33}$$

$x=\omega_o/\mu_1$, $\gamma=e^C=1.781$. The asymptotic values of $f(x)$ are

$$f(x)\approx\begin{cases} ln\,\frac{4}{x}-\frac{1}{8}\left(3\,ln\frac{4}{x}-\frac{7}{2}\right)x^2 & x\ll 1\\ \frac{\pi}{2\sqrt{2x}} & x\gg 1\end{cases} \tag{34}$$

From formula (33) we define α according to eq. (26). Assuming that ω_o is proportional to $M^{-1/2}$ we obtain: $d(ln\,x)=-1/2\,d(lnM)$. According to eq.(9). The asymptotic values at small and large values of x are

$$\alpha(x)\approx\begin{cases} \frac{1}{2}-\frac{1}{8}\left(5-3\,ln\frac{4}{x}\right)x^2 & x\ll 1\\ \frac{\pi}{8\sqrt{2x}} & x\gg 1\end{cases} \tag{35}$$

Experimental results are always given in the form of the dependence $\alpha(T_c)$. Although we have obtained equations describing T_c and α, they include an unknown interaction. More important, the characteristic phonon frequency can be renormalized, and hence depend on the electron density of states, i.e. on μ_1. At least, our attempts to compare the theory with the experiment on the basis of the assumption of a constant ω have failed. Since we do not want to introduce doubtful concepts about the phonon renormalization, we will perform the comparison in a different way.

From experiments we have the connection between T_C and α. According to our concept there should be little difference between compounds with different substitution of the constituents, provided that the CuO_2 planes are left intact. This is in fact confirmed by the data for