variation of α as defined by eq. (26), since, as we mentioned, the actual variations of M are small. We will consider here the case $\mu_I \gg T_c$, and at the end we will briefly discuss the case $\mu_I \lesssim T_c$ which corresponds to substances with the lowest α and highest T_c.

As before, we assume that the true interaction has the form

$$V(k) = g\left(\frac{æ^2}{k^2 + æ^2}\right)^n \frac{\omega^2(k)}{(\xi-\xi')^2 - \omega^2(k)}, \tag{28}$$

where ω is the phonon energy and ξ, ξ' - the electron energies before and after scattering. According to the previous considerations the order parameter in the region of the singularity does not depend on momenta. Since the electron energy depends only on p_x, we can integrate the interaction (5) with respect to p_y and p_z, and after this we obtain

$$\int \frac{dk_y dk_z}{(2\pi)^3} V(k) \to \frac{gæ^2}{8\pi^2(n-1)} \frac{\omega_o^2}{(\xi-\xi')^2 - \omega_o^2}, \tag{29}$$

where $\omega_b \sim cæ$ is some characteristic phonon energy at $k \sim æ$. Usually the factor with ω_b in the interaction (29) is replaced for simplicity by

$$\frac{\omega_o^2}{(\xi-\xi')^2 - \omega_o^2} \to \begin{cases} -1 & |\xi-\xi'| < \omega_o \\ 0 & |\xi-\xi'| > \omega_o \end{cases}. \tag{30}$$

. Unfortunately, due to the singular density of states, which is proportional to $(\varepsilon-\varepsilon_o)^{-1/2} = (\xi+\mu_I)^{-1/2}$ the interaction (29) as well as its simplified form (30) lead to unphysical singularities at $\mu_I = \omega_b$. The origin lies in the replacement of the integration over phonon frequencies by some fixed frequency ω_b. On the other hand such a replacement is very helpful for simplification of the theory. Therefore, instead of (30), we will use another simplified form, which has also the property of being confined to a certain energy interval around the Fermi energy and at the same time permits to avoid nonphysical singularities in the final expressions. We will substitute the frequency dependent factor in (29) by

$$-\frac{\omega_o^2}{(\xi-\xi')^2 + \omega_o^2}. \tag{31}$$