N is the number of possible off-centre positions. Q_0 may be called the off-centre displacement, but note that it does not necessarily describe a static displacement of the defect ion.

Inserting (5), (7), and (8) into (6) we obtain for the oscillator strength

$$f_{\Gamma_1^+\to\Gamma_4^+(\Gamma_5^+)} = A^2_{4(5)}\,\{\eta_x^2\,(\langle Q^2_{4\,y}\rangle + \langle Q^2_{4\,z}\rangle) + \text{cyclic terms}\} + A^2_{4(5)}\,\{\eta_x^2\,(Q^2_{4\,y\,0} + Q^2_{4\,z\,0}) + \text{cyclic terms}\}\,, \quad (10)$$

$$f_{\Gamma_1^+\to\Gamma_3^+} = A_3^2\,\{\eta_x^2\langle Q^2_{4\,x}\rangle + \text{cyclic terms}\} + A_3^2\,\{\eta_x^2\,Q^2_{4\,x\,0} + \text{cyclic terms}\}\,. \quad (11)$$

A_3, A_4, and A_5 are constants, depending on the excited state of the transition. $\eta = (\eta_x, \eta_y, \eta_z)$ is the unit vector of polarization. The first expression describes transitions from a nondegenerated state Γ_1^+ to the orbital triplet states Γ_4^+, Γ_5^+, the second one transitions to an orbital doublet state Γ_3^+. The second term represents the effect of the off-centre potential. Without stress the expressions (10) and (11) are isotropic in the polarization, because the mean square amplitudes of the lattice vibrations are equal in each direction:

$$\langle Q^2_{4\,i}\rangle = \langle Q^2\rangle = \frac{\hbar}{2\,\omega}\coth\frac{\hbar\,\omega}{2\,kT} \approx \begin{cases} \dfrac{kT}{\omega^2} & \text{for} \quad kT \gg \hbar\,\omega\,, \\ \dfrac{\hbar}{2\,\omega} & \text{for} \quad kT \ll \hbar\,\omega\,. \end{cases} \quad (12)$$

Inserting (12) into (10) and (11) we obtain the temperature dependence of the oscillator strength [2].

Uniaxial stress lifts the degeneracy of the resonance mode and we get different vibrational frequencies and different off-centre distortions parallel and perpendicular to the stress axis. As an example Fig. 4 shows the splitting of

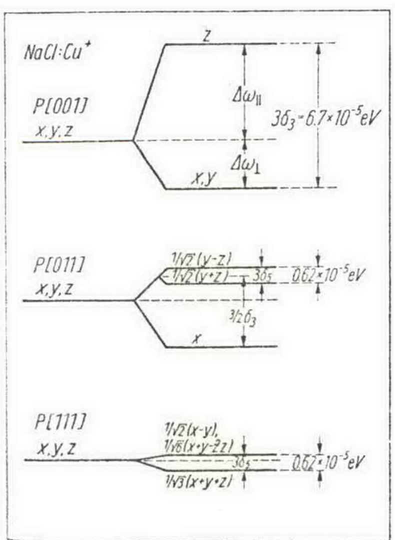

Fig. 4. Stress splitting of the local mode at 23.5 cm⁻¹ in NaCl:Cu⁺ at 4.3 °K. The applied stress is 100 kp/cm²

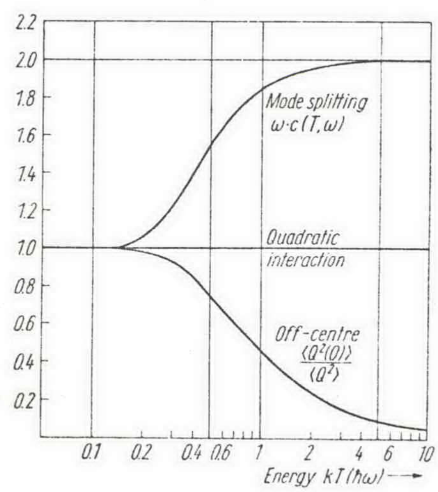

Fig. 5. Temperature dependence of the different effects contributing to $(f_{\parallel} - f_{\perp})/f$