in molecular orientation; the trend in ε' also indicates solid-state relaxation [8]. The dipolar molecules become more mobile as T increases, so the dipole component increases. Figure 3 illustrates this in terms of $\varepsilon - n^2$ for β-naphthoquinoline.

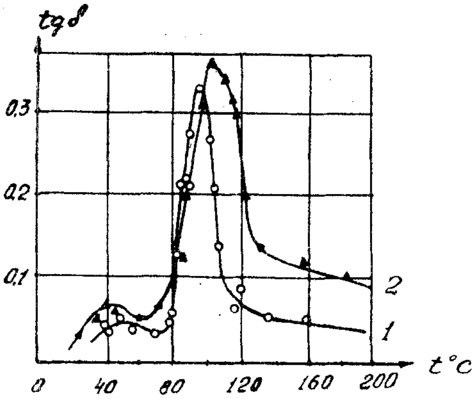

Fig. 2. Temperature dependence of tan δ for 1) β-naphthoquinoline, 2) o-phenanthroline.

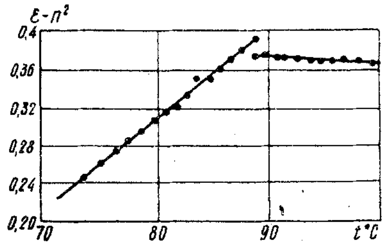

Fig. 3. Temperature dependence of the dipole component of ε' for β-naphthoquinoline.

The second peak (see table) corresponds to phase transition for all the polar compounds; it is more prominent than the low-temperature one and indicates a marked change in structure on melting [9, 10]. The ε' and tan δ curves are similar, so the UHF loss mechanisms must be similar, and, in particular, are probably due to relaxation processes. The most probable relaxation time is about 10^{-10} sec, a value characteristic of unassociated liquids.

Compound	t_{pl}, °C	Peak I		Peak II	
		tg δ_{max}	t^0_{max}, °C	tg δ_{max}	t^0_{max}, °C
Phenanthrene	100	—	—	—	—
β-naphthoquinoline	92	0.046	47	0.326	98
o-phenanthroline	100	0.064	41	0.355	104
Toluyl-2-azo-1-naphth-2-ol	126.3	0.044	65	0.072	126
Diamide of collidine dicarboxylic acid in diethyl ether	131	0.084	59	0.215	136

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DEGREES OF PARITY NONCONSERVATION IN Θ AND τ DECAYS

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The Θ and τ decays of K^+ mesons gave the first evidence for parity nonconservation, although each decay taken alone shows no asymmetry indicating nonconservation that can be measured (in this we have a difference from β-decay and other lepton processes associated with neutrino emission). This arises because the system of two or three pions produced by K^+ decay has $J = 0$, and this means that the parity is defined (+1 for two pions, −1 for three). There is then no pseudoscalar quantity different from zero. There are, however, other possible lepton decays of K^+ mesons in which nonconservation might be detected.

Radiative Θ and τ decays have been reported [1, 2]; papers have appeared [3-6] on the theory. This note deals with these decays:

$$K^+ \to \pi^+ + \pi^\circ + \gamma, \qquad K^+ \to 2\pi^+ + \pi^- + \gamma.$$

The final states of the system are two, which are opposite in parity: electric multipole radiation gives positive parity; magnetic multipole, negative.

The matrix element of the transition corresponding to radiative Θ decay is put [3, 4] in the very general form

$$M = e_\nu j_\nu = F_{\mu\nu} u_\mu p_\nu F_1 - i \varepsilon_{\alpha\beta\gamma\delta} F_{\alpha\beta} u_\gamma p_\delta \frac{F_2}{2}, \tag{1}$$

in which $F_{\mu\nu} = \kappa_\mu e_\nu - \kappa_\nu e_\mu$, the 4-vector u, p, κ, e being the 4-velocity of the K^+ meson, the 4-momentum of the π^+ meson, and the 4-momentum and polarization of the photon respectively; F_1 and F_2 are two invariants of the form factor that are governed by the strong interactions and are therefore unknown; they may be taken as constant in the dipole approximation, whereupon the two terms in (1) correspond to electric and magnetic dipole radiations. The bremsstrahlung contributes only to the first term and may, in principle, be extracted from the latter [4].

Formula (1) takes the following form in the system in which the K^+ meson is at rest and the photon moves along the z axis:

$$M = \boldsymbol{e}\,\boldsymbol{p} \cdot \kappa_0 F_1 + i\,\boldsymbol{e}\,[\boldsymbol{\kappa}\,\boldsymbol{p}]\,F_2. \tag{2}$$

We calculate the Stokes parameters of the polarization matrix for the photon in the usual way:

$$\xi_2 = \frac{2\,\mathrm{Re}\,F_1 F_2^*}{|F_1|^2 + |F_2|^2}; \qquad r = \sqrt{\xi_1^2 + \xi_3^2} = \frac{|F_1|^2 - |F_2|^2}{|F_1|^2 + |F_2|^2}. \tag{3}$$

The invariance with respect to reversal of time shows that F_1 and F_2 may be taken as real if we neglect the interaction in the final state:

$$\xi_2 = \frac{2F_1F_2}{F_1^2 + F_2^2}; \qquad r = \frac{F_1^2 - F_2^2}{F_1^2 + F_2^2}. \tag{3'}$$

We see from (3') that the circular polarization characterized by ξ_2 arises only if both terms are present in (1), i. e., only when there is parity nonconservation; it may serve as the quantity characterizing the degree of the latter. The degree of linear polarization r is less than 1 when there is nonconservation.

Now τ decay gives rise to two identical Bose particles (two π^+ mesons) in the final state, so the matrix element takes the same form as for Θ decay, i. e., (1), except that $p = p_1 + p_2$ is the over-all 4-momentum of the two π^+ mesons. The formula for the polarization has the same form, only the meanings of the quantities appearing in (3') being altered, i. e., the form factors relate to τ decay.

Thus, the Stokes parameters ξ_i must be known in both cases in order to elucidate the degree of parity nonconservation; these can be measured [7].

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