just below T_λ would be expected because of the anomalous expansion which takes place on ordering. The fact that NH_4Br expands on cooling into the tetragonal ordered phase whereas NH_4Cl undergoes an anomalous contraction on transforming into its cubic ordered phase presumably explains the observation that $c_{1_{ong}}$ far below T_λ is *smaller* than c_{11} in the disordered phase for NH_4Br (see Fig. 4), while the opposite is true for NH_4Cl. [7]

Our attenuation data can be compared with the recently reported results of Velichkina and co-workers, [13] who measured the [100] longitudinal attenuation at 5, 15, and 25 MHz in the range $5 \geq T - T_\lambda \geq -6\,°K$. Their method involves measuring the *relative* change with temperature in the height of a single pulse transmitted through a thin crystal. This is advantageous when the attenuation is very high but not too accurate in regions of low to moderate attenuation. (Indeed, a systematic correction of $\sim 4.5\,dB\,cm^{-1}$ must be made to all their data owing to an unfortunate choice of the reference point from which changes in attenuation were measured.) The values of α_c/ω^2 estimated from their data are larger than those given in Table I by a roughly constant factor of about 1.5. The reason for such a multiplicative difference is unclear. It should be pointed out that their attenuation data in the multidomain ordered phase appear, rather surprisingly, to be more reliable than those in the disordered phase; α_c varies with frequency in a somewhat erratic way above T_λ but shows a good quadratic dependence below. Incidentally, the presence of multiple domains in a crystal cooled below T_λ in the absence of a thermal gradient was demonstrated by the depolarization of linearly polarized light. [13]

Velichkina *et al.* have interpreted their ordered-phase attenuation in terms of the Landau-Khalatnikov model involving a critical relaxation time $\tau = 2.2 \times 10^{-9}/(T_\lambda - T)$. This does not seem compatible with the quadratic frequency dependence of their data or with the fact that both their α_c/ω^2 values and the values in Table I vary like $(\Delta T)^{-0.75}$. If one ignores the multiplicative factor of ~ 1.5 between our results and theirs and considers only the ratio of α_c in the ordered phase to that in the disordered phase, the critical attenuation in the tetragonal ordered phase would not seem to depend on the domain structure. Yet our experience indicates that two crystals which show the same attenuation in the disordered phase can give quite different α_c values in the ordered phase, depending on the perfection of the crystal and the manner of cooling. Thus the interpretation of α_c in the ordered phase is puzzling.

Although the critical attenuation in the disordered phase can be approximately fit by a simple power law (see Fig. 1), the χ^2 value is rather large (5.9)

and the data show systematic deviations from Eq. (1). These deviations are seen to become even larger for the 25-MHz data of Velichkina *et al.* when $\Delta T < 1\,°K$. Thus it is of interest to analyze the data in terms of a relaxation model. Whether a single-relaxation model is adequate to describe the low-frequency dynamical behavior of the order-disorder transition in NH_4Br is unclear. According to theoretical predictions for magnetic [14] and fluid [15] systems, a spectrum of relaxation times would be expected. However, none of the current theories seem to be directly pertinent to the analysis of NH_4Br. Moreover, the extensive hypersonic attenuation and dispersion data at room temperature show that, at least for temperatures far from T_λ, NH_4Br is well described by a single-relaxation model. In any event, the assumption of such a model leads to an empirical analysis of the ultrasonic attenuation data in which attractively simple behavior of both the relaxation strength and the relaxation time is obtained.

Since the critical attenuation data exhibit an f^2 frequency dependence, we shall adopt the low-frequency form of the single-relaxation expression:

$$\alpha_c = C\omega^2 \tau_{S,x}, \tag{4}$$

where α_c is the amplitude attenuation (in $Np\,cm^{-1}$), $\tau_{S,x}$ is the adiabatic relaxation time at constant strain, and the appropriate relaxation strength C is defined by

$$C = \frac{u^2(\infty) - u^2(0)}{2u(\omega)u^2(0)} \approx \frac{c^\infty - c^0}{2u(0)c^0}. \tag{5}$$

The analysis is based on using hypersonic-velocity data to estimate the high-frequency limiting stiffness c^∞ and ultrasonic data for the low-frequency limiting values $u(0)$ and $c^0 = \rho u^2(0)$. The resulting value of C at a given temperature is then combined with the corresponding experimental value of α_c/ω^2 to yield $\tau_{S,x}$. One could, of course, also analyze the data in terms of the adiabatic relaxation time at constant stress $\tau_{S,X}$. However, these two times are simply related to each other by $\tau_{S,x}/\tau_{S,X} = c^\infty/c^0$, and the behavior of $\tau_{S,X}$ does not differ in any significant way from that of $\tau_{S,x}$.

The temperature variations of c_{11}^0 and c'^0 are well known from ultrasonic measurements at 20 MHz. [4] Values of c_{11}^∞ and c'^∞ are known at 24 °C from an analysis of Brillouin scattering data at angles corresponding to frequencies between 6.5 and 24 GHz. [5] In order to estimate c'^∞ values near the transition, we have *assumed* a linear temperature dependence with a slope equal to the value of $d(c'^0)/dT$ at room temperature (see Fig. 5). This is a plausible but essentially arbitrary assumption. Fortunately, c_{11}^∞ near the transition can be estimated with much greater certainty. The hypersonic velocity of the [110] longitudinal wave is known as