term, \( v \) is the sound velocity and \( L = \frac{2}{\pi^{1/2}}(l_1 l_2)^{1/2} \), where \( l_1 \) and \( l_2 \) are the cross-sectional measurements of the crystal. \( A_v \) represents scattering by point impurities or isotopes.\(^1\) Klemens (35) gives an expression for \( A \) in the case of isotope scattering. \( B \exp(\frac{-z^2}{\alpha T}) w^2 T^3 \) is the relaxation time for Umklapp processes taken from Herring (46).

Actually, Herring's expression gave \( \tau^{-1}(q) = q^s T^{5-s} \), where \( s \) is an exponent determined by crystal symmetry. Callaway chose \( s = 2 \) which is characteristic of longitudinal phonons in a cubic crystal. The "a" is a factor that represents dispersion, being higher for higher dispersive spectrums. \( \tau_n^{-1} = B_2 w^2 T^3 \) is the relaxation time for normal phonon-phonon processes, after Herring (46).

The second part of the expression, \( \chi_2 \), is defined by

\[
\chi_2 = \frac{k}{2\pi v} \left( \frac{kT}{\hbar} \right)^3 \left( \frac{I_2}{I_3} \right)^2
\]

where

\[
I_2 = \int_0^{\Theta/T} \frac{\tau c}{\tau_n} \frac{x^4 e^x dx}{(e^x-1)^2}
\]

and

\[
I_3 = \int_0^{\Theta/T} \frac{1}{\tau_n} \frac{\tau c}{\tau_n} \frac{x^4 e^x dx}{(e^x-1)^2}
\]

The \( \chi_2 \) term is a correction factor for normal phonon-phonon processes which is negligible at low temperatures and is usually neglected in calculations (41, 48).

Holland (41) has shown that the expression for \( \chi_2 \) gives incorrect results at high temperatures because it does not properly take into

\(^1\)The strong inverse frequency dependence of \( \tau_c \) indicates that relatively long wavelength phonons are the dominant determiners of the thermal resistivity. Consequently, the use of a Debye spectrum may be justified even in the range where it does not give the correct results for the specific heat.