If $F_a$ or $F_b$ could be found at the same abscissas as $F_a$ or $F_b$, if the corresponding pairs of values are multiplied by proper coefficients and then be added or subtracted, a series of values of $F_a$ and $F_b$ could be obtained which are now pure functions of $F_a$ and $F_b$ respectively. Then if $\ln(F_a / F_b)$ and $\ln(F_b / F_a)$ are plotted against $\sin^2\theta$, two straight lines could be obtained which should intercept at the same point on the ordinate axis, the slopes of which represent respectively $\theta_a$ and $\theta_b$.

In the Debye theory of specific heats, the Debye parameter $\Theta$ may be expressed as $\Theta = \left(\frac{3h^3}{4\pi^2k}\right)^{1/3}$, where $h$ and $k$ represent Planck constant and Boltzmann constant respectively, $N$ is the mass of the atom, and $T$ is the absolute temperature at the time of taking Debye-Scherrer photographs. $\Theta$ is the Debye characteristic temperature, $\gamma = \Theta/\gamma$, and $\gamma$ is a function of $x$, given in original Debye theory. If $\Theta$ is set to $\Theta = \Theta^0$, then $\gamma = \gamma^0$. Solution of this equation may be performed graphically. Thus by making $x = \Theta^0 x$ and $x = \Theta^0/4$, the plotting of these two equations should give two curves, the intersection of which yields the value of $x$ determining the characteristic temperature at that temperature.

By means of these methods, the characteristic temperature of Al, Au, and Pb have been determined to be 376K, 205K, and 90K respectively. In the case of Zn, the characteristic temperature parallel to the principal axis is 212K, which is perpendicular to it is 328K, the difference being 116K. For CaF₂ crystals, the characteristic temperature of Ca²⁺ in 400K, while that of F⁻ is 476K, the difference being 76K.

11.4-02  DEBYE-WALLER FACTORS OF ZINC BLEND STRUCTURE COMPOUNDS. By John S. Reid, Department of Natural Philosophy, University of Aberdeen, Aberdeen, Scotland.

Tables are presented of the Debye-Waller factors for a substantial number of zinc blend structure materials over the temperature range 1K to 1000K (where appropriate). The factors are calculated using eigendata from up to $3 \times 10^3$ phonon modes obtained from the established lattice dynamical models including the shell model, the valence shell model, and the deformation dipole model. Taking good account of the zero phonon contribution the sampling error is reduced to negligible proportions. These figures provide the best harmonic Debye-Waller factors against which experimental results may be assessed for consistency, quasi-harmonic and other anharmonic contributions, and possible dynamic deformation effects. For most of the materials a comparison is made of the Debye-Waller factors from more than one lattice dynamical model in order to ascertail the existence of weak modes that are not A.E. amplified, namely: $[110]$ L and $[110]$ ST. These are due partly to mode conversion at the walls of the crystal, but also, to an appreciable extent, to a mechanism of mode conversion inherently present in the travelling acoustic domain, the nature of which is at present unknown. This mechanism is is such that the $[110]$ L and $[110]$ ST phonons are continuously produced as by-products of the intense $[110]$ TT flux, probably via anharmonic interactions. Since these phonons are not able to survive and to undergo A.E. amplification, they appear to propagate with the speed of the $[110]$ TT phonons.

11.4-03  LOWEST ORDER ANHARMONIC THERMAL SCATTERING OF X-RAYS BY SILICON-LIKE CRYSTALS. By J. P. Pirie, Department of Natural Philosophy, University of Aberdeen, Aberdeen AB9 2UB, Scotland.

The lowest order anharmonic contribution to thermally scattered X-rays has been calculated for diamond, silicon, germanium and $\alpha$-tin. This term can be regarded as an interference between the harmonic one phonon and two phonon scattering processes. The calculations were based on an anharmonic interaction restricted to nearest neighbours and used lattice eigenfrequency-eigenvector data obtained from published parameters for lattice dynamics models. Most of these models had been fitted to measured phonon frequencies.

Results will be presented for the main symmetry directions and other representative points in reciprocal space. This anharmonic contribution to the thermal scattering may be positive or negative and its magnitude will be compared with the harmonic thermal scattering and Compton scattering over a range of temperatures.