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tions in beryllium have been made using the MTR neutron-velocity selector. In the latter direction, only one of the transverse modes was investigated, that having atom displacement normal to the basal plane. Pertinent frequencies which were observed, in units of 10^{13} sec^{-1} are: (at the center of the zone) upper optical 1.9_9; lower optical, 1.3_3; (at the zone boundary in the [0001] direction) TA, 0.9_6; LA, 1.5_5; lower optical, 1.0_7; upper optical 1.6_3; (at the zone boundary in the [01$\bar{1}$0] direction) TA, 1.2_1; LA, 1.5_5; lower optical, 1.6_3; upper optical 1.6_9. The initial slopes of the acoustical branches agree well with the elastic-constant data, except for the longitudinal branch in the [0001] direction where the neutron data suggest a slightly higher wave velocity. Agreement of the lattice-dynamics theory with the experimental data is poor. The intercept at the center of the zone of the upper optical branch is predicted to occur approximately 50% above the observed value. Extension of the theory, which assumes that the atoms interact with central forces, to include interactions with 4th and 5th nearest neighbors yields better but still limited agreement with the data.

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YA7. Crystal Dynamics of Alkali Halides. R. A. COWLEY,* A. D. B. WOODS, AND B. N. BROCKHOUSE, *Chalk River Laboratories,* AND W. COCHRAN, *Cavendish Laboratory, Cambridge, England.*—The dispersion relations of the lattice vibrations in symmetry directions in NaI and KBr were calculated using shell models[1] which permit general forces between first neighbors and between second-neighbor negative ions, variable ionic charges, and polarizable ions. The models were fitted on the Cambridge University computer Edsac II, to the published experimental results,[1,2] and to new measurements of the longitudinal optical (LO) modes in NaI. These new frequencies (10^{12} c/s) are: [0,0,0] 5.2 ± 0.2, [0.4,0,0] 4.76 ± 0.1, [0.45,0.45,0] 4.80 ± 0.1, [0.25,0.25,0.25] 5.08 ± 0.1, [0.5,0.5,0.5] 5.17 ± 0.1. Apart from systematic discrepancies, particularly near [0.5,0.5,0.5] LO, the simple models gave quite reasonable agreement with the measurements. The more-complicated models gave excellent fits. However, the parameters for these models are not easily interpreted in terms of physical shells; the ionic charges are less than one, and the polarizability is more-equally shared between the two ions than expected.

* On leave from Cavendish Laboratory, Cambridge, England.
[1] A. D. B. Woods, W. Cochran, B. N. Brockhouse, Phys. Rev. **119**, 980 (1960).
[2] A. D. B. Woods, B. N. Brockhouse, W. Cochran, M. Sakamoto, R. N. Sinclair, Bull. Am. Phys. Soc. **5**, 462 (1960).

YA8. Elastic Constants and Stability of Rubidium Iodide. W. B. DANIELS, *Princeton University.*—The pressure dependence of the elastic constants of single crystals of RbI has been measured over the range from 1 atm to the pressure at which they transform from the NaCl structure to the CsCl structure, i.e., to about 4Kb. It may be seen that this transformation may be accomplished by compression along a trigonal axis of the NaCl structure plus a uniform dilation in directions perpendicular to that axis. Since this is equivalent to a set of finite C_{44}-type shear strains plus a uniform contraction, one might expect that the transformation takes place by a loss of stability of the NaCl structure with respect to such shear, i.e., that C_{44} would approach zero at the transformation pressure. Experimentally, however, only a 10% decrease in C_{44} is observed up to the transformation pressure. The possibility is discussed that instability of the low-pressure phase

occurs because of vanishing of a C_{44}-type lattice-vibrational mode having a propagation vector near the first BZ boundary.

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YA9. Optical Observations of the High-Pressure Transformation of RbI. A. SKOULTCHI AND W. B. DANIELS, *Princeton University.*—The process of transformation of RbI from the NaCl to the CsCl structure, which takes place near 4Kb, has been observed using a metallographic microscope. The results exhibit great sensitivity to the condition of the surfaces of the crystal. In crystal samples freshly cleaved from a large, single-crystal block, the transformation is observed to begin in small regions, growing and gradually engulfing the entire sample. On the other hand, crystals which have been stored under oil at room temperature for a long time exhibit a behavior qualitatively similar to that observed by other investigations; i.e., they appear unchanged up to pressures well above those at which the freshly cleaved crystals transform and then very suddenly they become opaque. The transformation process is discussed in the light of recent measurements of the elastic constants up to the transformation pressure.

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YA10. Overlap Repulsion in Sodium-Halide Crystals from Isothermal-Compression Data.* MARIO TOSI, *Argonne National Laboratory.*—The slope and the curvature of the overlap, repulsive energy, entering the Born model expression of the cohesive energy of the alkali halides, are evaluated as functions of the interionic distance in NaCl, NaBr, and NaI from the experimental pressure-volume relationship at room temperature, using the vibrational Mie-Grüneisen equation of state and its volume derivative at constant temperature. Over the compression range covered (up to linear compressions of almost 10%), deviations from a single-exponential, or an inverse-power, dependence of the overlap energy on the interionic distance become apparent. The overlap energy itself, as determined directly as a function of the interionic distance from the experimental data, can be fitted by an expression consisting of two exponential functions, pertaining to a first-neighbor and a second-neighbor contribution. The intervening parameters are very nearly the same as those determined by a careful Huggins-Mayer-type fit of the cohesive properties of the alkali halides at atmospheric pressure.

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YA11. Electronic Effect on the Debye Temperature of Germanium. ROBERT W. KEYES, *IBM Research Center, Yorktown Heights.*—This work correlates two recently discovered effects in degenerate, n-type germanium, namely, addition of donors decreases the calorimetric Debye temperature (θ_D)[1] and decreases the elastic constant C_{44}.[2] The theory of the electronic effect on C_{44}[2] and the theoretical relation between θ_D and the elastic constants[3] predicts a decrease of $2.4\times10^{-6}N_D^{\frac{1}{3}}$ degrees in θ_D. This value is in agreement with the results of Bryant and Keesom[1] within their stated experimental uncertainty. The interpretation of the change in θ_D as an electronic effect on the elastic constants implies that the elastic constant is affected at frequencies up to 4×10^{11} sec^{-1}, since phonons up to this frequency are important in the specific-heat measurement.

[1] C. Bryant and P. H. Keesom, Phys. Rev. **124**, 698 (1961).
[2] L. Bruner and R. W. Keyes, Phys. Rev. Letters **7**, 55 (1961).
[3] See, for example, J. de Launay, *Solid State Physics* **2**, 219 (1956).