could enter into chemical combinations in the same way as other matter. Hales himself never envisaged that there might be more than one "air" involved, and hence in his experiments he was content merely to measure the volume of air absorbed or released, without testing for differences in chemical behavior; indeed, had he noticed any such differences he would have attributed them not to real differences between the "airs" involved but to different impurities floating in a single undifferentiated elastic medium. Even so, his work had a profound influence on the succeeding generation of chemists. It led directly to a more detailed study of the chemistry of gases and thence to the crucial advances in chemical understanding that we normally associate with the name of Lavoisier.

In his own day, Hales was at least as well known for his philanthropic endeavors as for his science. He was an influential opponent of the notorious gin trade and played a significant part in having it brought under legislative control. He was an active member of the Society for Promoting Christian Knowledge and one of the trustees of the charitable trust that established the colony of Georgia in North America as a refuge for England's poor. He also sought to apply his scientific knowledge to alleviate suffering. He devised an effective ventilator for ships and an improved method for distilling seawater. In addition, his chemical investigations led him to a long but ultimately unsuccessful search for a satisfactory solvent for those painful sources of human affliction, kidney and bladder stones. Late in life, he played a leading role in the establishment of an important new London institution, the Society for the Encouragement of Arts, Manufactures and Commerce.

These various facets of Hales's career are described in detail in this new biography, in which Schofield provides the chapters on Hales's science and its influence and his inventions and Allan those of a more orthodox biographical kind. In addition to its 140 pages of text, the book includes a full calendar of Hales's correspondence and writings and a complete bibliography of his published works. It is the more welcome because the only other book-length biography, by A. E. Clark-Kennedy, though reprinted some years ago, is still not widely accessible. Furthermore, Schofield in particular has profited from the progress that has been made since Clark-Kennedy's day in our understanding of the way science evolved during the 18th century. His closing chapter on Hales's scientific reputation and influence is the most important in the book and represents a substantial advance on Clark-Kennedy's work. Disappointingly, however, even here the book develops few new or more general perspectives on Hales's work or career, apart from something of an attempt by Schofield to fit Hales into the general mechanism-versus-materialism classificatory scheme for 18th-century British science that he has proposed elsewhere.

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Solid State Physics

The Lattice Dynamics and Statics of Alkali Halide Crystals. JOHN R. HARDY and ARNOLD M. KARO. Plenum, New York, 1979. x, 314 pp., illus. $32.50.

In 1959 John Hardy wrote the first paper on the "deformation-dipole" model at approximately the same time that William Cochran published his investigation of phonons in a crystal (germanium) using the "shell" model of Dick and Overhauser (1958). The models are similar, since both consider the effect of displacement-induced dipolar forces resulting from the deformation of the electronic charge density in a lattice wave. This was the most important step in bringing the theory of lattice dynamics into quantitative contact with experimental data, in particular with neutron inelastic scattering results obtained by Brockhouse and other groups after 1958. In the subsequent two decades there was a fruitful period during which the essential features of lattice forces and related properties in many crystals were clarified. An important part of this clarification may be attributed to the use of what are nowadays called "dipolar models."

In the present book Hardy and Karo offer a comprehensive study of the static and dynamic properties of alkali halides. Discussion of the deformation-dipole model may be regarded as the "hard core" of the book, although many other features are discussed. After an introduction and a review of dipolar models, there is a detailed and useful presentation of dipolar coupling coefficients, Debye-Waller factors, and specific-heat data. After that, the experimental phonon dispersion curves of alkali halides are compared, in detail, with the rigid-ion model, the polarization model, and two versions of the deformation-dipole model. The treatment up to this point contains many impressive examples of agreement between experimental data and the deformation-dipole model, and the presentation of different deformation-dipole models is often very detailed. On the other hand, other interesting and successful approaches are not treated.

The last third of the book contains an interpretation of two-phonon infrared and Raman spectra of alkali halides as well as a short account of impurity dynamics and statics in alkali halides. Many useful references to the relevant literature and to the explicit use of dipolar models in actual calculations are given. The comparison of the models with experimental data and the consideration of the results of other groups are less satisfactory. There is no discussion of the microscopic theory or of models that try to establish explicit connections between the electronic band structure and properties of phonons. The authors state that both of these topics are beyond the scope of the book.

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Achievements in Astronomy

Oort and the Universe. A Sketch of Oort's Research and Person. Liber Amicorum Presented to Jan Hendrik Oort on the Occasion of His 80th Birthday, 28 April 1980. HUGO VAN WOERDEN, WILLEM N. BROUW, and HENK C. VAN DE HULST, Eds. Reidel, Boston, 1980 (distributor, Kluwer Boston, Hingham, Mass.). viii, 210 pp., illus. Cloth, $29; paper, $12.95.

Jan Hendrik Oort is, by common consent, the most influential astronomer of the present century. Born on 28 April 1900, Oort has made sustained and fundamental contributions to astronomy for some 60 years, and his major accomplishments during the past six decades are landmarks in the continuing development of astronomy. They include his discovery of galactic rotation in 1927, followed by his discussion of the galactic dynamics in the vicinity of the sun, his determination of the force field perpendicular to the galactic plane in 1932, his role in van de Hulst's prediction of the 21-centimeter line of hydrogen, his discussions relating to the formation and growth of interstellar grains during World War II, his first delineation of the spiral arms in the Milky Way system