SCIENCE NOTES AND NEWS

Award of Research Degrees

Andhra University has awarded the Ph.D. degree in Nuclear Physics to Shri K. M. M. S. Ayyangar for his thesis entitled "Studies on the Lifetimes of Excited States of Atomic Nuclei", Ph.D. degree in Chemistry to Shri A. Prabhakara Rao for his thesis entitled "Studies on the Use of Papers and Columns Treated with Ion Exchangers for Analytical Separation"; Ph.D. degree in Zoology to Shri G. Chandrasekara Rao for his thesis entitled "Studies on Marine Interstitial Fauna Inhabiting the Sandy Beaches of Waltair Coast".

Sri Venkateswara University has awarded the Ph.D. degree in Chemistry to Shri D. Adinarayana Chetty for his thesis entitled "A Structural Study of the Chemical Components of a few Indian Plants"; Ph.D. degree in Botany to Messrs. M. Vittal Rao and P. Gopala Rao for their theses entitled "Studies on the Root-infecting fungi with Special Reference to Microbial Antagonisms" and "Physiological Studies on the Influence of NAA and MH on the Acid Metabolism and Related Phenomena in Groundnut Seeds during Germination and Seedling growth in Dark" respectively.

Orbitron Vacuum Pump

The orbitron is a device in which electrons are orbited in a cylindrically symmetric electrostatic field between an outer cylinder which may be grounded and an axial rod or wire which is held at a positive potential. The principle of the orbitron was discovered during attempts to develop an efficient ion gauge. Soon after the successful application of the orbitron as an ion gauge it was tried as a getter ion pump, where it was immediately successful. In these early pumps the orbitron device served only to ionize the gas, and evaporation or sublimation was obtained either from a primer type assembly or with direct bombardment of a titanium rod by electrons from an auxiliary filament.

Scientists of the University of Wisconsin report the construction of an orbitron vacuum pump in a casing 10 cm. in diam. in which electrons are orbited around a central anode consisting of a tungsten rod supporting a titanium cylinder. Electrons have mean free paths of several hundred cm., they ionise inert gas and they heat the titanium cylinder to give sublimation. The pump was found dependable and stable in operation, and in one test went up to a pressure of 7×10^{-10} Torr.—(*Rev. Sci. Insts.*, 1965, *36*, 1.)

Angular Dependence of the Raman Scattering

The angular dependence of Raman scattering has never been successfully studied up to now due to the difficulty in obtaining well-collimated exciting beams maintaining both a well-defined frequency and a strong enough intensity. The discovery of the laser has provided the above requirements for a source, and accurate studies can now be undertaken on the angular dependence of Raman scattering. The importance of such studies lies in the fact that they would provide information for identification of point-group symmetries of molecular transitions.

In a communication to *Physical Review Letters* (January 4, 1965) Leite, Porto and Damen of the Bell Telephone Laboratories, New Jersey, report preliminary results on the angular dependence of some Raman emission lines from benzene, using the He-Ne gas laser, and photoelectrically recording the scattering.

The angular distribution intensity of the 992 cm.$^{-1}$ vibrational frequency of benzene which has A_{1g} symmetry follows a $\cos^2\theta$ law as was theoretically predicted for isotropic Raman scattered radiation.

The angular dependence of the 1585-1606 cm.$^{-1}$ doublet, both e_{2g} symmetry, follows a quadrupole type of scattering and the angular intensity distribution is in good agreement with Placzec's theoretical expression $1 + (\cos^2\theta)/13$.

A more involved case is furnished by the 3049–62 cm.$^{-1}$ doublet whose frequencies have different vibrational symmetries (e_{2g} and a_{1g} respectively). This is a combination of a quadrupole with an isotropic type of scattering, and the observed angular intensity distribution is found to be consistent with the above description.—(*Physical Review Letters*, 1965, 14, 9.)

Boron Requirement of a Marine Diatom

Boron has been known to be an essential micronutrient for growths of higher plants and is now thought to play a role in the formation of the cell-wall. In this connection a study of the boron requirement of a marine diatom has special interest since the diatom cell-wall is chemically and structurally unique by reason

of the absence of cellulose and the presence of silica.

J. C. Lewin of the Scripps Institution of Oceanography, California, reports an experiment on the study of the boron requirement of *Cylindrotheca fusiformis*, a marine pennate diatom. Since sea-water already contains 4·5 mg./l. of boron, the experiment with the marine organism can be demonstrated only in an artificially constituted medium in which the boron concentration can be limited. A synthetic saline medium simulating in all essentials (except for boron) the sea-water, where diatoms grow, has been devised to test the growth of C. *fusiformis*. Boron was supplied as H_3BO_3 at 0·5 mg./l. All growth experiments were carried out in plastic bottles containing 50 ml. of culture medium. It was found that when boron was omitted from the nutrient medium C. *fusiformis* did not grow.—(*Naturwissenschaften*, 1965, 52, 70.)

The Raman Effect in Crystals

The latest issue (1964, 13, No. 52) of *Advances in Physics*, the Quarterly Supplement of the Philosophical Magazine, contains a review article by R. Loudon which gives the progress in the theoretical and experimental study of the Raman Effect in crystals during the past ten years. The article draws attention to the theory of those properties of long-wavelength lattice vibrations in both cubic and uniaxial crystals which can be studied by Raman scattering. In particular the phenomena observed in the Raman scattering from crystals which lack a centre of inversion are related to the theory. The article also discusses how the angular variations of the scattering by any type of lattice vibration in a crystal having any symmetry can be easily calculated by using a complete tabulation of the Raman tensor. Recent measurements of first-order lattice vibration spectra are listed. There is also a discussion of Brillouin scattering.

The relation of second-order Raman spectra to critical points in the lattice vibration density of states is discussed, and measurements of the second-order spectra of diamond and alkali halides are reviewed.

The theory and experimental results for Raman scattering by electronic levels of ions in crystals are examined, and proposals for Raman scattering by spin waves, electronic excitations across the superconductive gap and by plasmons are collected together.

Finally, the prospects for applying lasers as sources for Raman spectroscopy are discussed, and progress in the new technique of stimulated Raman scattering is reviewed.

Aggregation of Ice Crystals in Strong Electric Fields

Experiments have demonstrated that the adhesion of ice crystals on collision is a sensitive function of temperature, humidity and crystal type. However, the effect of electric fields on the adhesion of ice crystals has not been so far examined. It appears possible that the attractive forces between ice cystals, produced by polarization charging within the field and accentuated because of the small radius of curvature of the crystal edges, may produce increased aggregation.

J. Latham and C. P. R. Saunders describe experiments to test this hypothesis. Ice crystals were formed at a predetermined temperature inside a cold chamber by producing a water cloud and seeding it with pellets of solid carbon-dioxide. While the crystals were growing inside the chamber, two small water drops of known identical diameter were suspended from tips of fine glass fibres located centrally within two identical ebonite tubes, and were then frozen. Windows in the walls of the ebonite tubes permitted visual observations or photography of the spheres. Arrangements were also made to expose one of the ice spheres to an electric field up to about 4000 V/cm.

Results showed that for field strengths below about 800 V/cm. there was no detectable difference between the masses collected by the two spheres, but for higher fields the mass collected by the sphere exposed to the electric field was considerably greater than that collected by the sphere in the field-free tube.

These experiments demonstrate that ice crystal aggregation is appreciably influenced by the presence of strong electric fields. The results are of meteorological importance on the formation of snow flakes inside thunderclouds where the crystal concentrations are high and fields of several thousand V/cm. have been measured. —(*Nature*, 1964, 204, 1293.)

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