

Books Received

- The Sources of Science—Experiments and Consideration Touching Colours.* By Robert Boyle (Johnson Reprint Corporation, 111, Fifth Avenue, New York), Pp. xxvi + 423.
- Indian Woods (Vol. II)—Their Identification, Properties and Uses—Linaceæ to Moringaceæ.* (The Manager of Publications, Delhi), 1963. Pp. x + 386. Price Rs. 32.50.
- Mossbauer Effect—Principles and Applications.* By G. K. Wertheim. (Academic Press, New York), 1964. Pp. viii + 116. Price \$ 2.45.
- Potential Barriers in Semiconductors.* By B. R. Gossick. (Academic Press, New York), 1964. Pp. x + 153. Price \$ 2.45.
- Elementary Dynamics of Particles.* By H. W. Harkness. (Academic Press, New York), 1964. Pp. ix + 219. Price \$ 2.95.
- Elementary Plane Rigid Dynamics.* By H. W. Harkness. (Academic Press, New York), 1964. Pp. ix + 191. Price \$ 2.95.
- The Chemical Society—Annual Reports on the Progress of Chemistry for 1963, Vol. LX.* (The Chemical Society, Burlington House, London W. 1), 1964. Pp. vi + 681. Price \$ 2.00.

- Crystals—Their Role in Nature and in Science.* By C. Bunn. (Academic Press, New York), 1964. Pp. viii + 286. Price \$ 3.45.
- Counterexamples in Analysis.* By B. R. Gelbaum and John M. H. Olmsted. (Holden-Day, Inc., San Francisco), 1964. Pp. xxiv + 194. Price \$ 7.95.
- Ways of Thoughts of Great Mathematicians.* By Meschkowski. (Holden-Day, Inc., San Francisco), 1964. Pp. viii + 110. Price: Cloth \$ 5.95; Paper \$ 3.95.
- Documents on Modern Physics—Theory of Crystal Dislocations.* By A. H. Cottrell. (Gordon and Breach, 150, Fifth Avenue, New York-11), 1964. Pp. ix + 91. Price: Cloth \$ 4.50; Paper \$ 2.50.
- Soils of India.* By S. P. Raychaudhuri, R. R. Agarwal, N. R. Datta Biswas, S. P. Gupta and P. K. Thomas. (Indian Council of Agricultural Research, Krishi Bhawan, New Delhi), 1963. Pp. vi + 496.
- Pure and Applied Mathematics (Vol. XV)—Geometry of Manifolds.* Edited by P. A. Smith and S. Eilenberg, 1964. Pp. ix + 273. Price \$ 10.50.

SCIENCE NOTES AND NEWS

Award of Research Degrees

Andhra University has awarded the Ph.D. Degree in Nuclear Physics to Shri K. Pardhasaradhy for his thesis entitled "Studies on the Absolute Photoelectric Cross-Sections of Gamma Rays"; D.Sc. Degree in Nuclear Physics to Shri K. Venkata Reddy for his thesis entitled "Level Scheme and Angular Correlations of Certain Even-Even Radioactive Nuclei".

Allahabad University has awarded the D.Sc. Degree in Chemistry to Dr. Surendra Nath Sinha for his thesis entitled "Studies on Metal Chelates of Some Lanthanons in Aqueous Solution".

Indian Phytopathological Society

The 15th and 16th Annual Meetings of the Society were held on December 29 and 30, 1964 at the University College of Science and Technology, Calcutta. Prof. T. S. Sadasivan (President for 1963) and Dr. S. Sinha (President for 1964) delivered their Presidential Addresses. A symposium on "Host Parasite Relationships in Plant Diseases" and a Session for reading of scientific papers were held. Shri M. J. Nara-

simhan delivered the Second Mundkur Memorial lecture on December 29 and Academician Professor N. A. Krasilnikov addressed the Society and gave a lecture on "Soil Micro-organisms in relation to Phytopathogens" on December 30.

Gas-Liquid Chromatography to Assess Milk Quality

Experiments at the National Institute for Research in Dairying at Shinfield, Reading, Berkshire, have demonstrated that gas-liquid chromatography can be successfully used in assessing milk quality. Since this technique is easily automated it may be possible to adapt it as the basis for an automatic test at milk factories.

As is well known in gas-liquid chromatography a very small sample of the mixture is carried by an inert gas through a narrow column where it contacts a liquid phase that delays the passage of individual components for slightly different periods, thus separating them. They escape in turn via a detector that records the emergence of the components as a series of

peaks on the chromatogram—each peak being characteristic for any one component.

When milk turns sour due to bacterial action, the main product is non-volatile lactic acid, but traces of volatile chemicals are also formed. Small amounts of these are normal constituents of fresh milk—souring merely alters their amounts and relative proportions. The pattern of peaks on a chromatogram of fresh milk therefore differs from the pattern produced by milk that is turning sour and the differences indicate how far deterioration in quality has progressed. Thus the chemical changes associated with souring are readily detectable by gas-liquid chromatography.

A stream of nitrogen gas, passed upwards via a hypodermic needle into a vertical glass tube containing a 0.2 millimetre sample, causes the milk to bubble up and form a film on the inside of the tube. The volatiles, entrained by the nitrogen stream as it sweeps past this comparatively large area of milk, are then trapped in a cooled metal coil. When this coil is warmed electrically, the volatiles pass on into the chromatograph where analysis is effected in about 20 seconds.—(Brit. Inf. Serv.)

Dislocations in Polymer Crystals

The recent discoveries that high polymers are capable of forming chain-folded lamellar single crystals when deposited from dilute solution, and that lamellar crystals of a similar nature are present in many bulk polymers, have aroused interest in the growth and properties of chain-folded molecular crystals. These crystals have been most widely studied in polyethylene, but attention has been confirmed, for the most part, to what may be considered properties of the *ideal* crystal. Properties sensitive to defect structures within *real* crystals have received no thorough investigation. It is known that giant screw dislocations are commonly present during growth and often give rise to growth spirals or terraced growth pyramids, and that Moire patterns occasionally reveal features probably indicative of the presence of edge dislocations.

In a contribution to the *Journal of Research* (A), National Bureau of Standards, H. D. Keith of Bell Telephone Laboratories, and E. Passaglia examine the role that dislocations are likely to play in chain-folded polymer crystals, particularly with regard to their influence on plastic deformation. It is assumed that primary bonds cannot be broken in backbone molecular chains; and this restriction, together with further

restrictions brought about by chain-folding, limits substantially the number of permissible dislocations and glide processes. It is shown that dislocations are unlikely to play a major part in bringing about deformations of appreciable magnitude in chain-folded polymer crystals.—[*Jour. Res. (A)*, Nat. Bureau Std., 1964, 68, 513.]

A New Hypothesis for the Red-Shift in the Spectra of Distant Stars

It is known that the lines in the spectra of distant stars show a red-shift which is proportional to the distance of the star from the observer. This is usually interpreted as a Doppler effect due to an assumed "expansion of the universe". Attempts have been made to explain the observed red-shift by the assumption that a photon travelling through space continually loses energy at a constant rate. Controversial opinions have been expressed as to how such a loss of energy could take place.

In a communication to *Physics Letters* (1 December 1964), R. Fürth proposes a mechanism for the loss of energy of the photons which assumes only gravitational effects on photons and leads to a numerical value for the expected red-shift of the right order of magnitude.

According to classical electrodynamics an electron, forced to move along a circular path, emits electromagnetic radiation and therefore continually loses energy or, in modern parlance, emits a very large number of low energy photons at a constant rate. Similarly one might imagine that a photon, forced to move along a curved path in a gravitational field, steadily loses energy by sending out "gravitational waves" (or emitting "gravitons").

Applying the quantum-mechanical treatment combined with the laws of electrodynamics applicable to electron, to the present case of a centripetally moving photon in a gravitational field, Fürth shows that the time dependence of the energy E of the system can be written as $E = E_0 \exp(-\epsilon l/R)$, where E_0 is the original energy of the photon on its emission from the source and l is the distance travelled by it, and ϵ a numerical constant of the order of unity. The red-shift for sufficiently small $\epsilon l/R$ will thus be $\Delta\lambda/\lambda \sim \epsilon l/R$. If it is assumed that the universe is a "closed sphere" of average curvature $1/R$, the photons travelling in such a universe will follow curved paths of this curvature, and R would then be the "gravitational radius" of the universe.—(*Physics Letters*, Amsterdam, 1964, 13, 221.)

A Capture Theory of the Origin of the Solar System

At present there is no completely acceptable theory of the origin of the Solar System. Current views on the problem are contained in the Proceedings of a Conference on the subject held in 1962 (see *Curr. Sci.*, July 20, 1964, p. 444). Two theories, however, hold the field as bases for any development in the subject. The nebular theory postulates that planets were formed during the process of condensation of the Sun. The tidal theory postulates a 'near collision' of the Sun with a second passing star, which resulted in drawing out a filament of gas from the Sun, from which condensation into planetary bodies subsequently occurred. It will be noted that in both the theories the material of the planets was at one time part of the Sun itself.

In a recent communication to the *Proceedings of the Royal Society* (A, 1964, 282, 485), M. M. Woolfson describes a new theory of the origin of the Solar system. It is essentially a tidal theory but one which involves a process hitherto not considered, namely, that the star which passed near the Sun was lighter and less dense than the Sun and itself provided the planetary material. Woolfson examines by a series of computations the conditions for such a mechanism and indicates the possibility that two stars may interact under gravitational forces alone in such a way that material from one may be captured by the other.

The 'capture' theory so far developed in the paper explains a number of the more important and grosser features of the Solar System. It is shown that planetary condensations could be formed and that these would take up orbits with radii having the required range of values. The distribution of angular momentum is reasonably well accounted for. It is to be noted that the angular momentum of the planets is derived directly from that of the star around the Sun, while the Sun would have scarcely been affected by the encounter. The 'capture' theory also postulates a cold origin of the material of the planet.—(*Proc. Roy. Soc.*, A, 1964, 282, 485.)

Melinex Polarizer for the Near Infra-Red

A widely used transmission polarizer in the near infra-red region is the 'pile of plates' type employing thin polythene film. The ready availability of large sheets of thin film makes it easy to construct such polarizers, including

large area ones, in contrast to the traditional selenium or silver-chloride types. However, polythene suffers from the disadvantage that its transmission steadily decreases with wavelength below 5μ (due to bulk absorption and scattering) and it possesses a very intense absorption band in the region $3.3-3.6\mu$.

It has been found that polarizers made of stack of thin Melinex (polyethylene terephthalate) possess advantages over the polythene polarizers for the near infrared. By comparison Melinex has a greater number of absorption bands, but only two of these are strong (3.35μ and 5.15μ), and neither is as intense as the 3.45μ of polythene. At all wavelengths from $1-5\mu$ the transmissions of Melinex is better than that of polythene.

At present Melinex may be obtained more readily than polythene in extremely thin sheets which are desirable to minimize the absorption and the lateral displacement of the radiation, thus obviating the necessity for a compensated arrangement. However, Melinex has sufficiently good transmission and surface finish for interference effects in the films to be of importance. This may be valuable in certain applications requiring exceptionally high polarisations—in other cases it may be a disadvantage.—(*Jour. Sci. Inst.*, 1964, 41, 687.)

Scintillations of Stellar Radio Sources

The quasi-stellar radio sources, sometimes called quasars, have been observed to fluctuate randomly in intensity by as much as 60% in a period of one or two seconds. This rapid fluctuation is superposed on a more gradual fluctuation that extends over a period of weeks or months.

While there is as yet no proper explanation for the slower fluctuation, Hewish, Scott and Wills of the Cambridge University Radio-astronomy Division, suggest that the rapid fluctuations are evidently caused by the solar wind, the tenuous stream of charged particles emitted outward by the sun. The solar wind creates disturbances in interplanetary space resembling that created in the earth's atmosphere by ordinary winds and convection currents. Thus the quasars, which have very small apparent diameters seem to twinkle like stars. Radio sources of extended diameter such as radio-galaxies are immune to interplanetary scintillation even as the larger planets resist atmospheric scintillation—(*Sci. Amer.*, November 1964.)