SCIENCE NOTES AND NEWS

Award of Research Degrees

Andhra University has awarded the Ph.D. degree in Nuclear Physics to Sri. A. Ramalinga Reddy for his thesis entitled "Studies on Incoherent Scattering of Gamma Rays by K-Shell Electrons"; Ph.D. degree in Chemistry to Sri. D. Satyasundar for his thesis entitled "Studies on the Solvent Extraction of the Blue Perchromic Acid"; Ph.D. degree in Pharmacy to Sri. R. V. Krishna Rao for his thesis entitled "Chemical Investigation of Some Medicinal Plants and Other Poisonous Plants of India"; Ph.D. degree in Zoology to Sri. T. Desiraju for his thesis entitled "Experimental Studies on a Sympathetic Ganglion and on Brain".

Osmania University has awarded the Ph.D. degree in Zoology to Sri. P. Sudershan for his thesis entitled "Studies on Joint Action of Insecticides and Synergists on Cockroach Heart".

Sri Venkateswara University has awarded the Ph.D. degree in Zoology to Sri. R. P. Sreenivasa Reddy for his thesis entitled "Biology of the Scorpions with Special Reference to the Pectines".

Indian Council of Medical Research—Supernumerary Research Cadre

The Indian Council of Medical Research has decided to constitute a Supernumerary Research Cadre to provide for research workers—both medical as well as non-medical—who return to India after completing their training abroad and to enable them to pursue research in the speciality in which they had received training. Selection to the Cadre will be made by a Committee appointed by the Governing Body, I.C.M.R. This Committee will also recommend suitable emoluments commensurate with the candidate's qualifications and research experience. Persons selected for the Cadre will be entitled to emoluments ranging from Rs. 500 to Rs. 1,000 p.m. Contingent grant of Rs. 3,000 per annum and some equipment will be provided to each research worker.

Further enquiries and applications may be sent to The Director, Indian Council of Medical Research, Ansari Nagar, New Delhi.

Grouping of "Elementary" Particles—SU(6) Symmetry

An important starting-point in the investigation of a physical system is the determination of the symmetries it possesses. Once these are known, many of the system's properties can be established by quite general means. The mathematical description of a symmetry is in terms of a corresponding set of operations that leaves the system unchanged. By this we mean the result of these operations still gives the same system although perhaps in a different state.

With the multiplicity of "elementary" particles whose existence has been experimentally established, the idea is gaining ground that they can be grouped into a few large families or "supermultiplets" within each of which the particles can be regarded as mathematical equivalents of one another. Present schemes for grouping of elementary particles and their reactions are based on the unitary symmetry theory called SU(3). Within the past few months a still more comprehensive ordering scheme called SU(6) has won broad support among theoretical nuclear physicists.

The SU(3) theory showed how particles that vary in certain basic properties (isotopic spin and hypercharge) can be regarded as members of a supermultiplet, provided they are alike in other basic properties (ordinary spin and parity). The most familiar particles that can be grouped in this way are the nuclear doublet (the neutron and proton), three sigma particles, two xi particles and a lambda particle. These constitute an octet supermultiplet with 8 members. A decuplet supermultiplet with 10 members which also fulfilled SU(3) requirements was lacking its tenth member at the time it was proposed. When this missing particle, the Omega *minus*, was discovered last year, it signalled a triumph for the SU(3) symmetry.

The new SU(6) theory is based on Wigner's suggestion, made some 30 years ago, that the forces inside the atomic nucleus might be largely independent of the spin of the nuclear components. The 8-member and 10-member supermultiplets of SU(3) are characterized by different amounts of spin angular momentum. Particles in the 8-member group have 1/2 unit of spin, while those in the 10-member group have 3/2 units of spin. In the SU(6) theory the spin itself is regarded as a secondary property, like charge, hypercharge, isotopic spin and mass. Thus in the SU(6) system the octet

and decuplet form a supermultiplet not of 18 members but of 56. This follows from the fact that each particle in the octet has two spin states thus giving rise to 16 states, and each particle in the decuplet has four spin states for a total of 40 states. According to the extended symmetry SU(6) the 56 members of the supermultiplet can transform into each other.

One unexpected triumph of SU(6) is that it accounts for the ratio of the magnetic moment of the neutron to that of the proton, which is $-1{\cdot}91/2{\cdot}79$ or $-{\cdot}68$. According to SU(6) it should be $-2/3$ or $-{\cdot}67$.—(*Sci. Amer.*, March 1965.)

Oldest Rocks : A Revision of the Age of the Earth ?

Analysis of the relative abundance of strontium isotopes in samples of rock from a group of islets halfway between South America and Africa indicates that the rock may be 4·5 billion years old, about a billion years older than any heretofore studied. The rocks nearest in antiquity are a South African granite with an isotope age of 3·2 billion years and a Minnesota granite with an age of 3·3 to 3·5 billion years.

The islets known as St. Peters and St. Paul Rocks lie on the mid-Atlantic ridge near the equator. They have long interested geologists because they are composed entirely of peridotite. In theory peridotite is a major component of the outer mantle. It has been speculated that the islets are surface exposures of this primordial layer.

Five peridotite samples from the region were analyzed during the last year by the isotope geology group of the Carnegie Institution of Washington to determine Sr^{87} (the decay product of Rb)/Sr^{86} ratio in their contents. One sample substantially exceeded the other four both in the proportion of Sr^{87} and in the quantity of undecayed rubidium present. The results indicate that it is not a product of the normal oceanic rock generation process, but it is possible that the sample is a fragment of outer mantle chemically unaltered from its time of formation 4·5 billion years ago.

Further evidence for a revision of the accepted age of the earth has also come from certain lead isotope analysis in feldspars and galenas of different ages on the North American continent. These investigations by the same group suggest a minimum age of 4·7 billion years for the earth.—(see *Carnegie Institution Year Book*, 1963.)

Site for the Mohole

After a six-year search for the ideal spot at which to drill a hole through the earth's crust to the underlying mantle, earth scientists have selected a site in the Pacific Ocean 100 miles north of Hawaii. At the chosen site the sea is some 14,000 ft. deep and the ocean floor is an estimated 17,000 ft. above the mantle, so that the surface-to-mantle distance is a relatively short six miles.—(*Sci. Amer.*, March 1965.)

Molecular Oxygen in the Venus Atmosphere

The detection of molecular oxygen in the atmosphere of Venus would be of great interest. The presence of this gas, if elementary to the atmosphere, might be indicative of the geological and perhaps biological history of the planet. However, spectroscopic investigations have, to date, shown unambiguously only the presence of carbon dioxide.

Spectroscopic method of estimating the molecular oxygen content of the Venus atmosphere consists in measuring the Doppler shift of the O_2 lines from Venus atmosphere with respect to the telluric O_2 lines. Using the 48-inch reflector of the Dominion Astrophysical Observatory, Ottawa, Canada, and with improved Doppler-shift technique and curve of growth analysis, H. Spinrad and E. H. Richardson have reported their determination of the upper limit to the O_2 content of the visible Venus atmosphere. Spectrograms were taken for range of Venus velocity from -13 to $+13$ km./sec. Measurements lead to a limit of 57 cm.-atm. O_2, less than the terrestrial abundance by a factor of 2,800. Relative abundance of O_2 in Venus atmosphere is $< 8 \times 10^{-5}$, for Earth it is 0·23.

The terrestrial O_2 is produced by photosynthetic activity of present-day plants and through photo-dissociation of H_2O. The lack of molecular oxygen in the Venus atmosphere probably means that the process of plant photosynthesis and the dissociation of H_2O are negligible. (*Astrophys. Jour.*, 1965, 141, 282.)

306–65. Printed at The Bangalore Press, Bangalore City, by T. K. Balakrishnan, Superintendent and Published by S. R. S. Sastry, for the Current Science Association, Bangalore.