Radio-sulphur

A RADIOACTIVE isotope of sulphur produced by the action of neutrons on carbon tetrachloride and decaying with a period of 80 days was first observed

DECAY CURVES FROM THREE BARIUM SULPHATE PRECIPITATES: x, PRECIPITATE I; o, PRECIPITATE II; ϕ , PRECIPITATE III.

by E. Buch-Andersen¹. In view of the very weak activity found, doubt was expressed as to the existence of this isotope. This fact induced us to investigate the action of fast neutrons on carbon tetrachloride and sodium chloride. In both cases the radioactive sulphur was obtained; the use of sodium chloride was found, however, to be preferable. Recently², the $^{35}_{16}\text{S}$ has been produced by the action of deuterons on sulphur, by making use of the Berkeley cyclotron.

The neutron sources, consisting of 600 mgm. radium plus beryllium, were placed in the centre of a glass vessel containing 2 kgm. of pure sodium chloride. After the lapse of two months, the sodium chloride was dissolved in water, and 20 mgm. of inactive sodium sulphate was added. In order to oxidize the radioactive sulphur possibly present in elementary state, nitric acid and hydrogen peroxide were added, and the sodium kept boiling for several hours. 100 mgm. of sodium phosphate was added, and the phosphorus was precipitated as ammonium phosphomolybdate. This procedure was repeated several times until the precipitate showed no essential activity. Finally, the sulphur was precipitated in the usual way as barium sulphate.

The activity of barium sulphate precipitates was measured by means of a Geiger counter provided with an especially thin mica window with regard to the very soft β -radiation emitted from the $^{35}_{16}\text{S}$. The window was mounted on a concave cylindrical surface (radius 38 mm.) in order to make it possible to use an extremely thin mica foil as a window. It has been shown³ that mica disks of 1.2 mgm./cm.² and 1 cm. in diameter could stand evacuation of the counter only when mounted on such a concave

surface. This mica window absorbs very little of the very soft β -radiation from sulphur.

The accompanying graph shows decay curves from three different barium sulphate precipitates obtained by the method described above; the decay was followed for more than 500 days. Precipitate I shows signs of a shorter period, indicating that this precipitate was not completely free from active phosphorus. All three curves show a half-life of 88 ± 5 days. It must, however, be mentioned that precipitates I and III seem to show weak residual activities which do not follow the 88-day decay. These activities are, however, so minute (1 count per min. on a background of 3 counts per min.) that it was not possible with the present arrangement to decide whether this weak activity is due to an unknown product obtained by the action of neutrons on sodium chloride or to traces of impurity.

An attempt has been made to estimate the hardness of the β -rays emitted by our preparation by means of absorption measurements. A 30 mgm./cm.² aluminium foil, for example, reduced the activity to less than 10 per cent of its initial value. In the present arrangement, the β -rays from uranium were reduced to half their intensity by 125 mgm./cm.² of aluminium. This enables us to estimate the upper limit of the β -rays from sulphur to be $1.0\text{--}2.0 \times 10^5$ ev., in agree-

ment with Libby⁴.

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¹ NATURE, **137**, 457 (1936); Z. phys. Chem., B, **32**, 237 (1936).

² Vogt, H. H., J. Amer. Chem. Soc., **61**, 1032 (1939); Tuck, J. L., J. Chem. Soc., 1293 (1939).

³ Arnold, W., Frisch, O. R., and Levi, H., Rev. Scient. Instr., **10**, 197 (1939).

⁴ Libby, W. F., and Lee, D. D., Phys. Rev., **55**, 245 (1939).

Origin of the Yellow Line in Twilight and the Night Sky Luminescence

THE appearance in the night sky spectrum of a yellow line was observed in 1929 by Slipher¹, who measured a wave-length 5892, by Dufay², Sommer³, Cabannes⁴ and by Vegard and Tönsberg⁵. The latter gave the wave-length 5892.6, and finding the line considerably broader than a single atomic line, they concluded that it had a fine structure. Twilight spectra giving the yellow line were obtained by Vegard at Oslo on January 13, 1936, and Tromsø in February of the same year⁶.

Taking into account the time of exposure, the yellow line should be about 50–100 times stronger in twilight than in the night sky. In 1936 Currie and Edwards⁷ published observations from the Polar Year programme showing the yellow line in twilight spectrograms. In November 1937 Bernard, working at the Tromsø Observatory, made further systematic investigations regarding the enhancement of the yellow line in the spectrum of twilight⁸. The wave-length found for the yellow line corresponds to the mean wave-length of the yellow doublet (D_1D_2) of sodium.