A hollow quartz cylinder possesses, in general, three fundamental frequencies. Two of them, independent of the length of cylinder, are of ordinary piezo-electric character and correspond respectively to radial (along the wall thickness) and circular (along the wall circumference) vibrations of the hollow cylinder. These modes of vibration are clearly shown by marking out the actual piezo-electric axes by discharge points in glow pattern or under examination with polarised light. The third frequency is probably of torsional oscillation. Further details will be published shortly elsewhere.

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March 28.

[1] A. Hund and R. B. Wright, *J. Res., Bureau of Standards*, **4**, 383; 1930. *Proc. Inst. Radio Eng.*, **18**, 741; 1930.
[2] Ny Tsi-Zé et Tsien Ling-Chao, *C.R.*, **198**, 1395; 1934.

Spontaneous Emission of Neutrons from Radioactive Isotopes

IN confirming the pioneer work of Fermi[1] on radioactivity induced by neutron bombardment, Curie, Joliot and Preiswerk[2] have shown that the radioactive isotopes produced when phosphorus and magnesium are bombarded by neutrons emit: (1) negative electrons, (2) high energy γ-radiation ($\sim 5 \times 10^6$ e.v.), (3) positrons (which they tentatively ascribe to pair formation, this explanation being very doubtful as the high energy limit of these electrons was $\sim 1{\cdot}0 \times 10^6$ e.v.), (4) neutrons. The neutron emission they ascribe to $_{14}Si^{31}$ and $_{13}Al^{28}$, unstable isotopes produced by the initial neutron bombardment.

Goldhaber[3] has shown, however, that these neutrons must get into a state of positive energy by some primary radioactive process and then be immediately emitted. It is the purpose of this note to support Goldhaber's suggestion and to indicate that the results observed arise from the β-ray radioactivity of the two isotopes mentioned.

It has been shown[4,5], from considering the nuclear disintegration experiments which have been performed, that the stable nuclei of the light elements of even atomic number consist of the maximum number of α-particles and neutrons, those of odd atomic number consisting of the maximum number of α-particles, a diplon and a loosely bound neutron. It has also been shown[6] that isotopes of the light elements of even atomic number containing three neutrons and those of the elements of odd atomic number containing a diplon and two neutrons, are β-ray radioactive. In addition it has been demonstrated[7] that β-radioactivity results from the formation of electron pairs within the nucleus with the production of a proton as the positron is captured by a neutron, the negative electron being emitted to form the disintegrating β-ray.

Applying these views, the β-radioactivity of $_{13}Al^{28}$ $(6\alpha + D + 2n)$ results in the formation of a new α-particle in the nucleus by the union of the diplon and the new diplon formed when the positron of the pair unites with the neutrons. This α-particle is formed in a state of excess energy as shown by Oliphant, Harteck and Rutherford[8]. It may then transfer to the normal state and be bound within the nucleus forming $_{14}Si^{28}$ (7α), with the emission of high energy γ-radiation. Or it may emit a neutron leaving $_2He^3$ within the new nucleus $_{14}Si^{27}$ $(6\alpha + D + p)$ and this 'radiosilicon' containing a 'free' nuclear proton[9] emits positive electrons transmuting to $_{13}Al^{27}$.

Similarly the β-ray emission of $_{14}Si^{31}$ results in the formation of a diplon within the nucleus, mass defect energy 5×10^6 e.v. being released. This may be emitted in the form of γ-radiation when the stable $_{15}P^{31}$ is formed, or the loosely bound neutron may be emitted immediately carrying the excess energy. As a result, 'radiophosphorus' $_{15}P^{30}$ is formed which spontaneously emits positrons transmuting to $_{14}Si^{30}$.

Thus, on the view of nuclear structure adopted, the γ-radiation of high energy, the neutron and the positron emission all result from the β-ray radioactivity of the unstable nuclei produced. It is to be noticed that spontaneous emission of protons is possible from $_{13}Al^{28}$.

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[1] Fermi, *Ricerca Scientifica*, **1**, 283, 330; **1934**.
[2] Curie, Joliot and Preiswerk, *C.R.*, **198**, 2089; 1934.
[3] Goldhaber, NATURE, **134**, 25, July 7, 1934.
[4] Walke, *Phil. Mag.*, **17**, 793; 1934.
[5] Walke, *Phil. Mag.*, **18**, 129; 1934.
[6] Newman and Walke, NATURE, **134**, 64, July 14, 1934.
[7] Walke, *Phil. Mag.*, **17**, 1176; 1934.
[8] Oliphant, Harteck and Rutherford, NATURE, **133**, 481, Mar. 31, 1934.
[9] Walke, *Phil. Mag.*, **18**, 154; 1934.

The Sycamore Maple in A.D. 1300

IN his description of the carvings of the sycamore on the shrine of St. Frideswyde in the Oxford Cathedral, Dr. Burtt Davy[1] gives a list of ten species of plants that were in all probability growing in or near Oxford about A.D. 1300, when the shrine was being carved. It is only fair to note that the remarkable truth to Nature of the carvings of the fruits and leaves of this tree, and of the nine other species of plants mentioned by Dr. Davy, had already been recognised by Mr. S. A. Warner, with the addition of two more, the water crowfoot, *Ranunculus aquatilis*, and the hogweed, *Heracleum sphondylium*, to the list which, with three illustrations, is printed in my "Early Science in Oxford", vol. 3, p. 198.

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The Old Ashmolean,
Oxford.
July 14.

[1] NATURE, **134**, 61, July 14, 1934.

THE three illustrations referred to by Dr. Gunther do not include *Acer pseudoplatanus*, nor do his published notes make any reference to the fact that the carving is the earliest known record of the occurrence of the sycamore maple in Britain, antedating previous records by a quarter of a century. I did not mention the hogweed and water crowfoot, as their identification seemed less certain than that of the other species.

I owe Dr. Gunther an apology for not having mentioned the notes and reproductions referred to, which—I regret to say—I had not seen.

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