Errata: The Collision of Neutrons with Deuterons and the Reality of Exchange Forces

[Phys. Rev. 71, 558 (1947)]

H. S. W. MASSEY AND R. A. BUCKINGHAM
University College, London, England

AND

Conductivity of Sodium-Ammonia Solutions

[Phys. Rev. 71, 563 (1947)]

D. K. C. MACDONALD AND K. MENDELSSOHN
Clarendon Laboratory, Oxford, England
AND
A. J. BIRCH
Dyson Perrins Laboratory, Oxford, England

THE Editor regrets that Fig. 2 of the first of the above papers has been interchanged with Fig. 1 of the second paper. The captions, however, are right, as they stand.

Erratum: The Quadrupole Moments and Spins of Br, Cl, and N Nuclei

[Phys. Rev. 71, 644 (1947)]

C. H. TOWNES, A. N. HOLDEN, J. BARDEEN, AND F. R. MERRITT
Bell Telephone Laboratories, Murray Hill, New Jersey

THE Editor regrets that Figs. 1 and 2 of the above paper have been interchanged. The captions for the figures, however, are correct as they stand.

Isotopic Changes in Cadmium by Neutron Absorption

A. J. DEMPSTER
Argonne National Laboratory, Chicago, Illinois
May 1, 1947

IN a recent letter B. J. Moyer, B. Peters, and F. H. Schmidt[1] report that the absorption of thermal neutrons in cadmium that had been enriched in the isotope at mass 113 was six times normal, and conclude that this isotope is mainly responsible for the large absorption in this element.

The mass spectra reproduced in Fig. 1 illustrate another phenomenon that also indicates the absorbing isotope, namely, the gradual alteration of the isotopic constitution of an element by long exposure to neutrons. The upper mass spectrum shows the normal isotopes at masses 110, 111, 112, 113, and 114, with $Cd^{113}=12.3$, and $Cd^{114}=28$ percent. The faint isotopes at 106 and 108 do not show on the prints. The lower spectrum shows the changed isotopic abundance in a sample scraped from the surface of a piece of metal that had been used to absorb intense neutrons from a pile over a long period of time. These neutrons include a considerable number with energies above the thermal range.

Photometric measurements, made by using Nier's measurements of the normal cadmium abundances as standards, showed that the isotope at mass 113 was reduced

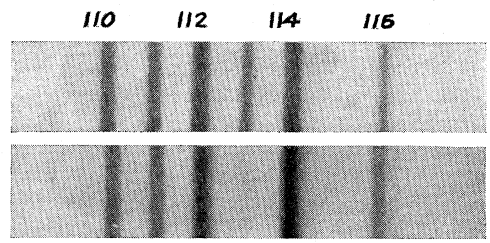

FIG. 1. Normal cadmium (above) and isotopes altered by neutron absorption (below).

to 1.6 ± 0.2 percent, about one-eighth of its normal abundance, and that the isotope at mass 114 was increased to 39.5 ± 1.5 percent. Within the limits of the accuracy attained, the increase in 114 is equal to the decrease in 113. Any changes in the abundances of the isotopes at masses 110, 111, 112, and 116 were less than five percent. It was noticed, however, that in both samples the isotopes at 110 and 111 had a greater difference in abundance than is indicated by Nier's measurements (12.8 and 13.0 percent). We may conclude that the other main isotopes have absorbing cross sections less than one-fortieth of that of Cd^{113}, and that if any $(n, 2n)$ or other reactions occur, they are comparatively rare.

[1] B. J. Moyer, B. Peters, and F. H. Schmidt, Phys. Rev. 69, 666 (1946).

Radiation from Electrons in a Synchrotron

F. R. ELDER, A. M. GUREWITSCH, R. V. LANGMUIR, AND H. C. POLLOCK
Research Laboratory, General Electric Company, Schenectady, New York
May 7, 1947

HIGH energy electrons which are subjected to large accelerations normal to their velocity should radiate electromagnetic energy.[1-4] The radiation from electrons in a betatron or synchrotron should be emitted in a narrow cone tangent to the electron orbit, and its spectrum should extend into the visible region. This radiation has now been observed visually in the General Electric 70-Mev synchrotron.[5] This machine has an electron orbit radius of 29.3 cm and a peak magnetic field of 8100 gausses. The radiation is seen as a small spot of brilliant white light by an observer looking into the vacuum tube tangent to the orbit and toward the approaching electrons. The light is quite bright when the x-ray output of the machine at 70 Mev is 50 roentgens per minute at one meter from the target and can still be observed in daylight at outputs as low as 0.1 roentgen.

The synchrotron x-ray beam is obtained by turning off the r-f accelerating resonator and permitting subsequent changes in the field of the magnet to change the electron orbit radius so as to contract or expand the beam to suitable targets. If the electrons are contracted to a target at successively higher energies, the intensity of the light radiation is observed to increase rapidly with electron energy. If, however, the electrons are kept in the beam past the peak of the magnetic field and then expanded to a target, the intensity of the radiated light appears to be independent of the energy at which the electrons are removed from the beam. This is to be expected, for in a given machine the radiation is proportional to the fourth power of the electron energy. The light radiation is not observed if the beam is contracted before its energy is about 30 Mev. When the electron beam has been accelerated to the peak of the magnetic field and then decelerated to low energy, a rough measurement of the phase angle over which the light was visible gave a value of 90–100 degrees. The light was viewed through a slotted disk rotating at synchronous speed.

If the r-f resonator is turned off a short time before the peak of the magnetic field, the electron beam slowly contracts to a radius just larger than that of the interior target and then expands as the magnetic field decreases. In this case, the observer no longer sees a single point of light but a short line with extension in the plane of the orbit.

The light emitted from the beam is polarized with the electric vector parallel to the plane of the electron orbit. It disappears as the observer rotates a piece of Polaroid before the eye through ninety degrees. An investigation of the spectral distribution of the energy is in progress and will be reported.

This work has been supported by the Office of Naval Research under contract N5ori–178.

[1] D. Iwanenko and I. Pomeranchuk, Phys. Rev. **65**, 343 (1944).
[2] J. P. Blewett, Phys. Rev. **69**, 87 (1946).
[3] L. I. Schiff, Rev. Sci. Inst. **17**, 6 (1946).
[4] J. S. Schwinger, Phys. Rev. **70**, 798 (1946).
[5] H. C. Pollock *et al.*, Phys. Rev. **70**, 798 (1946).