ond part of the exchange current density has a vanishing divergence and so represents the flow of charge in closed loops. This part of the current density cannot be determined completely from the imposed conditions, but the invariance properties of the Hamiltonian fix the dependence of these currents on the spins of the interacting nucleons and the direction of the line joining them to within certain arbitrary functions of their spatial separation.

A comparison of the results for the exchange contributions to the magnetic moments of H^3 and He^3 with the experimental values for these moments indicates that the part of the moment arising from the irrotational current distribution is not sufficient itself to account for what are presumed to be the exchange contributions to these moments but that the solenoidal terms are of the proper character to make up the deficiency. R.K.O.

The Phenomenological Theory of Exchange Currents in Nuclei. By R. K. Osborn and L. L. Foldy. *Phys. Rev. 79: 795, September 1, 1950.*

Light in the Eye

The most important determiner of the state of human visual sensitivity is the level of illumination to which the eye has been exposed. For this reason the technique of pre-exposing the eye to different illuminations and immediately thereafter measuring the threshold and the subsequent changes in threshold, i.e., measuring the course of dark adaptation, has furnished important information about visual function. According to a simple photochemical theory of vision it is assumed that a photosensitive substance is decomposed by light into its breakdown products and that during darkness these combine to re-form the substance. A special and theoretically interesting case arises when the eye is pre-exposed to intermittent light.

In this experiment subjects were pre-exposed for one minute to different values of illumination at various rates of intermittency. The data on the dark adaptation which followed were compared with those obtained after pre-exposure to a continuous light. For both conditions the product of light multiplied by time was equal. No significant differences were found—the intermittent pre-exposure was just as effective as the continuous in changing the sensitivity. That is, the flash brightness, the length of the inter-flash interval, or both, affected the visual system so that there was no recovery of sensitivity during the period between flashes.

Further research should be concerned with the effect of varying the light-dark ratio of the intermittent light, varying the total duration of pre-exposure for both the intermittent and continuous conditions, and determining the influence of other pre-exposure variations. F.A.M.

The Effect of Intermittent Pre-Adapting Light upon Subsequent Dark Adaptation in the Human Eye. By F. A. Mote, A. J. Riopelle, and D. R. Meyer. *J. Opt. Soc. Am. 40: 584, September, 1950.*

Electronic Pile Simulator

The variation of the neutron flux with time in a nuclear chain reactor is determined to a large extent by the delayed emission of a small fraction of the neutrons formed in fission. A set of six simultaneous differential equations is required to give the variation of the flux with time. One equation gives the neutron flux as a function of the effective multiplication and the concentration of the five (or six) delayed neutron emitters, the remaining equations giving the concentration of each delayed emitter. It is very convenient for the design and testing of pile control instruments, or for training, to have a device that behaves as a pile does without the inconvenience, cost, and danger of an actual pile.

An electrical analog computer or simulator has been built that follows the same set of differential equations as the pile. The neutron level is represented by a voltage and the position of a potentiometer arm represents the position of a control rod. Another potentiometer sets the value of the initial source of neutrons.

The simulator may be used over a flux ratio of about 5×10^2 from the lowest level that can be controlled to the maximum output of the device.

Stable accurate periods of as slow as thirty minutes to increase or decrease the flux by a factor of e can be maintained and transient jumps lasting only a few milliseconds can be produced. P.R.B.

The Electronic Pile Simulator. By P. R. Bell and H. A. Straus. *Rev. Sci. Inst. 21: 760, August, 1950.*

X-Ray Dose Measurements

Recently developed high output beryllium window x-ray tubes are very useful for work in radiation chemistry but dosage determinations are difficult because of the high output and the rapid absorption of the soft radiation. Chemical dosimeters offer several advantages over ionization chamber methods provided the determinations can be made rapidly and with accuracy.

Aqueous solutions of chloral hydrate have been found very satisfactory for making such dose measurements. Radiation produces HCl from the unionized organic molecule and this reaction permits the dose determinations to be made from measurements of the electrical conductance of the solution. Yields as high as 79 molecules of HCl per ion pair are obtained and this permits the determination of doses as low as 300 r with considerable accuracy.

The reaction is independent of dose rate, within wide limits, but does depend on the temperature at the time of radiation. Tungsten electrodes are used in the conductance cells since platinum catalyzes the reaction initiated by the radiation. Many organic halides have been found to yield the corresponding ionized acid following x-radiation but chloral hydrate has the practical advantage of being water soluble.

This reaction has been used to study depth dose curves of 50-kilovolt x-rays in water and for routine dose determinations in radiation chemistry experiments. H. L. A.

X-Ray Dose Determinations with Chloral Hydrate. By Howard L. Andrews and Parkhurst A. Shore. *J. Chem. Phys. 18: 1165, September, 1950.*