

for tubes which are reflected or refracted at an arbitrarily curved surface separating two homogeneous media. The incident tube is assumed to be conical, corresponding to light from a point source.

While the main result is the distribution of intensity of the reflected and transmitted light, various interesting auxiliary results are also obtained. Thus it is found that at two points along each tube the tube area becomes zero and thus the light intensity is infinite. The locus of such points is called a caustic surface. When two caustics touch, a point image is formed. It is found that only for special kinds of points on the reflecting surface, and for special directions of incidence, can point images occur, e.g., in reflection from an elliptic point on a surface for a particular direction of the incident ray. The focal length and general lens-mirror formula is obtained to determine the position of such point images.

The supposition concerning energy flux along a tube of rays on which the calculation is based is actually valid. A previous precise derivation of geometrical optics from electromagnetic theory (and of geometrical acoustics from fluid dynamics) yields this result, along with the other "laws" of geometrical optics. The derivations do not hold at caustic surfaces. H.B.K.

Determination of Reflected and Transmitted Fields by Geometrical Optics. By Joseph B. Keller and Herbert B. Keller. *J. Opt. Soc.* 40:48, January, 1950.

High Speed Oscillography

Users of electronic equipment in the field of nuclear physics have been pushing continually toward greater speed. The need for equipment which can respond very quickly and recover quickly is especially great where studies are being made which involve a sequence of changes in nuclear state or the simultaneous emission of two particles.

A synchroscope has been developed for use on the study of components and the testing of circuits for operation at speeds which represent the present frontier in this drive toward greater time resolution. It is not a new kind of device but is considerably faster than similar equipment generally available. It consists of a signal amplifier and a triggered sweep generator used with a commercially available high voltage cathode ray tube and power supply. A relatively new principle called distributed amplification is used in the signal amplifier because conventional cascade amplifiers are too slow in their response. A gain of about 1000 is obtained with a rise time of about 6.5×10^{-9} seconds. The electron beam can be deflected vertically 2 cm in either direction. It can be deflected horizontally across the tube in as little as 0.3 microsecond by the sweep generator.

Stimulus for the development of this instrument lay in studies of Geiger discharges and of the characteristics of various scintillation phosphors. It permits the photography of single pulses from a Geiger or photomultiplier tube, when used with a moving film camera to separate the traces. G.G.K.

A High Speed Synchroscope. By G. G. Kelley. *Rev. Sci. Inst.* 21:71, January, 1950.

Mathematical Biophysics

A modification of the two-factor theory of nerve excitation is introduced in the September, 1949 issue of the *Bulletin of Mathematical Biophysics*. As developed by Rashevsky and Hill, the two-factor theory predicts a quantitative relation between threshold value of the exciting voltage and the frequency of an alternating current. Experimental values agree very well with the predicted curve for low frequencies (up to 500 cycles per second). For high frequencies there is a marked and consistent deviation. By introducing a rectification phenomenon and by modifying the concept of accommodation, C. S. Patlak and H. D. Landahl extend the agreement between theory and experiment to a wider range.

In her second paper on the linkage theory of autopolyploids, Hilda Geiringer utilizes the segregation distribution for autopolyploids introduced in the first paper to establish a recurrence formula for the computation of gamete distributions for any generation, the initial distribution being known.

Random neural nets are discussed in a paper by A. Shimbel, who computes distortions in the output of a ganglion in relation to the input (considered as a function of time) due to randomization of synaptic delays. A steady state input-output function is derived for the case of a ganglion with "association connections," i.e., where the neurons in addition to being stimulated from the outside also stimulate each other.

In a paper by J. B. Best a mechanism is offered to explain the polar transport of auxin-like substances in plants. The model consists of a geometrically constrained enzyme system capable of driving a substance, which acts as a co-enzyme, to one of the enzymes of the system against a concentration gradient.

Mathematical sociology is represented by two papers, both based on the probabilistic approach. N. Rashevsky starts with an aggregate of individuals, each of whom may exhibit one of two mutually exclusive forms of behavior. The determining factor is actually a probability which is a function of a certain quantity which has a distribution function in the aggregate. Moreover there is interaction in the aggregate in that the particular behavior of each individual increases the probability of similar behavior in others. The equations describing the behavior of the aggregate turn out to be generalizations of analogous equations previously derived on the basis of more elementary assumptions.

A. Rapoport derives the distributions of various kinds of social structures based on "peck right," such as is observed in chickens, assuming complete randomness of events determining the peck right between each pair of individuals.

An approach to the mathematical biophysics of mitosis is suggested in another paper by N. Rashevsky based on the assumption of coiling and uncoiling of long chain molecules. A. RAPOPORT

The Bulletin of Mathematical Biophysics. Vol. 11, No. 3, September, 1949.