cated, a new game with MacMahon cubes is formulated and solved, and a new form of the cube game, involving hemispheres, is given.

The second chapter (p. 21–35), entitled *The mysterious grid or the thought reader*, seems to be a new mathematical game involving the binary scale of notation.

In the third chapter (pp. 35–61) on *The game of nim or fantan or three heaps*, it is noted that the mathematical theory of the game, and its name nim, were first given by C. L. Bouton, of Harvard University, in Annals of Mathematics, 1901, and it is remarked that "die weitgehendste Verallgemeinerung des Nimspieles verdanken wir dem berühmten amerikanischen Mathematiker E. H. Moore." This was published in the Annals, 1910. In both of these discussions the binary scale is employed. Most of the chapter is taken up with the discussion of modifications of the conditions of the game and with consideration of the relation of the discussion to that of Bouton and Moore.

The long fourth chapter (pp. 61–125) on *Puzzles of arrangement*, deals with a variety of problems, such as the Boss-puzzle, Sir Wm. R. Hamilton's dodecagon game (Quarterly Journal of Mathematics, vol. 5 (1862)), and a new kind of closed knight's move. The last chapter sets forth different forms of solitaire playing.

This valuable book notably supplements such works in English as those of Ball and MacMahon, and lives up to its motto throughout. Moreover the style of presentation is, for the most part, very pleasantly informal.

R. C. ARCHIBALD

Einführung in die theoretische Physik. In three volumes. By Clemens Schaefer.
    Volume 3, Part 1: *Elektrodynamik und Optik*. Berlin and Leipzig, de Gruyter, 1932. 918 pp.

A perusal of Professor Schaefer's admirable account of the classical electrodynamics and optics is like a visit to an old friend who is familiar with the great achievements of the past and can describe many modern discoveries in well-chosen language.

The first three chapters deal with static electric and magnetic fields and steady electric currents. The account of electromagnetic theory begins in Chapter IV, which contains a formulation of the laws for non-stationary processes. This is followed by a study of quasi-stationary currents and of electromagnetic waves in insulators and conductors. There is an admirable account of the optics of perfectly transparent media in which the phenomena of reflection are beautifully illustrated by diagrams indicating the flow of energy in the two media for the cases of partial and total reflection.

The chapter on the optics of crystals, supplemented by one on geometrical optics and diffraction, provides a clear elementary introduction to crystal theory.

There is a good presentation of the theory of electrons and dispersion which contains a brief account of its recent application by Larmor, Appleton, Nichols, and others to explain the striking fact that the range of the long waves of wireless telegraphy has a marked minimum for a wave-length of 200 m. The thermodynamical theory of radiation is well presented and the chapter on relativity closes with a sketch of the general theory, which the author regards as not yet fully established by the astronomical tests.   H. BATEMAN