The National Scientific Register of scientists was organized in 1950, temporarily in the Office of Education, in line with recommendations made by the National Security Resources Board. It is concerned primarily with the development and maintenance of an up-to-date inventory of selected groups of U. S. scientists for use in the event of all-out war and as a basis for analytical studies in the general field of scientific and technical personnel. Responsibility for supporting the project was taken over by the Foundation beginning with fiscal 1952.

Other NSF activities now under way include the emergency support being given the *Physical Review,* participation along with six other agencies in providing emergency assistance to *Biological Abstracts,* publication of results of the AAAS Symposium on Soviet Science held in Philadelphia last December, and some support of travel of U. S. scientists to attend international conferences. In connection with the last, travelling expenses of delegates to the First General Assembly of the International Mathematical Union in Rome were paid by NSF and similar funds will be provided for several attendants at the forthcoming International Biochemistry Congress to be held in Paris this summer.

The facts presented above leave no doubt but that NSF has made substantial progress during its first year of operation. They indicate clearly that the Foundation's several major programs are firmly established and ready to expand to vastly greater effectiveness as rapidly as funds up to the full original authorization can be made available. At present, however, the financial horizon for fiscal 1953 is unchanged from that of 1952. In the Independent Offices Appropriation bill, the House of Representatives Committee stated, "The bill includes $3,500,000 for salaries and expenses of this activity which is the amount provided for the current fiscal year and is $11,500,000 below the budget estimate. The committee is aware of the importance of this activity and the program which it sponsors and it is reluctant to retard the development of it. However, it is a new activity which is unlikely to provide assistance to the country in the immediate emergency. The committee feels, therefore, that expansion to the full amount of the authorization ($15,000,000) should be deferred until the financial condition of the Treasury has improved."

Short-sighted as this reasoning must appear to anyone who at all recognizes the extent to which applied research and development depend upon and lag behind the parent fundamental research, it is encouraging to note that a motion was made on the floor of the House by Representative Priest of Tennessee, supported strongly by Representatives Frank E. Smith of Mississippi and Javits of New York, to raise the appropriation to $10,000,000. This was defeated, however, and the bill was passed by the House as reported. Senators Alexander Smith of New Jersey and Hubert Humphrey of Minnesota at their own request appeared on behalf of the Foundation during hearings before the Senate Appropriations Committee.

Books

The Ether

A History of the Theories of Aether and Electricity. The Classical Theories. By Edmund Whittaker. 434 pp. Philosophical Library, Inc., New York, 1951. $12.00.

This work covers the significant developments in dynamics and electromagnetics (broadly speaking) from the age of Descartes to that of Lorentz, or roughly from 1600 to 1900; it ends, rather abruptly, with the prenatal stirrings of relativity and quantum theory. This edition, the first of two volumes, is a revised and enlarged version of one that appeared originally in 1910; the second volume will continue the account to the present time.

The author's viewpoint, which appears primarily in the preface—the text itself being a heuristic exposition—is best expressed in his own words:

> "As everyone knows, the aether played a great part in the physics of the nineteenth century; but in the first decade of the twentieth, chiefly as a result of the failure of attempts to observe the earth's motion relative to the aether, and the acceptance of the principle that such attempts must always fail, the word 'aether' fell out of favour and it became customary to refer to the interplanetary spaces as 'vacuous'; the vacuum being conceived as mere emptiness, having no properties except that of propagating electromagnetic waves. But with the development of quantum electrodynamics, the vacuum has come to be regarded as the seat of the 'zero-point' oscillations of the electromagnetic field, of the 'zero-point' fluctuations of electric charge and current, and of a 'polarization' corresponding to a dielectric constant different from unity. It seems absurd to retain the name 'vacuum' for an entity so rich in physical properties, and the historical word 'aether' may fitly be retained."

The book is a comprehensive, well documented, scholarly work with an author index that approaches perfection and an extremely useful table of contents in which the individual chapters are broken up to detail their highlights. The lucid expository style and the detailed development are well suited to the material; would that the same had been employed in his *Treatise on Dynamics,* particularly the "illustrative" examples. The reviewer strongly recommends the book to all physicists; to those working in electromagnetics with knowledge of their subject derived solely from current texts and articles the material will come as a revelation. Here the scaffolding of their structure is restored, the slightly too smooth bricks displayed alongside their crumbled originals, and the foundations, not all too stable, unearthed. More than this, in the personal sidelights and quotations from letters, the motivations of its constructors are clearly delineated.

One whose knowledge of the ether stems primarily from an occasional (and usually deprecatory) footnote, would find the titles of many of the papers by physicists of the last century incomprehensible, if not fantastic. The sweeping and unifying concept of the ether and its painstaking development here presented allow one to view in proper perspective the apparently frenzied activities of our precursors. Whittaker documents their preoccupation with dynamical models, their ingenuity in design and construction; he points out the value of such workable models—that they have properties other than those which suggested their construction, and so stimulate new lines of investigation. The concepts involved are far from trivial; even the most hardened pragmatist will rest his operational oars to ponder the fundamental questions tacitly raised in the presentation of the material.

It is clear that there is at least an intuitive need for the existence of an ether—a vehicle for the propagation of gravitation and radiation. Newton conjectured that the density of the ether varied and that bodies tended to move towards its rarer parts; he stated that to suppose "that one body may act upon another at a distance through a vacuum, without the mediation of anything else, . . . is to me so great an absurdity, that I believe no man, who has in philosophical matters a competent faculty for thinking, can ever fall into."

One of the significant models of the ether is Maxwell's of 1861; in this he correlated Faraday's tubes of force with the viewpoint that magnetism was a phenomenon of rotation, while electric currents were phenomena of translation. If it is assumed that there is fluid rotating around the axis within each tube of force, then the tendency of the tubes to contract longitudinally and expand laterally may be attributed to centrifugal force. Accordingly, supposing the medium within a magnetic field to be in rotation around the lines of magnetic force, he pictured each unit tube of force as an isolated vortex. However, since neighboring vortices rotated in the same direction, the motion might be discontinuous (for the particles in the circumference of one must move oppositely to those contiguous to them in an adjacent vortex). To obviate this, Maxwell introduced "idling wheels" to gear the vortices; he supposed a layer of movable particles interposed between, and sliding on, adjacent vortices—thus each vortex tends to make its neighbors revolve in the same direction as itself. Assuming next that the particles were not otherwise constrained, he showed that their flux was the analogue of the electric current.

He also showed that if the rotatory velocity of some vortices were altered, the disturbance propagated through the medium by the mutual action of particles and vortices. The model was extended to cover electrostatics and it was in this regard that Maxwell postulated the displacement current; it is simply related to the variations of the particles' displacement from their equilibrium positions, and this accounts for a rather unhappy choice of labels from our present viewpoint. The parameters of the distribution of vortices and particles—velocities, forces, stresses and strains—were all simply related to the electromagnetic variables.

There were other models too, and some were actually constructed. Fitzgerald's of 1885, for example, consisted of a planar configuration of rotating wheels with each wheel geared to each of its four neighbors by rubber bands. Those involving vortex motion, however, had singular attractions because of Helmholtz's discovery in 1858 that vortex rings are permanent in a perfect fluid; that although each consists of a motion pervading the whole of the fluid, they nevertheless may be considered as combining and interacting with each other without loss of individuality and without being destroyed. This suggested a connection with the atomic theory of matter; in fact Kelvin in 1867, stimulated by Tait's lecture-display of smoke rings, proposed a general physical theory based on vortex motion. The vortex-atom hypothesis also seemed applicable to the propagation of gravitation, which had been believed instantaneous from LaPlace's work; each vortex ring affects the entire fluid, involves all others, and the effects are simultaneous everywhere.

The book, however, is not merely a historical account —it parallels this with a concise analytic development of the significant electromagnetic equations; Whittaker displays much ingenuity and originality in the course of the derivations. In addition the many asides and letters which reveal the humans within the physicists make fascinating reading.

We read that the frogs Galvani experimented on might have been procured for his ill wife's nourishment; of Fresnel's disappointment in not being elected to the Academy—of his election, finally, and of how Arago found him dying when he came to present him with the Rumford medal; that Kelvin referred to Maxwell's displacement current as a "curious and ingenious, but not wholly tenable hypothesis", and that he never did fully accept it; and also from Gill's letter, that "Maxwell was not a good schoolmaster" and that the few responsive students "used to remain with him for a couple of hours after lectures, till his terrible wife came and dragged him away to a miserable dinner. . . ."

It is with a certain breathless expectancy that the reviewer awaits the second volume. The abrupt closure of the first at the crucial turn of the century is reminiscent of the serialized episodes once seen in movies; what have the fates in store for our somewhat enfeebled hero? We await the sequel, and suggest that the publishers divide the price of their book by three to obtain at least a threefold increase in sales.

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