Book Reviews

Relativity and Other Subjects

Magic without Magic. John Archibald Wheeler: A Collection of Essays in Honor of his Sixtieth Birthday. JOHN R. KLAUDER, Ed. Freeman, San Francisco, 1972. xiv, 492 pp., illus. $19.50.

In these days of highly specialized science, a festschrift that accurately reflects the research interests of the festschriftee risks having its appeal restricted to a very narrow audience. Fortunately, the problem does not arise for this collection of essays in honor of John Wheeler, for Wheeler is one of the most versatile physicists of our times. Younger physicists, who know Wheeler chiefly through his work on general relativity and relativistic astrophysics, should look over the table of contents of this book and reflect that every one of the topics covered—nuclear fission, muonic atoms, *S*-matrix theory, quantum electrodynamics, and gravitational collapse, among others—received an important boost early on from a seminal paper by Wheeler.

As is appropriate in a festschrift, many of the articles here evidently represent fragmentary ideas with which the authors are still toying, and are more tantalizing than illuminating. Some are more substantial, however. The series of papers by Richard Feynman and Bryce DeWitt on the quantization of gravitation is worth the price of the book to field theorists. For many years, the main line of attack on this problem was through the canonical formalism, in which it is easy to keep track of the independent degrees of freedom of the gravitational field but very hard to maintain Lorentz invariance. In the early '60's Feynman opened up a new approach, in which Lorentz invariance is maintained at every step but fictitious degrees of freedom have to be introduced, through what are called "ghost loops." This work of Feynman's later flowered into a complete formalism for the quantum theory of gravitation through the work of Fadeev, Popov, Mandelstam, and DeWitt, and this formalism has recently played a crucial role in van't Hooft's proof of the renormalizability of unified gauge theories of the weak and electromagnetic interactions. However, until the publication of this book, Feynman's original ideas were available only in the transcript of a taped lecture given at Warsaw in 1963. (Talk about fast information retrieval!)

In recent years, Wheeler's interest has particularly focused on the problem of finding astrophysical phenomena in which the gravitational fields are strong enough to bring general relativity into play in all its nonlinear non-Euclidean complexity. There is nothing in this book about geons, but Kip Thorne's article does a good job of summarizing the work of general relativists on black holes. These are stars, of about a solar mass or more, whose temperature has dropped too low to provide enough pressure to balance gravitation and which enter on an unstoppable gravitational collapse. I found myself a bit dissatisfied with Thorne's survey of opinion on the existence of black holes. He lists the "establishment" view, that gravitational collapse really does occur more or less as described in the 1930's by Oppenheimer and Snyder, and the "radical" view that something even weirder may happen, such as a reemergence of the imploding matter somewhere else in space-time. I would also have listed a "reactionary" view, that massive stars simply explode when they grow too cold for gravitational stability, so that the formation of a "trapped surface" (after which the star must abandon all hope of avoiding collapse) never occurs. I do not say that the reactionary view is right, but the possibility ought to be kept in mind.

Apart from the breadth of his brilliant contributions to physics, there is another feature of John Wheeler that makes it easy to compile a festschrift for him—it is simply that he is one of the best-liked physicists around. I found the reminiscences in this book wonderfully evocative of Wheeler's personality, especially those of Edwin Taylor in the last article. For my own part, I can add that although I have disagreed with Wheeler many times in the 17 years I've known him, over issues ranging from geometrodynamics to civil defense, I have found it quite impossible not to be on good terms with him. Those who know John Wheeler will understand what I mean.

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Seashore Patterns

Life between Tidemarks on Rocky Shores. T. A. STEPHENSON and ANNE STEPHENSON. Freeman, San Francisco, 1972. xiv, 426 pp., illus. Cloth, $15; paper, $6.95.

Many of the world's great naturalists, including Aristotle, Pliny the Elder, Linnaeus, and Darwin, have enjoyed the seashore. Possibly none has enjoyed it more than T. A. and Anne Stephenson. Probably none has seen as much of the world's seashore as they did, and certainly none has seen it with their appreciation of form and structure. Science begins with a search for unifying patterns in nature. The search for a universal pattern of intertidal zonation took the Stephensons to many of the world's shores, where T. A. Stephenson's artistic eye perceived as a Platonic ideal a universal pattern of zonation, which is sometimes clouded by a haze of natural variation. His paintbrush, line sketches, and selected photographs deftly cut through this haze and present to the reader a clear impression of zonation on many different shores.

Readers will find themselves thoroughly convinced that all of the marine organisms which reside in the intertidal region are exposed to physiological stresses resulting from the absence of seawater during low tides. The fact that these organisms have different tolerances to these stresses results in different upper limits to the range of their vertical distribution. Physical and biological factors which affect these physiological stresses usually modify the potential distribution limits. Each of the regions visited by the Stephensons is described with numerous qualitative observations which delimit the upper and sometimes lower limits of the ver-