trends to one that predicts the distribution and abundance of individual species.

Tilman's approach is powerful and elegantly developed. In describing an approach to plant ecology that is mechanistic rather than descriptive, it outlines a productive new era for the field. The program is incomplete in the sense that it is thin on detail and emphasizes only a few kinds of interactions. However, the simplicity that makes it incomplete also makes it accessible. Ultimately, the book's greatest contribution may be as a model for an approach. As such, it will undoubtedly help shape the field in the years ahead.

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The Fradkin School

Quantum Field Theory and Quantum Statistics. Essays in Honour of the Sixtieth Birthday of E. S. Fradkin. I. A. BATALIN, C. J. ISHAM, and G. A. VILKOVISKY, Eds. Hilger, Bristol, U.K., 1987 (U.S. distributor, Taylor and Francis, Philadelphia). In two volumes. Vol. 1, Quantum Statistics and Methods of Field Theory. xxii, 697 pp., illus. Vol. 2, Models of Field Theory. xxii, 599 pp., illus. $385.

These two monumental volumes commemorating the 60th birthday of Efim Samoilovich Fradkin contain some 60 papers by more than 90 authors. Among the contributors are many of Fradkin's former students and associates at the Lebedev Physical Institute of the Soviet Academy of Science in Moscow and an even greater number of physicists worldwide. The papers give a vivid representation of the vitality of modern field theory, its virility in cross-fertilizing disciplines, and, above all, the dynamism of one of its leaders: in the words of the editors, they describe "the phenomenon that is Fradkin."

The volumes are successful in conveying a sense of the Fradkin school: how its members select and pursue problems, how they relate one problem to another, how they respond to change. There are, however, shortcomings. The collection was assembled in 1984 and 1985, and many of the papers are now out-of-date. Activity in the area of superstring theories has exploded, and the nature of many of the outstanding issues in supersymmetry and supergravity theories has changed as they have been incorporated into the larger context of superstring theories. Furthermore, the representation of approaches in subfields is incomplete. For example, in the section of conformal field theory (vol. 1, part 3) the important algebraic approaches (using Kac-Moody and Virasoro algebra) are missing, as are their implications for string field theory and two-dimensional statistical models. In the section called "quantum gravity" (vol. 2, part 3) most papers are actually about higher-derivative gravitational theories. Although these are important topics in their own right, the issues of quantum gravity proper are not well represented. On the topic of the quantization of constrained systems, an area in which the Fradkin school (Batalin, Fradkin, Fradkina, Vilkovisky) has made fundamental contributions, one would expect—but does not find—a discussion of Hamiltonian quantum gravity by one of the canonical figures (for example, Kuchař or Ashtekar). In superstring theory an obvious omission is a contribution from the Princeton, Chicago, or Caltech groups, or from the "boys next door," Polyakov and company. Here the viewpoint of the Fradkin school is, perhaps understandably, promoted at the expense of a balanced perspective.

On the other hand, universality is achieved at a global level. The thread of quantum field theory connects the ten parts (not counting the historical and biographical papers) in the two volumes, which encompass quantization of dynamical systems, effective action, conformal field theory, many-body theory and statistics, new approaches, vector guage theory and problems of unification, quantum gravity, supersymmetry and supergravity, quantum anomalies, and superstring theory. Conformal field theory is used to calculate the critical indices in a contribution by Palchik and Zaikin, and quantum field theory is applied to amorphous systems by Parisi, to polymer blends by Edwards and de la Cruz, and to lattice models by Shteingradt. Esposito shows how formal developments such as the spectral density method developed by Fradkin and Kalashnikov can be useful to statistical physics. One also sees how topological, geometric, and group theoretical considerations enter in an essential way into modern quantum field theory, for example through the use of superspace geometry in supersymmetry theory. The use of harmonic superspace to deal with extended supersymmetry and to describe ten-dimensional heterotic superstrings is discussed by Galperin and by Kallosh. Ne'eman derives a geometric model for describing the auxiliary ghost fields introduced to preserve the unitarity of a gauge theory. Quantum anomalies of various kinds (scale, chiral, Lorentz, Schwinger) are known to be related to topological structure of fields. Jackiw discusses the relevance of Chern-Simons terms and cocycles in physics; de Wit and Grisaru address the question whether anomalies affect the gauge-equivalence for theories with compensating fields; and Nepomechie and Zee discuss the phase interaction between extended objects.

These volumes contain new ideas, such as Hawking's proposal to use cosmological boundary conditions to "exorcise the ghosts" in higher-derivative gravity theories and Kaku's random calculus approach to strong gravity. New approaches are also presented in field theory: Efimov's nonlocal field theory, Adler's quaternionic algebra, Klauder's stochastic quantization, and Nambu's intriguing theory of Galois fields. Many of the papers in these volumes will likely become standard references. These include a lucid review of the gauge- and field-reparametrization–invariant effective action by de Witt, a discussion of approximate effective action by Barvinsky and Vilkovisky, and a summary of the field-theory effective-action approach to quantum superstrings by Tseytlin. These summaries of the work of Fradkin and his collaborators on different aspects of field theory, in addition to the extensive overview by Feinberg, will probably be the most useful aspect of these volumes, at least for readers outside of the Soviet Union, because much of the original work has only appeared as reports of the Lebedev Institute or preprints at other institutes (such as the 1977 CERN preprint of Fradkin and Vilkovisky on the quantization of relativistic systems with constraints).

In addition to providing a record of the work of the Fradkin school, these volumes offer the reader a rare chance to examine and appraise Fradkin's life and work. Fradkin's first principle has always been to begin at the foundation and rely on the formal structures of field theory. One already sees this in his early work on functional integral formulation, operator schemes, and Green function techniques. The effective action method has served well in problems old and new—from QED and QCD to GUTs and strings. His work on the quantization of constrained systems has enabled him to consider a full range of basic issues, from Yang-Mills to gravitation theories. His belief in conformal invariance as a fundamental attribute of all forces has led him to pay attention to conformal field theory, conformal higher-derivative gravity theory, and conformal supergravity theory. These viewpoints and outlooks, in combination with his thorough and forceful approach, his keen interest in new developments, and his resilience in preserving old values, have set the course of a luminous scientific career.

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