above all, of cryptic comments that are exciting historical puzzles crying out for explanation. If read sympathetically and corrected for its numerous typographical errors, the book could easily become the spawning ground for important new studies of the history of scientific and technical education.

The general subject of the work is of obvious significance. It was in France, and by about 1800, that modern patterns of scientific and technological education were first practiced successfully, only to be borrowed and adapted to local conditions by all other industrialized countries in the world. The Ecole Polytechnique is only the most famous of institutions that served as a model for important innovations like Liebig's introduction of the chemical laboratory into German education and the founding of West Point and Rensselaer Polytechnic Institute in this country. By making science a prerequisite for technical education, the French profoundly challenged and eventually overturned the traditional practice of learning through emulation of the accomplished master-craftsmen. More than any other single factor, the adoption of the new patterns elaborated in France was responsible for the creation of applied science as well as for the transformation of engineering from a skilled trade to a learned profession.

Artz traces the roots of this revolution principally to the mercantilistic aspirations of the emerging nation-state, and its prominence in France to the paternalistic traditions set by Colbert. The new type of educational institution was first successfully established for the military profession and for mining and civil engineers, all of whom came under the control of the state apparatus. Far from reversing the trends begun in the Old Regime, the Revolution developed them by centralizing and democratizing instructional structures and by promoting scientific and technological pursuits as a viable alternative to professions based upon a classical and clerical education. After a brief setback during the early period of the Restoration, Artz perceives a continuation of these trends, closely linked now to a political ideology of liberalism. He ends his book rather abruptly, leaving the reader unprepared to puzzle out the reasons for France's relative decline as a technological leader of the Western world despite its increasingly liberal and anticlerical policies since 1850. To solve this problem, a new work is required.

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Second Quantization and Magnetism

Methods in the Quantum Theory of Magnetism. SERGEI V. TYABLIKOV. Translated from the Russian edition (Moscow, 1965) by Albin Tybulewicz. Plenum Press, New York, 1967. 370 pp., illus. $13.50.

This is a book marked strongly by the style of the Bogoliubov school of theoretical physics; it is a book organized around and developed from a central methodological theme. Tyablikov employs the Heisenberg model of magnetic insulators as a foil for the exposition of the techniques of modern statistical mechanics, as adapted from quantum field theory. In fact a large fraction of the book is devoted to what might be called "second quantized statistical mechanics," with only occasional reference to magnetism. After an introductory descriptive chapter on magnetism, Tyablikov devotes the second chapter to second quantization, the operator form of perturbation theory, and the properties of spin operators. The third chapter treats density matrices and the Wick-Bloch-de Dominicis theorem. In the fourth chapter Tyablikov discusses the "method of approximate second quantization," which consists of the truncation of the commutation relations of the relevant operators. Finally, in the fifth chapter, Tyablikov obtains spin wave theory as an application of the "method of approximation second quantization." This chapter is the most physical in the book, with sections on spin waves in isotropic Heisenberg ferromagnets, in antiferromagnets, and in helical structures, on the ground state of the antiferromagnet, and on ferromagnetic resonance. The sixth chapter, on molecular field theory and perturbation theory at high temperatures, dramatically illustrates the highly formal structure of the book. Tyablikov first presents and proves Peierls's general theorem that the free energy is smaller than the quantity

$$-\beta^{-1}\Sigma_i \exp(-\beta < i \mid \mathrm{H} \mid i >).$$

He then presents and proves a similar theorem of Bogoliubov. Finally, applying this variational theorem to the ferromagnet, he obtains the free energy function of molecular field theory! The seventh chapter returns again to general formalism, developing the theory of thermodynamic, two-time Green's functions. As is the preference of the Russian authors, the emphasis is on the retarded and advanced Green's functions, as contrasted to the causal Green's functions which are generally favored here (the relations between the two Green's functions are sufficiently simple that no appreciable inconvenience is caused by this choice). The eighth and last chapter develops a number of applications of the Green's function methods: to magnetization curves, specific heat, resonance line shapes, neutron scattering, and similar matters.

Throughout, Tyablikov refers to recent literature in some detail, and he concludes his discussions with brief citations of other work which he has not actually covered, in a style very similar to that of the annual *Magnetic Materials Digest*. This is a unique and helpful feature of the book. In addition, the book is well written and expertly translated, so that it reads smoothly and easily.

I am afraid that the audience for this book will be limited, and that is a pity. For those who are unfamiliar with the methods it is probably preferable to study them in their simpler applications to fermion or boson systems. And for those who already know the mathematical techniques the physics in the book perhaps is spread too thinly. But for readers who have an inactive familiarity with second quantized statistical mechanics, and who are interested in magnetic insulators, this is an authoritative and lucid account of current theory.

Interest in spin waves currently is shifting to the form of the spectral weight function at elevated temperatures, particularly in the neighborhood of the Curie temperature. This interest will undoubtedly increase as inelastic neutron scattering experiments provide additional data. The theory discussed by Tyablikov provides the only known approach to this problem, and the popularity of his book is apt to increase steadily over the next few years.

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