polarization effects (Sternheimer shielding), the discussion is then extended to results of molecular-orbital calculations. This establishes the background for the widely used semiempirical approximations due originally to Townes and Dailey, in which field gradients in molecules are related to the p electron density in the σ, π, and lone-pair orbitals of the atoms. Although the validity of these simplifying assumptions is considered with care, the author has not presented a formal development of this theory. It will likely occasion some confusion among the uninitiated—compounded here by some printing errors and some expressions quoted without derivation.

A particularly worthwhile account is given, however, of the importance of the radial part of the atomic wave functions in the accurate calculation of field gradients in both atoms and molecules. Lucken raises the very interesting question as to whether the σ and π electrons contribute equally in determining molecular coupling constants because they appear to differ in their radial dependence. The evidence on this point is sparse, but it is clear that the question is crucial in aiming at an improvement in the significance of the Townes and Dailey treatment.

The solid-state physicist will find that the book, although generally quite complete, makes scant mention of dynamic processes, relaxation effects, line widths and the general problems of field gradients in ionic solids and metals. A chapter on experimental methods in NQR is notably absent. Such an account might also have helped give the reader a feeling for the physics of the experiments, which is otherwise treated rather formally.

Experimental results are summarized in the second half of the volume, with extensive references up to the end of 1967. A spurt of new work on NQR in transition metals, principally cobalt, rhenium and manganese, has not been included. The author rightly does not attempt a complete compilation of known quadrupole-coupling constants, but quite enough are quoted to serve as a useful reference work.

ELLORY SCHEMPP
Bell Telephone Laboratories

Frühgeschichte Der Quantentheorie, 1899–1913

By Armin Hermann

181 pp. Physik Verlag, Mosbach in Baden, 1969. Paper, 24 DM; cloth, 27 DM

Armin Hermann's book makes it apparent that the history of the early years of quantum theory differs markedly from the sketchy, over simplified chronicle that many of us accept and recount to our students. This was brought home to me particularly by the chapter on the contributions of the Viennese theoretical physicist Arthur Haas (1884–1941).

Although I knew Haas and had worked with him on a project of mutual interest after he came to Notre Dame University in the 1930's, I had not realized his priority in applying the quantum idea to the atom. Hermann shows that in this regard, Haas anticipated the work of Niels Bohr by more than three years. For it was Haas who first connected Planck's constant with the dynamics of the atom and who first succeeded in expressing the Rydberg constant in terms of fundamental atomic quantities.

Curiously enough, the model used by Haas was not the nuclear atom but that of J. J. Thomson; Ernest Rutherford's scattering experiment had not yet been conceived. Nevertheless, the result was valid for a planetary atom because the Haas calculation referred to electrons coursing over the *surface* of the Thomson model. As a consequence, the size of the sphere of positive charge did not affect the result.

Because of a computational error, the numerical value of the Rydberg constant turned out to be wrong, but both R and the atomic radius a_1 were of the right order of magnitude. More importantly, the method used by Haas was essentially the one Bohr later adopted.

Haas first presented his ideas in a talk before the Vienna Chemical and Physical Society in February 1910. Unfortunately this was at about the time of the winter carnival and the experimenter Ernst Lecher characterized Haas's work as a carnival spoof. Later, according to an unpublished Haas autobiography, Fritz Hasenöhrl remarked to a colleague that "Haas was not to be taken seriously because he naively tried to combine quantum theory and spectroscopy—two subjects that could not possibly have anything in common." Subsequently, Hasenöhrl reversed himself, and others were at least charitable enough to characterize Haas's thesis as "harmless."

By October 1910, H. A. Lorentz had dignified the idea as "a daring hypothesis;" and it was taken up and seriously discussed by Arnold Sommerfeld at the first Solvay Congress in 1911. Finally, in a recorded interview for the *Sources for the History of Quantum Physics* Bohr remarked that "It was quite clear [in 1912] . . . that we now had the Rutherford atom . . . and that it was regulated by the quantum. Haas had written all these things the year before, but I did not know of them . . . ." Another ironical twist in the skein of history.

Frühgeschichte der Quantentheorie, 1899–1913 is an exceedingly well documented account of the first 15 years of the quantum idea. It takes the reader from Planck's presentation of his theory of blackbody radiation in a talk before the Berlin Physical Society on 14 December 1900 to Bohr's quantum description of the hydrogen atom in March 1913.

The author, formerly engaged in high-energy physics research in Hamburg, is now professor of the history of the natural sciences and technology at the Stuttgart University. He is the editor of a recently compiled collection of the Einstein–Sommerfeld correspondence.

The book is arranged according to the work of the eight greatest contributors to the theory: Planck, H. A. Lorentz, Einstein, Stark, Haas, Sommerfeld, Nernst and Bohr each get a chapter. This ordering by men rather than by ideas makes for some repetition, but it is not troublesome. The author's intention is to make possible the reading of any one chapter independent of the rest. A comprehensive list of literature references is appended to each chapter.

Hermann maintains that one can attain a true understanding of a theory only by personally following the thought process that originally led to its establishment—the path taken by the great innovators themselves. His book proves to be an effective guide in this quest.

IRA M. FREEMAN
Rutgers University

Understanding Thermodynamics

By H. C. VanNess

103 pp. McGraw-Hill, New York, 1969. Cloth $4.95, paper $2.95

This little collection of lectures is a laudable attempt to help students who, for the first time, are encountering thermodynamics beyond the substituting-in-formula stage. The work is frankly pedagogic, and therefore shares the vulnerability to differences in taste that is characteristic in poetic or culinary works. It is *not* a text, but is rather a supplement to any standard one.

The response to the material varies even in a single reader. The opening chapter, on the First Law, is in my view an unfortunate beginning. In the attempt to show the basic character of the First Law, H. C. VanNess, professor of chemical engineering at Rensselaer Polytechnic Institute, has unwittingly violated his own precept of trying first to help the students. The treatment, to be sure, is rewarding for those who already understand its logical nature. But a beginning student must feel that the conservation of energy principle, as met in a thermodynamics course, is