

"One of the great physicists. . . and great characters"

Landau: A Great Physicist and Teacher

Anna Livanova

227 pp. Pergamon, Elmsford, N. Y., 1980.
\$22.50

Reviewed by N. D. Mermin

Imagine a *New Yorker* profile in the literary style of *Krokodil*, and you have this book. Not a biography of Lev Davidovich Landau, it is an attempt to portray the human and scientific style of this extraordinary man and the remarkable school of theoretical physics he single-handedly created and sustained. Written for the edification of youth, it suffers from that turgid sentimentality—the rapture of an elephant in heat—that seems to accompany all Soviet efforts at morally elevating prose. It should nevertheless be fascinating reading for anyone working along the trails first blazed by Landau himself, that is, for almost all physicists.

After two introductions (why two? why not, I suppose, but this is typical of the literary anarchy that follows) Anna Livanova gives us a tantalizing glimpse of Landau before the age of sixteen, when he entered the university in Leningrad. Aside from a nod to his wife (an engineer in a chocolate factory; love at first sight; a son, Igor, in 1946) the rest is, so to speak, history, and the history is told (and this is the saving grace of the book) primarily through a wonderful series of anecdotes and vignettes.

There are two main sections: an evocation of the school of Landau as it operated under the Master, and an attempt to convey in nontechnical terms the nature of his contributions to the theory of superfluid helium. The former is the better part. The weekly theoretical seminar is brought vividly to life: "Noise, shouts, questions continually interrupting and annoying the speaker, exchange of tart repartee, no hesitation in calling out 'nonsense,' 'idiotic,' 'crazy,' 'pathology,' and even more scathing comments. . . . Cossack anarchy." He presided over it like a conductor. M. I. Kaganov's assessment



is all the more powerful as an island in the sea of inspirational hyperbole: "Landau had an impressive combination of quick reactions with informed knowledge and profound understanding. I have never seen anyone like him." Entrance to the school was through the "theoretical minimum," Landau's *Gradus ad Parnassum*. Anyone could take it, but it was mastered by only 43 people between 1933 and 1961, all examined (though, toward the end, only in part) by Landau himself, the names of the survivors being duly inscribed by him in a book.

I was interested to learn that Landau suffered from writer's block. It is well known that Evgenii Lifshitz single-handedly cared for the literary side of the *Course of Theoretical Physics*, but "even the papers containing only his work, without co-workers, were written for him by Lifshitz, from the middle 1930s until the end." In an Appendix (one of the high points of the book, together with a marvelous preface by

Rudolf Peierls) Lifshitz tells us that Landau's "insuperable desire for brevity and clarity of expression forced him to devote so much time to the choice of each phrase, that ultimately the task of writing anything, be it a scientific article or a personal letter, became a torment." Could this be the origin of that tight and terse style that characterizes to this day the writings of the Soviet school?

It is the many views of the man and his way of working that give the book its real power. Aspects of the story that Soviet youth might find unedifying, however, receive a curious treatment. A single remark hints at the extent of Landau's celebrated problems with the Stalin regime: "In one very burdensome year Landau reconstructed for himself the theory of shock waves. He made all the calculations mentally, without paper and pencil." Also in the words-of-one-syllable department is the account of the termination of Petr Leonidovich Kapitza's Cambridge career: "Arriving on holiday in the summer of 1934, he learned that he must now work in the Soviet Union." Kafka could not have put it better.

In spite of—perhaps, in some ways, because of—its limitations, this is an intriguing and strangely moving book. It abounds with gems: a short appearance by one Genia Kannegiesser, the belle of Leningrad physics, now Lady Peierls; Landau's 50th birthday party ("Everybody's fifty now, except the kids"); Landau's classification of conversations, and of physicists (the latter on a scale of 1 to 5, Einstein rating $\frac{1}{2}$, Bohr and the other founding fathers 1, Landau himself, $2\frac{1}{2}$ (but promoted later in life to 2), and the 5's—"pathologists"); in keeping with this scheme, Landau, in thoughtful reply to a young lady: "No, I'm not a genius. Bohr is, and Einstein is. I'm not. But I'm very talented. . . . Yes, I'm very talented."

One finishes the book yearning for a real biography. If people are not already at work on one, someone should begin while Landau is still so vibrantly alive in the memories of his friends and pupils, those fortunate enough to have

known (in Peierls's words) "one of the great physicists and one of the great characters of our generation."

* * *

N. D. Mermin is professor of physics at Cornell University. Struggling to qualify as a 44, he has made occasional contributions to the theory of phase transitions and liquid helium.

Energy and Human Needs

S. C. Curran, J. S. Curran

330 pp. Halsted (Wiley), New York, 1979. \$24.95

Energy and Human Needs bills itself as being for the serious reader, to leave "him in a position in which he can arrive at his own considered judgement." This is an area in which the layperson needs information. Sadly, this book is no help; though it was published in 1979, it leaves the reader bemused and unable to understand the discussions of the last decade. I am reminded of the story of a German poet who was asked where he would like to spend the Last Day. He replied London, since it always took London a decade to catch up with the rest of the world.

The thesis of this book is that without growth in energy supply, economic growth will cease: "How can the continuous growth of energy consumption, at the high rate maintained during the past fifty years, be sustained?" The authors neither look at what energy is used for, nor why demand grew. They overlook elementary energy economics, in which demand as well as supply plays a leading role. Given this position, they are forced to present nuclear power as the solution:

In 1971 Chauncey Starr [of the Electric Power Research Institute] probably spoke for the majority of scientists and engineers, and possibly for the public at large when he said, "there is no question that nuclear power is a saving technical development for the energy prospects of mankind."

Times have changed. In the February 1981 special energy issue of *National Geographic* magazine Starr is quoted as saying, "Only conservation can be implemented quickly enough to make a substantial difference." The idea of energy growth as *a priori* justified has faded, to be replaced by a concept of energy as just one of a number of inputs to the economy. Where more efficient devices or processes are available, they may substitute for energy growth, leading to decreased energy use with increased GNP. The flow of ideas has left this book high and dry.

Beached ideas may be of interest;

many an elegant theory has been slain by a stubborn fact. On the basis of this book, however, the cause of death was simply lack of brain. The analysis presented is incompetent, as illustrated by the discussion of the development of nuclear power in the UK. The move from Magnox to advanced gas reactors (AGR) is described, but without any exploration of why it happened. There is no mention of the enormous difference in burnup between the Magnox uranium metal fuel and the AGR uranium oxide fuel. To further complicate matters, the pressurized water reactor is falsely stated as using metal fuel, while the boiling water reactor is correctly stated as using oxide fuel. Compounding the analysis is armchair pontification. Small power plants are dismissed because they "offend the aesthetic sensibilities of many more country and urban dwellers," and as a global solution to acid rain "the acidity of waters in rivers and lakes might be corrected by adding lime."

Finally, a word must be said about the sources of information cited. They range from such tracts as *The Health Hazards of Not Going Nuclear*, by Petr Beckmann, to newspapers such as *The [London] Times*, and *The Scotsman*, through popular scientific literature such as *Scientific American*, finally to literature such as *Nature* and *Science*. The layperson could easily read most of these in the original.

The information gap between professionals and the public is not served by this type of regurgitation. The book simply cannot be recommended for any audience.

PETER CLEARY

Lawrence Berkeley Laboratory

Theory of Meson Interactions with Nuclei

J. M. Eisenberg, D. S. Koltun

415 pp. Wiley, New York, 1980. \$39.95

In the last fifteen years a new specialty in nuclear physics, "intermediate-energy physics," has matured to the point that it is being pursued with great intensity at meson factories, laboratories and theorists' desks. This specialty can be defined as the study of phenomena involving nuclei and mesons or nuclei and nucleons at energies higher than those customary for nuclear physics. Its goal—in addition to increasing the understanding of these phenomena—is to elucidate better the structure of nuclei and to discover new physics that occurs in a multinucleon environment.

Theory of Meson Interactions with Nuclei by Judah Eisenberg and Daniel Koltun describes some of the theoretical methods used in intermediate-energy

physics. Because of its clear, fairly short, yet pedagogically strong discussion of the basis for the working tools of the specialty, it should be a valuable text for advanced graduate students or new (and some present) workers in the field. Because by design it is neither a comprehensive text nor a review, the serious reader will have to look elsewhere for the details of the present state of the art (a task made easier by this readable and thoughtful volume). The authors are well suited for their task: Both have been popular and engaging rapporteurs at conferences; both have conducted original research in many of the topics covered in the text; and both have previously written works of considerable pedagogical value.

The text concentrates on the description of pion (and to a much lesser extent, kaon and nucleon) interactions with nuclei provided by multiple-scattering theory. Where the conventional Schrödinger equations dynamics may no longer be adequate is noted, for example, in the influence of meson absorption on elastic scattering. In fact, the combination of quantum field theory, multiple-scattering theory, many-body physics techniques, nuclear physics, and particle physics presented here epitomizes what makes this specialty appealing. The authors present an excellent discussion of the theory of the two-body (meson-nucleon) and three-body (meson-deuteron) problems, a treatment which complements G. E. Brown and A. D. Jackson's *The Nucleon-Nucleon Interaction*. They are then able to contrast their discussion of multiple scattering from a many-nucleon system to the simpler three-body problem and relate the meson-nucleus optical potential to the elementary two-body physics. They also cover comprehensively both the approximations necessary for deducing some popular optical potentials and the possible importance of higher-order corrections not usually included in the popular potentials. The text is rounded out by a clear description of the "P & Q" formulation of the optical potential and of the delta-hole description of meson-nucleus interactions.

Although the book is strong in formalism, its description of phenomenological and computational aspects of the field is uneven. A student would need the supplements provided by the texts by W. O. Lock and D. F. Measday or R. J. Barrett and D. F. Jackson, or some of the reviews in *Physics Reports*, *Annual Reviews*, and so forth. Beyond that, the authors do not appear to provide the same level of appreciation or degree of understanding of the applications of the theory as they provide for its derivation. In particular, their "results" appear too simple and somewhat