HIROOMI UMEZAWA, GIUSEPPE VITIELLO: *Quantum Mechanics*. Napoli: Bibliopolis, 1985. (Monographs and Textbooks in Physical Science, Lecture Notes, vol.1.) ix, 278 pp., figures and index.

Today, after the final death of Dirac and more than 60 years after the invention of Heisenberg's 'Matrizenmechanik' and Schrödinger's 'Wellenmechanik' and the latter's realization of their physical equivalence often referred to as 'Quantenmechanik' (Quantum Mechanics, QM), the generation of theory-founders is immortal. And their congenial pupils who took part in the painstaking intellectual struggles for a physical understanding of new concepts like 'state vector' or 'spin' have either died too, or are beyond the age of writing textbooks about quantum mechanics. The teachers of today's students have already been educated in a phase of theory development where special problems of application and extension to other domains (esp. quantum field theory) were treated with the tools and in the framework of an unquestioned, settled, 'paradigmatic' QM. The selection of topics that are discussed (or omitted) in these lecture notes as well as the way in which these are presented demonstrates this modern style of teaching QM.

The main author of the lecture notes under review here is the Japanese physicist Hiroomi Umezawa (now at the Univ. of Alberta, Canada); the Italian physicist Giuseppe Vitiello (now at the Univ. of Salerno, Italy), attended Umezawa's lectures and assisted him in preparing the manuscript which is reproduced in typewritten form and supplied with handdrawn figures.

As claimed in their Preface, they indeed "present in a comprehensive way many mathematical aspects of the theory which have become part of every day luggage of the theoretical physicist", but contrary to their assurance, the "underlying physical concepts" aren't dealt with "much stress". The publishers do recommend these lecture notes "for graduate and undergraduate students with a basic knowledge of general physics and elementary calculus", but I can't imagine any undergraduate student being able to develop physical understanding and insight into what's going on in QM after having read this book only. Central concepts such as *e.g.* 'state vector' and 'observable' are introduced en passant, with short, sometimes even insufficient information about their content. Let me give one example only: that "any observable is associated with an hermitian operator" (p. 51, see also p. 95 as definition) isn't a sufficient characterization of the concept 'observable', but only the formal prerequisite. Next, the subsequent introduction of the concept of 'state vector' is announced with the comment that it will be shown that "a state vector can always be expressed as superposition of a complete set of eigenvectors [extra spacing, stemming from erased words] of an observable". But the promised passage (94ff.) doesn't illuminate the reader unless he already knew what is meant before starting to read this book.

I do not want to imply that the authors should have included more historical material – for modern lecture notes about QM it seems to me to be all right deciding not to go "into the details of the history" (p. 29), since there are enough books solely devoted to its history by now [1]. And although the name of Niels Bohr isn't mentioned throughout the book, there are a couple of references to interesting and less well-known papers, *e.g.* to Duane's explanation of the Davisson-Germer-experiment as particle-scattering for an illustration of the wave-particle dualism (p. 33), or to Kossel's anticipation of Pauli's exclusion principle in 1914 (p. 209f.). This strategy once more shows the authors' aim to write a textbook suited to *supplement, not to substitute* the standard textbooks with standard references.

To sum up, the aim of these lecture notes is not to motivate the introduction of central QM-concepts but to give a condensed survey about the mathematical beauty of the theory

[1] Such as Jammer's *Conceptual Development of QM*, Mehra/Rechenberg's multi-volume oeuvre and many others.

formulated with them. While some basic standard textbook topics are missing [2], it instead contains useful supplementary material [3] and many topics only marginally dealt with in typical textbooks are discussed in great detail [4], often with stringent mathematical derivations usually omitted. Therefore, their lecture notes are helpful for a physicist's second reading of QM on an advanced level to fill up gaps left by more elementary textbooks.

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[2] *E.g.* the quantum numbers n, l, m in the H-atom problem are introduced in a purely formal way without any mentioning of their spectroscopic origin (p. 125).

[3] As *e.g.* a treatment of the Feynman pathintegral formulation of QM in Schrödinger representation (p. 167ff.), references to sources on the convergence of the Born expansion in elastic scattering, or their treatment of the Lamb-shift on pp. 131-137.

[4] See, *e.g.*, the instructive remarks about the adiabatic trick in perturbation approximations (p. 155) or about the 'unitary trick' for finding bounded operators connected with p and q as a set of unbounded operators (p. 100).