3. M. Frazier and B. Jawerth, *Decompositions of Besov spaces* (to appear).

4. S. M. Nikol'skij, *Approximation of functions of several variables and imbedding theorems*, Grundlehren Math. Wiss., Band 205, Springer-Verlag, 1975.

5. S. Krantz, *Review of "Integral representations of functions and imbedding theorems" by Oleg V. Besov*, Bull. Amer. Math. Soc. (N.S.) **2** (1980), 216–222.

6. J. Peetre, *New thoughts on Besov spaces*, Duke Univ. Math. Ser., Durham, N. C., 1976.

7. M. Taibleson, *Review of "Approximation of functions of several variables and imbedding theorems" by S. M. Nikol'skiĭ*, Bull. Amer. Math. Soc. **83** (1977), 335–343.

8. H. Triebel, *Interpolation theory, function spaces, differential operators*, North-Holland, 1978.

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*Probabilistic and statistical aspects of quantum theory*, by A. S. Holevo, North-Holland Series in Statistics and Probability, Vol. 1, North-Holland Publishing Company, Amsterdam, 1982, xii + 312 pp., $85.00, Dfl. 225.00. ISBN 0-444-86333-8

It has been known for over sixty years that quantum mechanics is, by its very nature, a statistical theory. The predictions of quantum mechanics are probabilistic and cannot be exact. However, the probability theory underlying quantum mechanics is not classical probability theory. It is a different kind of probability theory, which is phrased in terms of operators on a Hilbert space. Operators play the role of probability measures and random variables in quantum probability theory. Since these operators need not commute, quantum probability is sometimes called a noncommutative probability theory. This noncommutativity is the main difference between the two theories. The present book gives an account of recent progress in the statistical theory of quantum measurement stimulated by new applications of quantum mechanics, particularly in quantum optics. The main stress of the book is on the recently developed field of quantum estimation.

Quantum probability theory is attracting the attention of an increasing number of researchers. It is located at a junction between physics (in particular, quantum mechanics) and mathematics. It combines a blend of the abstract and the practical. It has been investigated by philosphers, physicists, mathematicians, electrical engineers, and computer scientists. There are interesting lines of research in this field for mathematicians who know little about quantum mechanics. For the mathematician there is a fascinating interplay between probability theory and functional analysis. There are also applications in this field involving group representations, operator algebras, partial differential equations, Schwartz distributions, functional integration, lattices, algebraic logic, and many others. This field was first presented in a rigorous operator-theoretic setting by von Neumann **[9]**. Later books which emphasize its geometric and logical aspects are **[1, 4, 5, 6, 8]**, and still more recent books in which probabilistic methods are treated are **[2, 3, 7]**. The present book is the first to emphasize the quantum estimation problem.