# STATISTICAL STRUCTURE OF QUANTUM THEORY

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An introductory lecture course

**Abstract**

The course presents some basic concepts and rigorous results of a new scientific discipline – *quantum information theory*. It starts with a thorough reconsideration of the mathematical foundations of quantum theory from the modern statistical/information theoretic viewpoint, requiring only a minor prior knowledge of standard quantum mechanics. The concepts of quantum *state*, *observable* and (irreversible) *dynamics* of a quantum system are carefully discussed and appropriately generalized. A central notion of quantum communication *channel* is explained with a number of examples. The mathematical framework of the lectures is operator (matrix) theory in finite dimensional Hilbert space, so that knowledge of a basic linear algebra, along with basic probability, would be a sufficient technical prerequisite.

# References

[1] A. S. Holevo, *Statistical structure of quantum theory*, Springer-Verlag, Berlin–NY, 2001.

[2] M. A. Nielsen, I. Chuang, *Quantum Computation and Quantum Information*. Cambridge University Press, 2000.

[3] M. Hayashi, *Quantum information: an introduction*, Springer, Berlin 2006.