

OPERATOR ALGEBRAS AND QUANTUM THEORY

A Fall 2017 topics course proposal

Mathematical language of basic quantum mechanics is Hilbert space theory, including spectral theory of operators. The more complete treatment of quantum theory requires more sophisticated tools. It is not enough to study one, or a handful of self-adjoint operators and their spectral decompositions: one needs to look at whole families of such operators, forming an algebra. The appropriate concept turns out to be that of a von Neumann algebra. This course will develop the theory of von Neumann algebras from scratch, assuming only introductory knowledge of Hilbert spaces. I will concentrate on the aspects of the theory which are important for quantum physics, but the course can also be taken as a topics course in functional analysis, with the intrinsic beauty of the subject as the main motivation. I have not decided on a single text and the material will be combined from various sources, including:

O. Bratteli, D. Robinson: Operator algebras and quantum statistical mechanics

A. Guichardet: Special topics in topological algebras

S. Stratila, L. Zsidó: Lectures on von Neumann algebras

Please let me know if you have any questions or want to talk about the course.

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