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Quantum ergodicity under more relaxed conditions in quantum systems

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Abstract

The first attempt to describe statistical mechanics based on quantum theory was made by von Neuman [1,2]. Quantum mechanics' relatively rigorous mathematics seemed to be an appropriate framework in which one could study ergodic hypothesis. As a result, he managed to prove a certain theorem he suggested as ergodic hypothesis within this framework even before formulating this hypothesis mathematically in classical statistical mechanics. von Neuman's theorem suggested that his statement holds if the Hamiltonian via which the closed system evolves is non-degenerate and non-resonance, alongside a certain condition on the dimension of Gibbs' cells. In this work we revisit a general property of closed quantum systems known as normal typicality and propose a statement of Ergodic hypothesis based on this property. We also show that conditions imposed before on a system to be normally typical (non-degeneracy and non-resonance conditions on the Hamiltonian) can be relaxed.

References

- [1] J. von Neuman, Proc. Natl. Acad. Sci. U. S. A. **18**, 72 (1932).
- [2] J. L. Lebowitz, C. Mastrodonato, R. Tumulka, and N. Zanghi, Proc. R. Soc. London, Ser. A **46**, 3203 (2010).