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Many-body localization in disordered spin and Hubbard chains [1]

Peter Prelovšek[1]

[1] *Jožef Stefan Institute, Ljubljana, Slovenia*
[2] *Faculty of Mathematics and Physics, University of Ljubljana, Ljubljana, Slovenia*

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Many-body localization (MBL) is the quantum phenomenon involving the interplay of disorder and particle interaction, characterized by the lack of thermalization and d.c. transport at finite temperatures. Recently MBL has been intensively investigated theoretically within one-dimensional many-body models, and experimentally in optical lattices of cold atoms, but might be relevant also for materials with spin chains. In the talk the evidence for the transition to the MBL will be presented as it emerges from numerical and analytical investigations on the one-dimensional disordered spin and Hubbard models. Within a random-field spin chain dynamical nonergodic behaviour of local correlations can be used as the order parameter for the MBL phase, where it can be well treated also via the reduced-basis approach starting with Anderson localized basis, while the ergodic-nonergodic transition is best characterized by the universal critical dynamics. On the other hand, an analogous investigation of the Hubbard chain indicates that disordered potential alone does not induce full MBL, but only charge localization, while spin correlations remain ergodic even for large disorder. Similar conclusion follows from the construction and counting of independent local integrals of motion.

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