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Abstract for an Invited Paper
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Universal dynamics across many-body localization phase transition

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Many body localization allows quantum systems to evade thermalization owing to the emergence of extensive number of local conserved quantities [1,2]. Many-body localized (MBL) systems exhibit universal dynamics, qualitatively distinct from dynamics in ergodic systems. In this talk I will survey recent progress in understanding the properties of the MBL phase, which follow from the picture of local conserved quantities. In particular, I will discuss the power-law relaxation of local observables [3], which gives an experimentally observable signatures of the MBL phase. In the second part of my talk, I will demonstrate how the delocalization transition can be probed by characterizing the breakdown of local conservation laws. Using statistics of matrix elements of local operators, I will introduce an analogue of many-body Thouless conductance which probes the response of the system to local perturbations [4]. Its scaling allows one to locate the MBL transition, and predicts the onset of logarithmically slow transport at the MBL transition, consistent with results from the renormalization group [5,6]. In addition, I will demonstrate how the properties of matrix elements govern the crossover of the level statistics across the MBL transition, and relate to the dynamics in the ergodic phase. I will conclude by discussing experimental implications and open challenges in understanding the MBL transition.

[1] M. Serbyn, Z. Papic, D. A. Abanin, Phys. Rev. Lett. 110, 260601 (2013); Phys. Rev. Lett. 111, 127201 (2013).

[2] D. A. Huse, V. Oganesyan, Phys. Rev. B 90, 174202 (2014).

[3] M. Serbyn, Z. Papic, D. A. Abanin, Phys. Rev. B 90, 174302 (2014).

[4] M. Serbyn, Z. Papic, D. A. Abanin, arXiv: 1507.01635.

[5] R. Vosk, D. A. Huse, E. Altman, Phys. Rev. X 5, 031032 (2015).

[6] A. C. Potter, R. Vasseur, S. A. Parameswaran, Phys. Rev. X 5, 031033 (2015).