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How to detect many body localization in experiments RAHUL NANDKISHORE[1], Princeton University — The standard theory of many body localization (MBL) is framed in terms of exact eigenstates of perfectly isolated quantum systems. However, exact eigenstates can neither be prepared nor measured in the laboratory, and perfectly isolated quantum systems are equally unrealizable. In this talk I explain how MBL can be reformulated without invoking exact eigenstates or perfect isolation. I introduce a way to think about MBL in terms of correlation functions of local operators, evaluated in arbitrary states. This perspective reformulates the standard theory in terms of (in principle) experimentally measurable quantities. Moreover, this "spectral" perspective on MBL is far more robust than the conventional "eigenstate" perspective. Eigenstates thermalize upon arbitrarily weak coupling to an external environment, but the correlation functions (which are the physical observables) continue to show signatures of MBL as long as the coupling to the environment is weaker than the characteristic energy scales in the system Hamiltonian. I also show how this "spectral perspective" can be used to reveal additional structure in the MBL phase, and to make progress on otherwise intractable theory problems.

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