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**Early Breakdown of Area-Law Entanglement at the Many-Body Delocalization Transition** TRITHEP DEVAKUL, Princeton University, RAJIV SINGH, University of California, Davis — We introduce the numerical linked cluster expansion as a controlled numerical tool for the study of the many-body localization transition in a disordered system with continuous nonperturbative disorder. Our approach works directly in the thermodynamic limit, in any spatial dimension, and does not rely on any finite size scaling procedure. We study the onset of many-body delocalization through the breakdown of area-law entanglement in a generic many-body eigenstate. By looking for initial signs of an instability of the localized phase, we obtain a value for the critical disorder, which we believe should be a lower bound for the true value, that is higher than current best estimates from finite size studies. This implies that most current methods tend to overestimate the extent of the localized phase due to finite size effects making the localized phase appear stable at small length scales. We also study the mobility edge in these systems as a function of energy density, and we find that our conclusion is the same at all examined energies. Work based on Phys. Rev. Lett. 115, 187201.

Trithep Devakul
Princeton University

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