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Representing highly excited eigenstates of many-body localized systems using matrix product states BRYAN CLARK, Kavli Institute for Theoretical Physics, University of California at Santa Barbara; Physics Department, University of Illinois at Urbana Champaign, DAVID PEKKER, Department of Physics, Caltech; Department of Physics and Astronomy, University of Pittsburgh — Many-body localization remains a mysterious topic largely due to the lack of tools for describing highly excited eigenstates of interacting quantum systems. Matrix Product States (MPS) are a family of low-entanglement variational ansatz. Typically, excited states of many-body systems exhibit volume law scaling of the entanglement entropy and therefore cannot be efficiently described by an MPS of low bond-dimension. In many-body localized systems, though, the eigenstates generically have area law scaling suggesting the existence of an efficient MPS representation. Here we investigate how to to find these states. Our achievement opens a new numerical window on many-body localization.

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