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**Exploring one particle orbitals in Many-Body Localized systems with SIMPS** BENJAMIN VILLALONGA, XIONGJIE YU, DAVID J. LUITZ, BRYAN K. CLARK, University of Illinois at Urbana-Champaign — A disordered interacting quantum system can give rise to what is known as a Many-Body Localized (MBL) phase. We study the properties of the natural single particle orbitals given by the eigenvectors of the one particle density matrix of single MBL eigenstates of a system of interacting spinless fermions in one dimension, subject to a random potential. Using a recently proposed matrix product state method, SIMPS [X. Yu, et al., 2015], to target highly excited many-body states, we are able to obtain accurate results for large system sizes.

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