Many-body Localization Transition in Rokhsar-Kivelson-type wave functions[1] XIAO CHEN, XIONGJIE YU, University of Illinois at Urbana-Champaign, GIL YOUNG CHO, Korea Advanced Institute of Science and Technology, BRYAN CLARK, EDUARDO FRADKIN, University of Illinois at Urbana-Champaign — We construct a family of many-body wave functions to study the many-body localization phase transition. The wave functions have a Rokhsar-Kivelson form, in which the weight for the configurations are chosen from the Gibbs weights of a classical spin glass model, known as the Random Energy Model, multiplied by a random sign structure to represent a highly excited state. These wave functions show a phase transition into an MBL phase. In addition, we see three regimes of entanglement scaling with subsystem size: scaling with entanglement corresponding to an infinite temperature thermal phase, constant scaling, and a sub-extensive scaling between these limits. Near the phase transition point, the fluctuations of the Renyi entropies are non-Gaussian. We find that Renyi entropies with different Renyi index transition into the MBL phase at different points and have different scaling behavior, suggesting a multifractal behavior.

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