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Dynamical quantum phase transitions in random spin chains RONEN VOSK, EHUD ALTMAN, Weizmann Institute of Science — Quantum systems can exhibit a great deal of universality at low temperature due to the structure of ground states and the critical points separating distinct states. On the other hand, quantum time evolution of the same systems involves all energies and it is therefore thought to be much harder, if at all possible, to have sharp transitions in the dynamics. In this paper we show that phase transitions characterized by universal singularities do occur in the time evolution of random spin chains. The sharpness of the transitions and integrity of the phases owes to many-body localization, which prevents thermalization in these systems. Using a renormalization group approach, we solve the time evolution of random Ising spin chains with generic interactions starting from initial states of arbitrary energy. As a function of the Hamiltonian parameters, the system is tuned through a dynamical transition, similar to the ground state critical point, at which the local spin correlations establish true long range temporal order. As in ground state quantum phase transitions, the dynamical transition has unique signatures in the entanglemenent properties of the system.

Ronen Vosk
Weizmann Institute of Science

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