Non-ergodic and insulating phases of Josephson Junctions Arrays

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We show that chaotic dynamic may not result in thermalization in certain bosonic model that can be realized as an array of Josephson junctions. This model exhibits a many-body localization transition which separates insulating and metallic phases. Localization prevents the system to show thermal behaviour in the Many-Body localized phase. We argue that there is an intermediate region in the phase diagram, between Many-Body localized and ergodic phases, in which the system behaves as a metal but exhibits non-thermal properties.


Figure 1: Phase diagram of one dimensional Josephson junction array. The MBL phase transition separates the non-ergodic bad metal with exponentially large but finite resistance from the insulator with infinite resistance. Cooling the non-ergodic bad metal transforms it into a good ergodic metal. The points show approximate positions of the effective $T/E_J$ for the quantum problem with a finite number of charging states. The red stars indicate insulator, blue circles bad metal, and squares good metal.