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Extended coherently delocalized states in a frozen Rydberg gas
MATTHEW EILES, GHASSAN ABUMWIS, ALEX EISFELD, Max Planck Institute for the Physics of Complex Systems — The long-range dipole-dipole interaction can create delocalized states due to the exchange of excitation between Rydberg atoms. We show that even in a random gas many of the single-exciton eigenstates are surprisingly delocalized, composed of roughly one quarter of the participating atoms. We identify two different types of eigenstates: one which stems from strongly-interacting clusters, resulting in localized states, and one which extends over large delocalized networks of atoms. These two types of states can be excited and distinguished by appropriately tuned microwave pulses, and their relative contributions can be modified by the Rydberg blockade and the choice of microwave parameters.

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