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Many-body localization in quantum spin glasses

In this presentation I will compare glassiness and localization in their role as obstructions for (respectively) thermal annealing and quantum annealing by relating some recent results of my research. In particular, we studied the Ising spin glass model in a transverse field defined over a regular random graph as a test-case for a problem that exhibits both quantum glassiness and localization. Using the forward approximation we computed numerically the critical line where localization sets in (the "mobility edge") and found it to be distinct from the critical line of the glassy phase. Consequently, the glassy phase is split into a delocalized region where tunnelling amplitudes are expected to be nonzero in the thermodynamical limit, and a localized region where tunnelling is suppressed. This suggest that in the glassy, delocalized region quantum annealing will perform well while thermal annealing will fail.