Abstract

Plenary

David Gosset (University of Waterloo)

Entanglement subvolume law in 2D frustration-free spin systems

Joint with Anurag Anshu and Itai Arad

The area law conjecture asserts a bound on the entanglement of the ground state of a quantum spin systems with local interactions on a d-dimensional lattice and a nonvanishing spectral gap. It states that the entanglement entropy of the ground state between any region A and its complement should be proportional to $|\partial A|$, the area of the boundary of the region. This contrasts with the naive upper bound which is proportional to the volume $|A|$. Hastings proved the area law conjecture for the special case of 1D spin systems, but the 2D case remains open. In this talk I will consider the case of frustration-free 2D systems, and describe the first *subvolume* bound on entanglement entropy of the ground state. In particular, for any bipartition of the grid into a rectangular region A and its complement, we show that the entanglement entropy is upper bounded as $\tilde{O}(|\partial A|^{5/3})$. In contrast with previous work, our bounds rely on the presence of a nonvanishing local (rather than global) spectral gap of the Hamiltonian. We prove our results using a known method which bounds the entanglement entropy of the ground state in terms of certain properties of an approximate ground state projector (AGSP). To this end, we construct a new AGSP which is based on a robust polynomial approximation of the AND function and we show that it achieves an improved trade-off between approximation error and entanglement.