Mathematics and CS Seminar

Random variables, entanglement and nonlocality in infinite TI systems

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We consider the problem of certifying entanglement and nonlocality in one-dimensional TI infinite systems when just averaged near-neighbor correlators are available. Exploiting the triviality of the marginal problem for 1D TI distributions, we arrive at a practical characterization of the near-neighbor density matrices of multi-separable TI quantum states. This allows us, e.g., to identify a family of separable two-qubit states which only admit entangled TI extensions. For nonlocality detection, we show that, when viewed as a vector in R^n, the set of boxes admitting a TI classical extension forms a polytope, i.e., a convex set defined by a finite number of linear inequalities. We prove that some of these inequalities can be violated by distant parties conducting identical measurements on an infinite TI quantum state.

Our attempts at generalizing our results to TI systems in 2D and 3D lead us to the (to our knowledge, virtually unexplored) problem of characterizing the marginal distributions of infinite TI systems in higher dimensions. In this regard, we show that, for random variables which can only take a small number of possible values (namely, bits and trits), the set of nearest (and next-to-nearest) neighbor distributions admitting a 2D TI infinite extension forms a polytope. This allows us to compute exactly the ground state energy per site of any classical nearest-neighbor Ising-type TI Hamiltonian in the infinite square or triangular lattice. Remarkably, some of these results also hold in 3D.
In contrast, when the cardinality of the set of possible values grows (but remains finite), we show that the marginal nearest-neighbor distributions of 2D TI systems are not described by a polytope or even a semi-algebraic set. Moreover, the problem of computing the exact ground state energy per site of arbitrary 2D TI Hamiltonians is undecidable.

Monday, February 6, 2017 11:00am - 01:00pm

Seminar room Big Ground floor / Office Bldg West (I21.EG.101)

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