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Quantum Many-Body Theory: Tensor Network Approach and Applications to Information Compression GEORGE DAVILA, EDUARDO MUCCIOLO, University of Central Florida — Tensor Networks may be used to describe the entanglement spectrum of Quantum Many-Body (QMB) systems in a manner which tells us about the entanglement between subsystems without loss of the description of the entire system. One such approach for 1D entanglement in gapped systems is the Matrix Product State (MPS) approach. While MPS-derived algorithms give us the entanglement spectrum for a QMB system, they similarly describe the singular value spectrum, corresponding to various patterns, in more general data sets. The MPS representation of any given set of data will therefore tell us about underlying structures in the data. Data sets which contain dominant patterns (i.e. localized subsystems) are compressible. Random sets (i.e. thermalized systems) are, to the contrary, incompressible. Not only can compressible systems be stored more compactly, but they also have a polynomial number of degrees of freedom and thus may be constructed (or deconstructed) via a finite quantum circuit array in polynomial time. Here we construct MPS representations for samples of DNA. We show that individual genes are relatively randomly structured and that one can exploit the properties of DNA so as to compress combinations of samples from multiple members of a given species.

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