Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

"Random tensor networks and holographic coherent states"

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Abstract: Tensor network is a constructive description of many-body quantum entangled states starting from few-body building blocks. Random tensor networks provide useful models that naturally incorporate various important features of holographic duality, such as the Ryu-Takayanagi formula for entropy-area relation, and operator correspondence between bulk and boundary. In this talk I will overview the setup and key properties of random tensor networks, and then discuss how to describe quantum superposition of geometries in this formalism. By introducing quantum link variables, we show that random tensor networks on all geometries form an overcomplete basis of the boundary Hilbert space, such that each boundary state can be mapped to a superposition of (spatial) geometries. We discuss how small fluctuations around each geometry forms a "code subspace" in which bulk operators can be mapped to boundary isometrically. We further compute the overlap between distinct geometries, and show that the overlap is suppressed exponentially in an area law fashion, in consistency with the holographic principle. In summary, random tensor networks on all geometries form an overcomplete basis of "holographic coherent states" which may provide a new starting point for describing quantum gravity physics.

References

[1] Patrick Hayden, Sepehr Nezami, Xiao-Liang Qi, Nathaniel Thomas, Michael Walter, Zhao Yang, JHEP 11 (2016) 009
[2] Xiao-Liang Qi, Zhao Yang, Yi-Zhuang You, arxiv:1703.06533

12:00pm
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Host: Xiao-Gang Wen