

HARVARD UNIVERSITY
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Tuesday, June 9, 2020, at 10:00 (Boston)
15:00 (UK/Eire) 16:00 (C.Europe) 22:00 (China)

Mathematical Picture Language Seminar
Zoom at: <https://harvard.zoom.us/j/779283357>

“The sign problem and its relation to the spectral gap of quantum many-body systems”

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Abstract: The partition function of a quantum system without a sign problem can be represented by a path integral in which every amplitude is efficiently computable and nonnegative, which is a substantial simplification from the interference of complex amplitudes in the general quantum case. In quantum computing the presence of a sign problem has been recast as a virtue, because it helps to increase the complexity of the quantum system beyond the range of classical simulation. This is particularly important for quantum adiabatic algorithms based on ground states, where the run time depends on the scaling of the spectral gap above the ground state. This motivates us to study the relation of the sign problem to the spectral gap, using methods such as random matrix theory and spectral graph theory. The latter relates the discrete geometry of ground states (in a world where vertices are basis elements and edges are Hamiltonian matrix elements) to the level spacings in the low energy spectrum using the higher-order signed Cheeger inequalities. This talk will include analytical results from 1703.10133 and 2004.07681.

