Abstract:

The derandomization of MA, the probabilistic version of NP, is a long standing open question. In this talk, we connect this problem to a variant of another major problem: the quantum PCP conjecture. Our connection goes through the surprising quantum characterization of MA by Bravyi and Terhal. They proved the MA-completeness of the problem of deciding whether the groundenergy of a uniform stoquastic local Hamiltonian is zero or inverse polynomial. We show that the gapped version of this problem, i.e. deciding if a given uniform stoquastic local Hamiltonian is frustration-free or has energy at least some constant, is in NP. Thus, if there exists a gap-amplification procedure for uniform stoquastic Local Hamiltonians (in analogy to the gap amplification procedure for constraint satisfaction problems in the original PCP theorem), then MA = NP (and vice versa). Furthermore, if this gap amplification procedure exhibits some additional (natural) properties, then P = RP. This is a joint work with Dorit Aharonov.