



Mathematics and CS Seminar

Concentration of measure for thermal distributions of quantum states

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We generalize Lévy's Lemma, a concentration-of-measure result for the uniform probability distribution on high-dimensional spheres, to a more general class of measures, so-called GAP measures. For any given density matrix ρ on a separable Hilbert space H , $\text{GAP}(\rho)$ is the most spread out probability measure on the unit sphere of H that has density matrix ρ and thus forms the natural generalization of the uniform distribution. We prove concentration-of-measure whenever the largest eigenvalue $\|\rho\|$ of ρ is small. With the help of this result we generalize the well-known and important phenomenon of "canonical typicality" to GAP measures. Canonical typicality is the statement that for "most" pure states ψ of a given ensemble, the reduced density matrix of a sufficiently small subsystem is very close to a ψ -independent matrix. So far, canonical typicality is known for the uniform distribution on finite-dimensional spheres, corresponding to the micro-canonical ensemble. Our result shows that canonical typicality holds in general for systems described by a density matrix with small eigenvalues. Since certain GAP measures are quantum analogs of the canonical ensemble of classical mechanics, our results can also be regarded as a version of equivalence of ensembles. The talk is based on joint work with Stefan Teufel and Roderich Tumulka.

Tuesday, March 26, 2024 04:15pm - 05:15pm

Office Bldg West / Ground floor / Heinzl Seminar Room (I21.EG.101)



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