CTIC workshop:
Quantum Information & Quantum Cryptography
October 19-23, 2015
Aarhus University, Denmark

Title: Entropy accumulation

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We ask the question whether entropy accumulates, in the sense that the operationally relevant total uncertainty about an n-partite system $A = (A_1, \ldots A_n)$ can be seen as the sum of the entropies of its parts~A_i. The well-known Asymptotic Equipartition Property implies that this is indeed the case asymptotically for large n, under the assumption that the individual parts A_i are identical and independent of each other. Here we show that entropy accumulation occurs more generally, i.e., without an independence assumption, provided one quantifies the uncertainty about the individual systems A_i by the von Neumann entropy of suitably chosen states. This result has a number of applications as it allows us to reduce the analysis of a large system to the study of its parts. We also present some sample applications of the result by giving a security proof of a QKD protocol, and an upper bound on the fidelity of fully quantum random access codes.

This is joint work with Omar Fawzi and Renato Renner