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# Relative entropy and dynamical black holes

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Since the discovery of the Bekenstein-Hawking formula, there had been many attempts to derive the entropy of black holes from the entanglement between the degrees of freedom inside and outside the event horizon. This entanglement entropy reproduces the area-law, but it suffers from divergences in the continuum limit. In this talk, I show how to derive the Bekenstein-Hawking entropy from the relative entropy, which is well-defined also for continuum theories such as QFT, in the case of dynamical, spherically symmetric black holes. I first review the algebraic quantization of a free scalar field on curved space-times, and show how to compute its relative entropy from the initial data at infinity. Using the back-reaction of a free, scalar quantum field on the metric, I show that a variation in the relative entropy between coherent states of the field produces a variation of one-quarter of the black hole horizon area.

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