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Horizon-horizon scattering and black hole thermodynamics

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The thermal canonical partition function for a free scalar field outside a black hole horizon is ill-defined due to the continuous nature of the normal mode spectrum. In this talk, I will explain how non-trivial spectral information can be extracted from the near-horizon asymptotics of the normal modes through a relativistic generalization of the Krein-Friedel-Lloyd formula. These considerations lead to a family of well-defined renormalized canonical partition functions parametrized by a choice of reference scattering problem. Remarkably, for a specific choice of reference, the renormalized canonical partition function is equal to the 1-loop Euclidean black hole determinant, leading to a precise statistical interpretation of the latter. Time permitting, I will comment on the generalizations to spinning fields and interacting theories.

The talk is mostly based on joint works with Dionysios Anninos, Frederik Denef, Manvir Grewal, Klaas Parmentier, and Zimo Sun.

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