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Quantum fields on rotating black holes

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Since astrophysical black holes are expected to be rotating, one would like to study quantum fields on such spacetimes. In this talk, we lay some of the mathematical foundations for this endeavor. We construct a physically motivated state, the Unruh state, for the free scalar quantum field on Kerr de Sitter and show that it is a Hadamard state. Moreover, we demonstrate that a similar construction for fermions on Kerr results in a Hadamard state for any subextremal black hole, extending previous results for small angular momentum. Finally, we discuss the divergence of the stress-energy tensor of the quantum scalar field towards the Cauchy horizon. We show that the leading divergence has a universal, state-independent behaviour, even in rotating black hole spacetimes, as long as there is a non-zero spectral gap for the corresponding equation of motion.

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