

“*Quantum Probing of Black Holes and PP-Waves*”

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Abstract:

Singularities are predicted by the singularity theorems of Hawking and Penrose under very generic conditions. They mark the breakdown of the point-particle description in general relativity. We raise the question, what if one uses quantum fields instead? Using the functional Schrödinger representation of quantum field theory, we analyze under which conditions classical singularities can be probed by free quantum fields. To this aim we introduce the notion of quantum completeness and show that Schwarzschild black holes are indeed quantum complete. This impacts information processing inside black holes and is connected to the interaction with the (unresolved) gravitational degrees of freedom. We contrast this result with pp-wave space-times in which an impulsive wave propagates through otherwise flat space-time.

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