General Relativity and Quantum Cosmology

Effective temperature for black holes

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The physical interpretation of black hole's quasinormal modes is fundamental for realizing unitary quantum gravity theory as black holes are considered theoretical laboratories for testing models of such an ultimate theory and their quasinormal modes are natural candidates for an interpretation in terms of quantum levels. The spectrum of black hole's quasinormal modes can be re-analysed by introducing a black hole's effective temperature which takes into account the fact that, as shown by Parikh and Wilczek, the radiation spectrum cannot be strictly thermal. This issue changes in a fundamental way the physical understanding of such a spectrum and enables a re-examination of various results in the literature which realizes important modifies on quantum physics of black holes. In particular, the formula of the horizon's area quantization and the number of quanta of area result modified becoming functions of the quantum "overtone" number n. Consequently, the famous formula of Bekenstein-Hawking entropy, its sub-leading corrections and the number of microstates are also modified. Black hole's entropy results a function of the quantum overtone number too. We emphasize that this is the first time that black hole's entropy is directly connected with a quantum number. Previous results in the literature are re-obtained in the limit n \to \infty.

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