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ENTROPY SPECTRA OF SINGLE HORIZON BLACK HOLES IN TWO DIMENSIONS

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The Hod conjecture proposes that the asymptotic quasinormal frequencies determine the entropy quantum of a black hole. Considering the Maggiore modification of this conjecture, we calculate the entropy spectra of general, single horizon, asymptotically flat black holes in two-dimensional dilaton gravity. We also compute the entropy quanta of the two-dimensional Witten and AdS_2 black holes. Using the results for the entropy quanta of these two-dimensional black holes, we discuss whether the produced values are generic. Finally we extend the results on the entropy spectra of other black holes.

Keywords: Two-dimensional black holes; entropy spectrum; quasinormal modes; Hod's conjecture.

1. Introduction

For a stationary black hole, Bekenstein[1–3] suggests that in the semiclassical limit the area spectrum of its event horizon takes the form[a]

$$A_s \approx \epsilon \hbar s, \quad s = 0, 1, 2, \ldots, \tag{1}$$

with $\hbar$ denoting the reduced Planck constant and ϵ the parameter of order unity. We believe that the exact value of ϵ must be determined by the quantum theory of gravity, nevertheless, based on some assumptions, the parameter ϵ is calculated in several references,[4–18] and we notice that two values of ϵ appear frequently, $\epsilon = 4\ln(3)$ and $\epsilon = 8\pi$.

One way to get the value $\epsilon = 4\ln(3)$ is to assume a strict statistical interpretation of the black hole entropy, in such a way that the area elements of the event horizon have three internal degrees of freedom.[4,5] For the four-dimensional Schwarzschild

[a]In units where $G = k_B = c = 1$. Here G is the gravitational constant, k_B is the Boltzmann constant, and c is the velocity of light in vacuum.