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Area spectrum of the *d*-dimensional Reissner–Nordström black hole in the small charge limit

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Abstract

A conjecture by Hod states that for the black hole horizon the spacing of its area spectrum is determined by the asymptotic value of its quasinormal frequencies. Recently to overcome some difficulties, Maggiore proposes some changes to the original Hod's conjecture. Taking into account the modifications proposed by Maggiore we calculate the area quantum of the *d*-dimensional Reissner–Nordström black hole in the small charge limit.

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1. Introduction

Taking into account semiclassical arguments and assuming that the horizon area of a non-extremal black hole behaves as an adiabatic invariant, Bekenstein proposes a discrete and evenly spaced spectrum for the horizon area [1–4]. Thus, at least in the semiclassical limit, he proposes that the mathematical form of the area spectrum is

$$A_n = \epsilon \hbar n, \tag{1}$$

where $n = 0, 1, 2, \ldots$, $\hbar$ stands for the reduced Planck constant, and ϵ is a dimensionless parameter of order 1. It is believed that a quantum theory of gravity allows us to determine the value of the parameter ϵ (in the case that the quantum theory confirms that the area spectrum of the black hole horizon takes the form (1)).

At the present time we do not know a complete quantum theory of gravity. Nevertheless, supposing that the area spectrum is of the form (1) and using different semiclassical methods we can calculate the parameter ϵ (see [5–34] for some examples). In the previous references, for the parameter ϵ, the values $\epsilon = 8\pi$ and $\epsilon = 4\ln(j)$, with $j = 2, 3, \ldots$ are often found.