

Entropy of Reissner-Nordstrom-de Sitter Black Hole in Nonthermal Equilibrium

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Abstract: By making use of the method of quantum statistics, we directly derive the partition function of bosonic and fermionic fields in Reissner-Nordstrom-de Sitter black hole and obtain the integral expression of black hole's entropy and the entropy to which the cosmic horizon surface corresponds. It avoids the difficulty in solving the wave equation of various particles. Then via the improved brick-wall method, i.e. the membrane model, we calculate black hole's entropy and cosmic entropy and find out that if we let the integral upper limit and lower limit both tend to the horizon, the entropy of black hole is proportional to the area of horizon and the entropy to which cosmic horizon surface corresponds is proportional to the area of cosmic horizon. In our result, the stripped term and the divergent logarithmic term in the original brick-wall method no longer exist. In the whole process, the physical idea is clear and the calculation is simple. We offer a new simple and direct way for calculating the entropy of different complicated black holes.

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Key words: membrane model, entropy of black hole, non-equilibrium system

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