Total Quantum Statistical Entropy of Reissner-Nordstrom Black Holes:in Dirac Field Case

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Abstract: The total quantum statistical entropy of Reissner-Nordstrom black holes in Dirac field case is evaluated in this article. The space-time of the black holes is divided into three regions: region 1 ($r>r_o$), region 2 ($r_o > r > r_i$), and region 3 ($r_i >r>0$), where r_o is the radius of the outer event horizon, and r_i is the radius of the inner event horizon. The total quantum statistical entropy of Reissner-Nordstrom black holes is $S=S_1+S_2+S_3$, where S_i ($i=1,2,3$) is the entropy, contributed by regions 1,2,3. The detailed calculation shows that S_2 is neglectfully small. $S_1=w_t(\pi^2/45)k_b(A_o/\varepsilon^2\beta^3)$, $S_3=-w_t(\pi^2/45)k_b(A_i/\varepsilon^2\beta^3)$, where A_o and A_i are, respectively, the areas of the outer and inner event horizons, $w_t=2^s[1- 2^{-(s+1)}]$, $s=d/2$, d is the space-time dimension, here d=4, s=2. As r_i approaches r_o in the extreme case the total quantum statistical entropy of Reissner-Nordstrom black holes approaches zero.

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