About Hawking entropy formula

By Wan-Chung Hu

Abstract

Hawking entropy formula describes the entropy of a black hole. Here, I demonstrate that Hawking entropy's relation with Boltzmann's entropy. Both reflect the total numbers of the microstates. I also explain the entropy arrow, temperature arrow, and time arrow and their relationship.

Main text

For a black hole, the entropy of it is given as Hawking formula:

$$S = \frac{kA}{4l_p^2}$$

In my previous deduction, I have shown that the smallest length of space is 2Lp, so the unit square of space unit is 4Lp^2. Thus, Hawking entropy reduces to:

$$S = kN$$

N is the total number of unit squares in the black hole event horizon A

We compare this to Boltzmann formula:

$$S = k \ln \omega$$

W is the total numbers of the microstates in a system. The nature log is just trying to make calculation more easily. Thus, we can view entropy as the total numbers of space unit in a given system. Because light wave will cause this space unit oscillation, more numbers of the units will increase the randomness. Thus, we can explain the physical reason of entropy. Temperature can cause space dilation, and more and more space units are generated with more and more entropy. Thus, we can link temperature arrow, entropy arrow, and time arrow. We can have a clearer picture about the thermodynamics of universe.