Advice

Here is some advice for PhD students in high-energy physics.

$$ds^2 = -f(r)dt^2 + \frac{dr^2}{f(r)} + r^2 d\Omega_2^2 \tag{1}$$

Black-Scholes (Equation 2) is a mathematical model that seeks to explain the behavior of financial derivatives, most commonly options:

$$\frac{\partial \mathrm{C}}{\partial \mathrm{t}} + \frac{1}{2}\sigma^2 \mathrm{S}^2 \frac{\partial^2 \mathrm{C}}{\partial \mathrm{C}^2} + \mathrm{rS}\frac{\partial \mathrm{C}}{\partial \mathrm{S}} = \mathrm{rC} \tag{2}$$

$$ds^2 = -f(r)dt^2 + \frac{dr^2}{f(r)} + r^2 d\Omega_2^2 \tag{3}$$

$$f(r) = 1 - \frac{r_+}{r} \tag{4}$$

We would like to compute the thermal partition function of this system. Since we know the spectrum, we can write down the answer

$$Z(\beta) = \sum_n e^{-\beta E_n} = \sum_{n \in \mathbb{Z}} \exp\left(-\beta \, \frac{n^2}{2R^2}\right) . \tag{5}$$