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# Entropy Product Function and Central charges in NUT Geometry

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We define an entropy product function (EPF) for Taub-Newman-Unti-Tamburino(TNUT) black hole(BH) following the prescription suggested by Wu et al. [PRD 100, 101501(R) (2019)].
The prescription argues that a generic four-dimensional TNUT spacetime might be expressed in terms of three or four different types of thermodynamic hairs. They can be defined as the Komar mass($M = m$), the angular momentum($J_n = mn$), the gravitomagnetic charge ($N = n$), the dual (magnetic) mass ($\tilde{M} = n$). Taking this prescription and
using the EPF, we derive the central charges of dual CFT (conformal field theory) via Cardy's formula. Remarkably, we find that for TNUT
BH there exists a relation between the central charges and EPF as $c = 6\left(\frac{\partial calF}{\partial calN_i}\right)$,
where $calF$ is EPF and $calN_i$ is one of the integer-valued
charges i.e. the NUT charges($N$) or any new conserved charges($J_N$).
We reverify these results by calculating the exact values of different thermodynamic parameters. We define the EPF $calF$ from the first law of thermodynamics of both horizons. Moreover, we write the first laws of both the horizons for left-moving and right-moving sectors.
Introducing the B\'{e}zout's identity, we show that for TNUT BH one
can generate more holographic descriptions described by a pair of integers $(a, b)$. More holographic pictures have
a great significance in understanding the holographic nature of quantum gravity. Furthermore, using the EPF we derive the central charges for Reissner-Nordstr\"{o}m-NUT(RNNUT) BH, Kerr-Taub-NUT-(KNUT) BH and Kerr-Newman-NUT-(KNNUT) BH proved that they are equal in both
sectors provided that the EPF is mass-independent(or universal).

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