Abstract Submitted
for the APR20 Meeting of
The American Physical Society

Do black holes store negative entropy?[1] KOJI AZUMA, NTT Basic Research Labs, SATHYAWAGEESWAR SUBRAMANIAN, University of Cambridge — The Bekenstein-Hawking equation argues that entropy of a black hole is proportional to the area of its horizon. However, this equation leads to an inconsistency, if it is combined with the first law of black hole mechanics, the original pair-creation picture of Hawking radiation, and quantum mechanics. Here we show that this inconsistency is completely resolved if the simple entropy in the Bekenstein-Hawking equation is replaced with the coherent information from the outside of a black hole to the positive-energy particles inside it. The coherent information is "minus" the conditional entropy, which can be defined only in the purely quantum regime and is associated with distillable entanglement in quantum information theory. Therefore, our equation argues that the black hole stores quantum entanglement, whose size reflects the area of its horizon. Our equation reproduces not only the Bekenstein-Hawking equation in the case where the effect of Hawking radiation is small, but also known results, such as Hawking's area theorem and Bekenstein's generalized second law. Besides, our equation is free from the information loss paradox in contrast to the Bekenstein-Hawking equation, and from the firewall paradox in contrast to Page's model. This talk is based on arXiv:1807.06753.

[1]CREST, JST JP-MJCR1671; PREST, JST JP-MJPR1861; SERB (Government of India); Cambridge Trust

Koji Azuma
NTT Basic Research Labs

Date submitted: 09 Jan 2020 Electronic form version 1.4