Correlation and the black hole information loss paradox

Qing-yu Cai[1]

[1]*State Key Laboratory of Magnetic Resonances and Atomic and Molecular Physics, Wuhan Institute of Physics and Mathematics, Chinese Academy of Sciences, Wuhan 430071, China*

qycai@wipm.ac.cn

Abstract

Information is physical, it cannot simply disappear in any physical process. This basic principle of information science constitutes one of the most important elements for the very foundation to our daily life and to our understanding of the universe. However, this fundamental principle is challenged by the physics of black holes [1]. In this talk, I will talk about how to resolve the paradox based on the Parikh-Wilczek nonthermal spectrum [2]. I will prove there are information-carrying correlations among Hawking radiations, and the total entropy of radiations and the hole is conserved during Hawking radiation process [3]. Next, I will demonstrate that the area entropy of a black hole, i.e., the so-called Bekenstein-Hawking entropy, is information entropy [4]. Therefore, entropy conservation indicates no information loss. Finally, I will discuss the possibility of experimental testing of quantum gravity theory in lab.

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[3] B. Zhang, Q.-Y. Cai, M. S. Zhan and L. You, Information conservation is fundamental: Recoverying lost information in Hawking radiation. IJMPD 22, 1341014 (2013). *First Award in the 2013 Essay Competition of Gravity Research Foundation.*

[4] D. He, Q.-y. Cai, C.-p. Sun and L. You. Area entropy if information entropy: An supporting evidence of unifying quantum mechanics with gravity (To be submitted).