复旦大学物理系物质科学报告

Black Hole Information Loss Paradox

–The War Continues to Rage –

Physics Department Colloquium

Prof. Pisin Chen

Department of Physics and Graduate Institute of Astrophysics &

Leung Center for Cosmology and Particle Astrophysics

National Taiwan University

The question of whether Hawking evaporation violates unitarity, and therefore results in the loss of information, remains unresolved since Hawking's seminal discovery 40 years ago. If Hawking radiation does not carry any information out from the ever-shrinking blackhole, it seems that unitarity, a fundamental assumption in quantum mechanics and quantum field theory, is violated once the black hole completely evaporates. On the other hand, attempts to recover information via quantum entanglement lead to the firewall controversy. In this talk, we will first introduce the essence of the black hole information loss paradox. Then we will review various proposed solutions to the paradox with their pros and cons. Attention will be given to the cases of black hole remnant and the firewall proposals. Inparticular, we argue that, if thefirewall is located near where the horizon would have been, based on the space time evolution up to that time, later quantum fluctuations of the Hawking emission rate can cause t

he “teleological’’ even thorizon to have migrated to the inside of t he firewall location, rendering the firewall naked. This casts doubt about the notion that firewalls are the “most conservative” soluti on to the information loss paradox. Last but not least, we suggest t hat this raging black hole war may hopefully be settled experimental ly through “accelerating plasma mirrors ” using advanced laser and nano-fabrication technologies.

Pisin Chen received his Bachelor ’ s Degree from NTUP hysics in 1972 and PhD from UCLA in theoretical particle physics under J. J. Sakurai . He joined NTU Department of Physics and Graduate Institute of Astrophysics as a professor in 2007. He holds the NTU C. C. Leung Chair Professor of Cosmology and has been the founding Director of Leung Center for Cosmology and Particle Astrophysics(LeCosPA) since 2007. He initiated the founding of the Kavli Institute for Particle Astrophysics and Cosmology (KIPAC) at Stanford University and SLAC in 2000 , and has been its Permanent Member. He was elected Fellow of American Physical Society in 1994. He is two-time recipient of the Gravity Research Foundation Annual Essay Competition Awards (3rd Prize, 2002; 4th Prize, 1995). He is internationally recognized for contributions in plasma physics, particle beam physics, particle astrophysics, cosmology, gravity and black hole physics. Trained as a theoretical physicist, he developed a strong interest in experimentation since 1990s. He initiated the Askaryan Radio Array (ARA) cosmic neutrino observatory in 2009 and serves as its International Co-Spokesperson. ARA is ROC’ s first major scientific project at the South Pole. Another project, the Ultra-Fast Flash Observatory (UFFO), to observe the prompt signals of gamma ray bursts (GRB) within 1-2 seconds, was successfully launched by Russiaon April 28, 2016.

Time： 2:00pm,Tuesday, 2016.05.24

Location： Physics Building, Room 221B

(Cookies and coffee are served from 1:45 pm)