Semi-local Quantum Liquids

Hong Liu*

Center for Theoretical Physics, Massachusetts Institute of Technology, USA

***Email of Presenting Author: hong_liu@mit.edu**

Abstract

Gauge/gravity duality applied to strongly interacting systems at finite density predicts a universal intermediate energy phase to which we refer as a semi-local quantum liquid. Such a phase is characterized by a finite spatial correlation length, but an infinite correlation time and associated nontrivial scaling behavior in the time direction, as well as a nonzero entropy density. This unstable phase sets in at an energy scale of order of the chemical potential, and orders at lower energies into other phases; examples include superconductors, Fermi liquids of "heavy fermions", and antiferromagnetic-type states. While the precise nature of the lower energy state depends on the specific dynamics of the individual system, we argue that the semi-local quantum liquid emerges universally at intermediate energies through deconfinement (or equivalently fractionalization). We also discuss the possible relevance of such semi-local quantum liquid to heavy electron systems and the strange metal phase of high temperature cuprate superconductors.

Reference:

N. Iqbal, H. Liu and M. Mezei, JHEP 1204, 086 (2012).

About the speaker

Prof Hong Liu received his BS in 1993 at the University of Science and Technology of China and PhD in 1997 at Case Western Reserve University. He was a postdoctoral fellow at Imperial College, London and a research associate at New High Energy Theory Center of Rutgers University before joining Massachusetts Institute of Technology in 2003, where he is now the Associate Professor of Physics with tenure.

He was the Alfred Sloan Fellow from 2004-2008, the Outstanding Junior Investigator of the Department of Energy from 2005-2010, the Simons Fellow in 2012, and is currently an editor of Journal of High Energy Physics.