TOHOKU FORUM for CREATIVITY

Tohoku Forum for Creativity Thematic Program 2015
Fundamental Problems in Quantum Physics: Strings, Black Holes and Quantum Information
International Workshop on Strings, Black Holes and Quantum Information

Geometry and Dynamics of Information Spacetime Derived from Entanglement Spectrum

Hiroaki Matsueda
(SNCT)

Schedule:
Friday, September 11, 9:30-10:30

Place:
TOKYO ELECTRON House of Creativity 3F, Lecture Theater
Katahira Campus, Tohoku University

Abstract:

  We examine geometry and dynamics of classical spacetime derived from entanglement spectrum. The spacetime is a kind of parameter space defined by the Fisher information metric. In particular, the spectrum for free fermions in spatially one dimension has exponential family form like thermal probability distribution owing to mixed-state feature emerging from truncation of environmental degrees of freedom. We find that the spectrum has geometrical meaning associated with gauge-gravity correspondence: the emergent geometry becomes anti-de Sitter spacetime with imaginary time, and a radial axis as well as spacetime coordinates appears spontaneously. This method enables us to access to internal structure of the gauge-gravity correspondence in a sense that the structure is a kind of momentum space of entanglement Hamiltonian and the correspondence becomes clear in the momentum space. Furthermore, some deformation of the spectrum near the conformal fixed point is mapped onto dynamics of the spacetime. The entanglement entropy embedded into the spacetime behaves like free scaler field. When we regard the dynamics as fluctuation of the entropy from uniformly curved background, the dynamics is described by the Einstein equation with a negative cosmological constant.