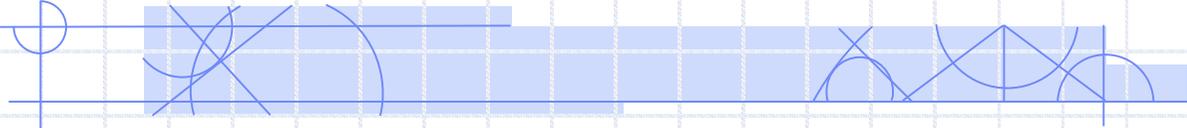


The 20th workshop on General Relativity and Gravitation in Japan

Non-equilibrium Condensation Process in a Holographic Superconductor



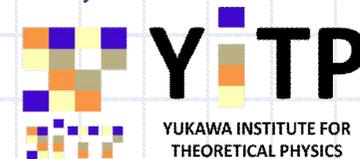
No. 28

This talk is based on **JHEP 07 (2010) 050**
(arXiv:1005.0633)

Shunichiro Kinoshita (YITP)

In collaboration with

Norihiro Tanahashi (UC Davis), Keiju Murata (DAMTP)





AdS/CFT correspondence

- AdS/CFT correspondence plays a central role in the study of the strongly coupled region of quantum field theory
 - In a limit, it is simply described by classical gravity theory on AdS
 - We should solve classical dynamics of gravitational systems
- Applications of AdS/CFT
 - We would like to get insights for strongly coupled systems from holographic approach
 - Quark-gluon plasma, superconductor, ...

Holographic Superconductor

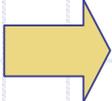
Hartnoll, Herzog and Horowitz (2008)

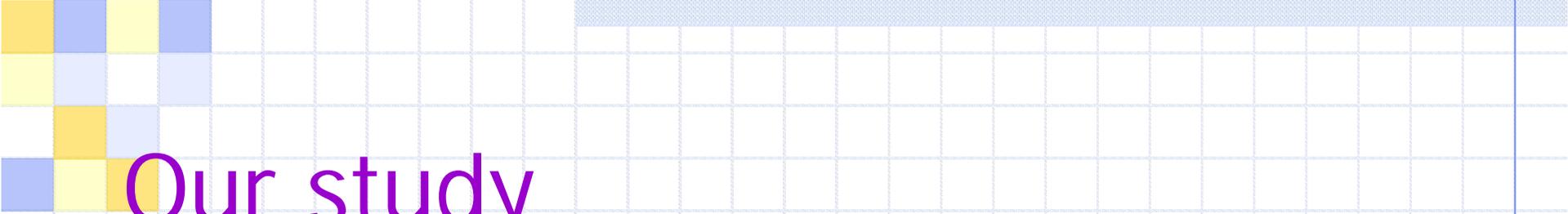
- This model was proposed as gravitational dual to superconductor
 - 4D Einstein-Maxwell-charged scalar

$$S = \int d^4x \sqrt{-g} \left(R + \frac{6}{L^2} - \frac{1}{4} F_{\mu\nu} F^{\mu\nu} - |\nabla_\mu \Psi - iq A_\mu \Psi|^2 - m^2 |\Psi|^2 \right)$$

$(m^2 = -2/L^2)$

- For low temperatures, there are two BH solutions
 - RN BH $\Psi = 0$
 - Hairy BH, which has non-vanishing scalar field $\Psi \neq 0$

RN-AdS is unstable for low temperature  This instability is identified with superconducting phase transition.



Our study

- We have studied a non-equilibrium condensation process in a holographic superconductor model
 - We have solved non-linear time evolutions in the Einstein-Maxwell-complex scalar system
- The final state of the instability of RN is the hairy BH obtained by Hartnoll et al.
 - The hairy BH is stable against plane symmetric perturbations
- We have studied the time evolution of horizons in the bulk
 - It seems to be reasonable that the mapping between the horizon and the boundary is null