KIAS-YITP Joint Workshop 2017 "Strings, Gravity and Cosmology"

September 19th-22nd, 2017 @ Panasonic auditorium, Yukawa memorial hall, YITP, Kyoto University

Title and abstract

19th (Tuesday)

10:00-10:45 **Registration**

10:45-11:00 **Opening**

11:00-12:00 **Sumit Das (Kentucky)**

A Three Dimensional view of the SYK Model

We argue that the SYK model can be interpreted as a three dimensional scalar in $AdS_2 \times S^2/\mathbf{Z}_2$. At strong coupling the KK spectrum reproduces the SYK spectrum exactly, and a non-standard propagator of the 3D theory reproduces the two point function of the bilocal fields. Furthermore, this three dimensional picture reproduces the leading finite coupling correction to the "zero mode" contribution.

14:00-15:00 **Yu Nakayama (Rikkyo)**

Very special conformal field theories and their holographic duals

Cohen and Glashow introduced the notion of very special relativity as viable space-time symmetry of elementary particle physics. As a natural generalization of their idea, we study the subgroup of the conformal group, dubbed very special conformal symmetry, which is an extension of the very special relativity. We construct field theory examples as well as holographic realization of the very special conformal field theories.

15:30-16:30 **Jerome P. Gauntlett (ICL)**

Holographic Transport and Black Hole Horizons

In seeking possible applications of holography to real materials the transport of heat and charge are basic physical observables to analyse. Like the entropy we explain how the DC thermoelectric conductivity can be obtained from the behaviour of black hole spacetimes purely at the horizon. More precisely, the DC conductivity can be obtained by solving a generalised set of Navier-Stokes equations for an auxiliary fluid living on the black hole horizon. Unlike other connections between fluids and black holes, this is an exact result and and can be viewed as a precise manifestation of the old membrane paradigm for black holes in holography. We also derive the dispersion relations for quasi-normal hydrodynamic modes associated with diffusion of heat and charge, obtaining a generalised Einstein relation for diffusion in inhomogeneous media.

16:45-17:45 **Sangjin Sin (Hanyang)**

Holography in Dirac Materials

We will first argue that dirac materials like graphene or surface of a Topological insulators are strongly correlated. We construct holographic models for such materials and calculate transport coefficients. The results are compared with experiments.

20th (Wednesday)

9:30-10:30 **Atsushi Taruya (YITP)**

Relativistic distortions of large-scale structure

The large-scale structure of the Universe observed via galaxy redshift surveys contains valuable cosmological information, but it appears distorted due to the observational systematics of the redshift determination, known as redshift-space distortions (RSD). Recently, however, the measurement of RSD is renewed with great interest as a probe of gravity on cosmological scales. In this talk, after briefly reviewing the 'standard' RSD caused by the peculiar velocity of galaxies, I discuss yet another distortion arising from general relativistic effects. Unique feature of this distortion is demonstrated based on the simulated catalog taking account of the relativistic effects, together with some implications.

11:00-12:00 **Ho-Seong Hwang (KIAS)**

Testing the Standard Model of Cosmology with Large-scale Structures in the Real and Simulated Universe

Measurement of the matter distribution in the universe is one of the key components in observational cosmology. This provides an important test of structure formation scenarios and cosmological models. I discuss the results from statistical comparisons of large-scale structure between observations and cosmological simulations as a test of standard cosmology.

14:00-15:00 **Jinbeom Bae (KIAS)**

Modular Constraints on conformal field theories with holomorphic currents

We study the constraints coming from the modular invariance of the partition function of two-dimensional $c > 1$ conformal field theories(CFT). With the presence of holomorphic and anti-holomorphic currents, we analyze the constraint using semi-definite programming. We find the bounds on the twist gap for the non-current primaries are sensitive to the presence of the holomorphic currents and it shows several intriguing peaks. Various rational CFTs are realized at those peaks or other numerical boundary of the twist gap problem, saturating the maximal bound on degeneracies. Such theories include Wess-Zumino-Witten models for the Deligne's exceptional series, the Monster CFT and the Baby Monster CFT. We also study modular constraints imposed by W-algebras of various type and observe that the bounds on the gap depends on the choice of W-algebra in the small central charge region.

15:30-16:20 **Gong-show by poster presenters**

16:20-18:20 **Poster session**

18:45-20:45 **Banquet** @ Coop Cafeteria "Hokubu shokudo" 2F

9:30-10:30 Mukund Rangamani (QMAP, UC Davis)

Thermal equivariance and its applications

I will describe how techniques from topological field theory and equivariany cohomology find a role in physical problems. I will define the notion of thermal equivariance which will involve gauging thermal diffeomorphisms, and argue that these constructions naturally lead to entropy being interpretable as a Noether current. Time permitting I will describe some applications and open questions.

11:00-12:00 Aron Clark Wall (SITP, Stanford)

Entropic Focussing

In classical general relativity with positive energy matter, nearby light rays are always focussed by matter. This simple fact has been used to prove many important results about black holes, singularities, and other spacetimes. I will describe how this focussing result can be generalized to situations involving quantum fields, and also to higher curvature gravity actions.

14:00-15:00 Ruben Minasian (Saclay)

Supersymmetry and geometry of stringy corrections

Stringy corrections to effective supergravity theories are encoded in the alpha' and the genus expansion, with the former generating higher derivative corrections to the supergravity and the latter corresponding to string quantum corrections in spacetime. While their importance for many four-dimensional applications is well appreciated, our knowledge of the ten- and eleven dimensional couplings is rather incomplete, even for the leading higher-derivative terms. I will describe a suitable generalisation of the Lichnerowicz formula, that relates the squares of supersymmetric operators to the effective action, the Bianchi identities for fluxes, and some equations of motion, for heterotic strings and for eleven-dimensional supergravity together with their higher-derivative couplings. I will also discuss how such formulae underlie the (generalised) geometry of supersymmetric theories.

15:30-16:30 Daniel Baumann (IoP, Amsterdam)

Fossils from Inflation

16:45-17:45 Stefano Liberati (SISSA)

Quantum gravity Phenomenology: Where do we stand?

Quantum gravity phenomenology is a booming field of research that aims at testing quantum gravity theories via possible relic signatures below the Planck scale. While there are different classes of effects that can be looked for, a lot of attention has been given in the past to departures from exact Lorentz invariance at ultra high energies. In this talk I will review what we have learned about this scenario as well as about several alternative ones which have been consider in recent years. Finally, we shall discuss the perspectives for further advancement of the field.

9:30-10:30 **Gary Shiu (Wisconsin-Madison)**

The Weak Gravity Conjecture, Black Holes, and Cosmology

In this talk, I will review the evidences so far in support of the Weak Gravity Conjecture and related statements about the Swampland, applications of these conjectures to inflation and black hole physics, and the Standard Model Landscape. Some form of these conjectures, if true, can make sharp predictions about the neutrino type and masses (which can be tested by future CMB, large scale structure and 22cm line observations), and properties of the Higgs potential at high scale.

11:00-12:00 **Tom Rudelius (IAS)**

Axion Inflation and the Lattice Weak Gravity Conjecture

The last few years have seen great advances in our understanding of the Weak Gravity Conjecture and its relationship to axion inflation. In this talk, we will review the results of the past few years and see how recent progress in our understanding of the conjecture affects its implications for axion inflation. We will see that some models of axion inflation are in conflict with the conjecture, while others are compatible with it.

14:00-15:00 **Enrico Trincherini (SNS Pisa)**

Relaxing the Cosmological Constant

15:30-16:30 **Misao Sasaki (YITP)**

Inflation and Beyond