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KIAS-YITP Joint Workshop 2017 "Strings, Gravity and Cosmology"
September 20th, 2017 @ room Y206, Y306, Yukawa memorial hall, YITP, Kyoto University

Poster title and abstract

1. **Araujo**, Thiago Rocha (APCTP)

Yang-Baxter deformations & Noncommutative field theories

"In this poster I'll try to make a summary of recent developments on Yang-Baxter deformations of integrable models, applications in the string theory context and the relation between YB-deformed SUGRA backgrounds and the conjectured holographic non-commutative field theories."

2. **Banerjee**, Aritra (ITP-CAS)

Tensionless Strings and Worldsheet Symmetries

3. **Choi**, Jaewang (YITP)

Super Yang-Mills theory with position dependent couplings

"When the coupling depends on the position, whether supersymmetry is preserved or not is not manifest. We found some conditions to preserve supersymmetry with position dependent coupling by deforming the $\mathcal{N} = 4$ SYM theory. And we got some non-trivial solutions to satisfy these conditions in some specific case. And also in perspective of supergravity in 10 dimension, we can guess that our deformed SYM action have relations with D3 branes' world-volume action in general supergravity background. So, we also discuss about relation with our new deformation terms and 10 dimensional supergravity fields."

4. **Du**, Yi-Hsien (NCKU/ ICL)

Butterfly Effect and Holographic Mutual Information under External Field and Spatial Non-commutativity

"We apply the transformation of mixing azimuthal and internal coordinate or mixing time and internal coordinate to a stack of N black M-branes to find the Melvin spacetime of a stack of N black D-branes with magnetic or electric flux in string theory, after the Kaluza-Klein reduction. We slightly extend previous formulas to investigate the external magnetic and electric effects on the butterfly effect and holographic mutual information. It shows that the Melvin fields do not modify the scrambling time and will enhance the mutual information. In addition, we also T-dualize and twist a stack of N black D-branes to find a Melvin Universe supported by the flux of the NSNS b-field, which describes a non-comutative spacetime. It also shows that the spatial noncommutativity does not modify the scrambling time and will enhance the mutual information. We also study the corrected mutual information in the backreaction geometry due to the shock wave in our three model spacetimes."

5. **Farsam**, Mohammad (Semnan)

The growth of holographic entanglement entropy in ADS Born-Infeld model of gravity with perturbative approach

"In this work we use of a perturbative model for studying the growth of entanglement entropy for small size regions in CFT boundary of an ADS model of Born-Infeld gravity. In this size saturation time would happen before null shell formed considered black hole and so the evolution of entanglement entropy ceased before reaching to local equilibrium state of black hole. By this approach we investigate effects of parameters in ADS model on saturation time and the shape of entanglement growth. We can see the instantaneous rate of growth never exceed the speed of light which is in contrary to analytical results for two dimension holographic CFTs. We then study the connection between the time evolution of different regimes and the size of that region."

6. **Hotta**, Kenji (Hokkaido University)

Unruh Effect in Superstring Theory

"Previously, Unruh effect in open bosonic string field theory was discussed by Hata, Oda and Yahikozawa. However, it is natural to argue this effect for the closed strings which can propagate bulk spacetime. We investigate Unruh effect in the case of closed strings on the basis of light-cone gauge string field theory proposed by Kaku and Kikkawa. By superposing the solutions of the Klein-Gordon equation in Minkowski spacetime, we construct the superstring fields which satisfy the Klein-Gordon equation in Rindler spacetime. Using these string fields, we show that the Minkowski vacuum is a thermal state for closed superstrings in the Rindler wedge. We also investigate Unruh effect in the case of open superstrings on D9-brane-anti-D9-brane pairs, and discuss the relation between open string system and closed string one."

7. **Hwang**, Chiung (KIAS)

Vortex Partition Function in 3d Seiberg-like Dualities

"We explore 1d vortex dynamics of 3d supersymmetric Yang-Mills theories, as inferred from factorization of exact partition functions. Under Seiberg-like dualities, the 3d partition function must remain invariant, yet it is not a priori clear what should happen to the vortex dynamics. We observe that the 1d quivers for the vortices remain the same, and the net effect of the 3d duality map manifests as 1d Wall-Crossing phenomenon; Although the vortex number can shift along such duality maps, the ranks of the 1d quiver theory are unaffected, leading to a notion of fundamental vortices as basic building blocks for topological sectors. For Aharony-type duality, in particular, where one must supply extra chiral fields to couple with monopole operators on the dual side, 1d wall-crossings of an infinite number of vortex quiver theories are neatly and collectively encoded by 3d determinant of such extra chiral fields. As such, 1d wall-crossing of the vortex theory encodes the particle-vortex duality embedded in the 3d Seiberg-like duality. For $\mathcal{N} = 4$, the D-brane picture is used to motivate this 3d/1d connection, while, for $\mathcal{N} = 2$, this 3d/1d connection is used to fine-tune otherwise ambiguous vortex dynamics. We also prove some identities of 3d supersymmetric partition functions for the Aharony duality using this vortex wall-crossing interpretation."

8. **Kajuri**, Nirmalya (IITM)

State dependence in Eternal Black Holes revisited

"Papapodimas and Raju have argued that the AdS/CFT map is state dependent even for perturbations around an eternal black hole background, or one runs into certain paradoxes. We revisit their argument and show that the paradoxes can be resolved without invoking state dependence."

9. **Kusuki**, Yuya (YITP)

Evolution of Entanglement Entropy in Orbifold CFTs

"In this work we study the time evolution of Renyi entanglement entropy for locally excited states created by twist operators in cyclic orbifold $(T^2)^n/\mathbf{Z}_n$ and symmetric orbifold $(T^2)^n/S_n$. We find that when the square of its compactification radius is rational, the second Renyi entropy approaches a universal constant equal to the logarithm of the quantum dimension of the twist operator. On the other hand, in the non-rational case, we find a new scaling law for the Renyi entropies given by the double logarithm of time loglog for the cyclic orbifold CFT."

10. **Lin**, Chunshan (YITP)

a class of minimally modified gravity theories

11. **Matsuo**, Yoshinori (NTU)

Static black holes with back reaction from vacuum energy

"We study spherically symmetric static solutions to the semi-classical Einstein equation sourced by the vacuum energy of quantum fields in the curved space-time of the same solution. We found solutions that are small deformations of the Schwarzschild metric for distant observers, but without horizon. Instead of being a robust feature of objects with high densities, the horizon is sensitive to the energy-momentum tensor in the near-horizon region."

12. **Miyaji**, Masamichi (YITP)

From path integrals to tensor networks for the AdS/CFT correspondence

"We present a realization of tensor network for general interacting quantum field theories. In our method, we deform Lagrangian of the theory while the final wave function being fixed. As a result, we obtain a flow of renormalized wave functions of a tensor network naturally. This work may put the conjectured relation between tensor network and AdS/CFT on more concrete footings."

13. **Mizuno**, Shuntaro (YITP)

Primordial perturbations from inflation with a hyperbolic field-space

"We study primordial perturbations from hyperinflation, proposed recently and based on a hyperbolic field-space. In the previous work, it was shown that the field-space angular momentum supported by the negative curvature modifies the background dynamics and enhances fluctuations of the scalar fields qualitatively, assuming that the inflationary background is almost de Sitter. In this work, we confirm and extend the analysis based on the standard approach of cosmological perturbation in multi-field inflation. At the background level, to quantify the deviation from de Sitter, we introduce the slow-varying parameters and show that steep potentials, which usually can not drive inflation, can drive inflation. At the linear perturbation level, we obtain the power spectrum of primordial curvature perturbation and express the spectral tilt and running in terms of the slow-varying parameters. We show that hyperinflation with power-law type potentials has already been excluded by the recent Planck observations, while exponential-type potential with the exponent of order unity can be made consistent with observations as far as the power spectrum is concerned. We also argue that, in the context of a simple D-brane inflation, the hyperinflation requires exponentially large hyperbolic extra dimensions but that masses of Kaluza-Klein gravitons can be kept relatively heavy. "

14. **Mori**, Taro (SOKENDAI/KEK)

Multi-field effects in a simple extension of R^2 inflation

"We consider inflation in the system containing a Ricci scalar squared term and a canonical scalar field with quadratic mass term. In the Einstein frame this model takes the form of a two-field inflation model with a curved field space, and under the slow-roll approximation contains four free parameters corresponding to the masses of the two fields and their initial positions. We investigate how the inflationary dynamics and predictions for the primordial curvature perturbation depend on these four parameters. Our analysis is based on the δN formalism, which allows us to determine predictions for the non-Gaussianity of the curvature perturbation as well as for quantities relating to its power spectrum."

15. **Nakada**, Hiroshi (TMU)

Inflation from $(R + \gamma R^n - 2\Lambda)$ gravity in higher dimensions

"We derive the inflaton potential from modified gravity in higher dimensional spacetime. We obtain a relation between spacetime dimension and the parameter n by demanding the existence of a plateau. We study the concrete examples in D=8 and D=12."

16. **Nii**, Keita (HRI)

3d Deconfinement method and Seiberg duality

"I will explain a "3d deconfinement method" which produces Seiberg dualities for 3d $\mathcal{N} = 2$ supersymmetric gauge theories with two-index matters, like adjoint or (anti-)symmetric representations. By using this method, we can find new s-confining phases for those theories as a by-product."

17. **Nosaka**, Tomoki (KIAS)

Complete factoriztion in minimal $\mathcal{N} = 4$ Chern-Simons matter theory

"We revisit the three sphere partition function of the $U(N)_k \times U(N+M)_{-k}$ linear quiver $\mathcal{N} = 4$ superconformal Chern-Simons theory. The partition function of this theory is known to be given as a $2N + M$ dimensional ordinal integral as a result of the supersymmetry localization. By performing these integration explicitly, we obtain the closed form expression for the partition function for general values of (k, N, M), which is found to be a simple fermionic extension of the pure Chern-Simons partition function. Our result also proposes a noble bound on the ranks against the Chern-Simons level where the partition function diverges, which appears below the bound from the s-rule."

18. **Park**, Minkyu (YITP)

Non-Abelian supertubes

"We found an example of non-Abelian supertube solutions. This is a natural extensions of all known (Abelian) supertube solutions so far. We present most simple such solution which is 2-supertube system with non-Abelian monodromy around each tube. The solution is analyzed in the limit where two supertubes are close enough. We also discuss it in the context of microstate geometry program."

19. **Paul**, Chandrima (SU)

Holographic RG group flow in $SU(2) \times U(1)$ gauge theory coupled to non Abelian scalar and the duality

"A high temperature superconductor undergoes quantum phase transition from insulating antiferromagnetic to metallic nonmagnetic phase. In an attempt to construct the gravity dual we consider $SU(2) \times U(1)$ gauge theory coupled to matter field in adjoints and study RG group flow following the Hamilton Jacobi formalism. We construct Callan Symanzik equation and subsequent β functions. By applying the superpotential method we extract two fixed points, the first one corresponding to the dual of the metallic phase. The second one is nontrivial and breaks $SU(2) \times U(1)$ to $U(1) \times U(1)$ symmetry. This breakdown of symmetry with a nontrivial v.e.v of scalar has earlier been established as a signature of antiferromagnetism. Thus our gravity model with two fixed points resembles the theory of high temperature superconductors."

20. **Pradhan**, Parthapratim (HMMC)

Thermodynamic Product Formula in Modified Gravity and Kerr-MG/CFT Correspondence

"We study the thermodynamic properties of *inner* and outer horizons of scalar-tensor-vector gravity (STVG) or modified gravity (MG) and its consequences on the holographic duality. We derive the thermodynamic product formula for this gravity. We consider both spherically symmetric solution and axisymmetric solution of MG. We find that the area (or entropy) product formula for both cases is *not* mass-independent because they depends on ADM (Arnowitt-Deser-Misner) mass parameter while in Einstein gravity (EG) this formula is mass-indepedent (universal). We also examine the *first law* is fulfilled at the inner horizon (IH) as well as outer horizon (OH). We also derive other thermodynamic products and sums. We further derive the *Smarr like mass formula* for this kind of black hole (BH) in MG. Moreover, we derive the area (or entropy) bound for both the horizons. Furthermore, we show that the central charges of the left and right moving sectors are same via universal thermodynamic relations. Finally, we derive the mass-independent area (or entropy) product combinations for regular MG BH. In the Appendix section, we discuss the most important result of *Kerr-MG/CFT correspondence*. We find the central charges for Kerr-MG BH is $c_L = 12J$ which is same as in Kerr BH. We also derive the dimensionless temperature for extreme Kerr-MG BH which is $T_L = \frac{1}{4\pi}\frac{\alpha+2}{\sqrt{1+\alpha}}$, where α is a free parameter. This is actually dual CFT temperature of the Frolov-Thorne thermal vacuum state. In the limit $\alpha = 0$, we find the dimensionless temperature of Kerr BH, $T_L = \frac{1}{2\pi}$. Consequently, Cardy formula gives us microscopic entropy for extreme Kerr-MG BH, $S_{micro} = \frac{\alpha+2}{\sqrt{1+\alpha}}\pi J$ for the CFT which is completely in agreement with macroscopic Bekenstein-Hawking entropy. Therefore we may conjecture that in the extremal limit Kerr-MG BH is holographically dual to a chiral 2D CFT (conformal field theory) with central charge $c_L = 12J$."

21. **Rosa**, Dario (KIAS)

Contrasting SYK-like Models: RMT and Chaos

"We compare and contrast the Random Matrix Theory (RMT) properties of various SYK-like hamiltonians: the Gurau-Witten (GW) model, the standard SYK model and a flavored version of the SYK model due to Gross and Rosenhaus. The latter, even though disorder averaged, shows parallels with the GW model. In particular, the two models fall into identical Andreev ensembles as a function of N. Our main diagnostic tool of the chaos aspects of these models is the Spectral Form Factor (SFF). We relate the main features and peculiarities of the SFF with the features of the spectra of the corresponding hamiltonians. We also provide estimates of the relevant time scales of a given model on the base of the corresponding spectrum."

22. **Sadeghi**, Amirhossein (ESI)

Superposition of Mass and Breakdown of Semiclassical Gravity

"In this work, we argue that neither of our major standard theories of quantum or classical physics can predict the behaviour of the gravitational field of a very simple system: matter wave double slits experiment. By a comparison with electrodynamics counterpart, one might expect that a full quantum gravity theory is needed to answer this question. Even in that case, we show that there is a table-top phenomenon in low energy regime in which quantum gravity should induce a correction. While there is no complete theory of quantum gravity, it might be possible that phenomenologically discover the quantum modifications to the classical gravity of a such a spatial cat state. "

23. **Sato**, Yoshiki (Tokyo)

Boundary Holographic Witten Diagrams

"We discuss geodesic Witten diagrams in generic holographic conformal field theories with boundary or defect. Boundary CFTs allow two different decompositions of two-point functions into conformal blocks: boundary channel and ambient channel. Building on earlier work, we derive a holographic dual of the boundary channel decomposition in terms of bulk-to-bulk propagators on lower dimensional AdS slices. In the situation in which we can treat the boundary or defect as a perturbation around pure AdS spacetime, we obtain the leading corrections to the two-point function both in boundary and ambient channel in terms of geodesic Witten diagrams which exactly reproduce the decomposition into corresponding conformal blocks on the field theory side."

24. **Sciarappa**, Antonio (KIAS)

Relativistic Toda eigenfunctions from five-dimensional gauge theory

"We show how exact eigenfunctions for the quantum Baxter equation associated to the N-particle relativistic Toda chain can be obtained from gauge theory/open topological strings. Quantum mechanical instantons for the Toda chain, related to non-perturbative effects in topological string theory, are taken into account in the gauge theory approach by considering squashed S^5 backgrounds."

25. **Seo**, Min-Seok (CNU)

Large gauge transformation in quantum electrodynamics

"Nature of Large gauge transformation (LGT) in quantum electrodynamics (QED) is discussed. We point out that electric and magnetic properties of photon at null infinity reflects the behavior of photon under little group of Lorentz group."

26. **Seto**, Osamu (Hokkaido)

Non-minimally coupled Coleman-Weinberg inflation

"We study viable small-field Coleman-Weinberg (CW) inflation models with a non-minimal coupling to gravity. We show the a CW inflation model with a logarithmic non-minimal coupling has wide viable parameter regions. "

27. **Shiraishi**, Kiyoshi (Yamaguchi)

Multi-scalar boson stars

"We study solutions for boson stars in the multi-scalar field theory with global symmetry $U(1)^N$. The properties of the boson stars are investigated by the Newtonian approximation with the large coupling limit. Our purpose is to study the models bringing about exotic mass distributions which explain flat rotation curves of galaxies. We propose plausible models in which coupling matrices are associated with various graphs in graph theory."

28. **Sugishita**, Sotaro (Osak)

Time Evolution of Complexity in Abelian Gauge Theories - And Playing Quantum Othello Game -

"Quantum complexity is conjectured to probe inside of black hole horizons (or wormhole) via gauge gravity correspondence. In order to have a better understanding of this correspondence, we study time evolutions of complexities for generic Abelian pure gauge theories. For this purpose, we discretize $U(1)$ gauge group as $\mathbf{Z}_N$ and also continuum spacetime as lattice spacetime, and this enables us to define a universal gate set for these gauge theories. We evaluate time evolutions of the complexities for diagonalized Hamiltonians explicitly. It is conjectured that the complexity grows to a large value like exp(entropy) for the system dual to a black hole. We find that the Abelian gauge theory needs to be maximally nonlocal to have such a large complexity of the diagonal Hamiltonian."

29. **Sun**, Sichun (NTU)

New Views on Dark Matter from Emergent Gravity

"We discuss a scenario that apparent dark matter comes from the induced gravity in the 4-dimensional spacetime, embedded into higher dimensions.The dark matter stress energy tensor backreacts on the 4 dimensional spacetime, and can be determined by the Hubble constant, local gravity and the visible matter contents. Our approach may show a new interpretation for Verlinde's emergent gravity from higher dimensions. This type of scenarios is also expected to be consistent with early universe evolution and partly resembles the braneworld models. We also comment on some phenomenological implications, including gravitational wave solutions and MOND limit."

30. **Tamaoka**, Kotaro (Osaka)

Geodesic Witten diagram with various representations

"We study the equivalence between the conformal blocks and geodesic Witten diagrams for various irreducible representations (for example, symmetric traceless, mixed-symmetric, etc.). Geodesic Witten diagram is defined as Witten diagram whose interactions are restricted at geodesics between boundary operators. To this end, we improve and use the embedding formalism that makes many analysis in AdS simpler. This presentation is based on [1609.04563] in collaboration with M. Nishida and my recent work [1707.07934]."

31. **Tomita**, Kenji (YITP)

Cosmological models with the energy density of random fluctuations and the Hubble-constant problem

"First the fluctuation energy is derived from the adiabatic random fluctuations due to the second-order perturbation theory. The pressureless matter as a constituent of the universe at the later stage is assumed to consist of ordinary dust and the fluctuation energy. Next, cosmological models including the fluctuation energy as a kind of dark matter are derived using the above relation, and it is found that the Hubble parameter and the other model parameters in the derived models can be consistent with the recent observational values."

32. **Umemoto**, Koji (YITP)

Holographic Entanglement of Purification

"We study properties of the minimal cross section of entanglement wedge which connects two disconnected subsystems in holography. In particular we focus on various inequalities which are satisfied by this quantity. They suggest that it is a holographic counterpart of the quantity called entanglement of purification, which measures a bipartite correlation in a given mixed state. We give a heuristic argument which supports this identification based on a tensor network interpretation of holography. This implies that the entanglement of purification satisfies strong superadditivity for holographic conformal field theories."

33. **Uzawa**, Kunihito (KG)

Supersymmetry and geometrical structure in dynamical M-brane background

"The supersymmetry arises in certain theories of fermions coupled to gauge fields and gravity in a spacetime of 11 dimensions. The dynamical brane background has mainly been studied for the class of purely bosonic solutions only, but recent developments involving time-dependent brane solution have made it clear that one can get more information by asking what happens on supersymmetric systems. In this poster, we present an exact supersymmetric solution of dynamical M-brane background in the 11-dimensional supergravity, and show supersymmetry breaking. We also discuss the geometric features near the singularity and the black hole horizon."

34. **Watanabe**, Kento (YITP)

Optimization of Path-Integral in CFTs and Complexity

"Recently emergent spaces from tensor network descriptions for quantum states have been investigated actively as a toy model of holography or AdS/CFT. In this poster, we reformulate this conjectured connection to (continuous) tensor networks from the viewpoint of Euclidean path-integral. We discuss an "optimization" procedure of Euclidean path-integral for wave functionals in CFTs. For a ground state in CFTs, the optimization gives a hyperbolic space or a time slice of AdS. It suggests how to estimate a computational complexity in CFTs."

35. **Werner**, Marcus Christian (YITP)

Constructing and testing area metric spacetimes

"Area metrics are fourth order tensor fields that measure areas, thus providing a new stringy-inspired non-metric spacetime geometry. Here, we consider area metric perturbations about an effective Minkowski background. Insisting on predictive spacetime kinematics, implemented mathematically through bihyperbolicity, it turns out that the corresponding gravitational dynamics can be derived with geometrodynamics. We present the solution for a point mass, that is, a perturbative area metric Schwarzschild solution, and investigate observational tests using light propagation: after carefully deriving the electromagnetic energy-momentum and its conservation law in this area metric spacetime, we find a modified Etherington distance duality relation which deviates by Yukawa terms from the standard metric relation. Recent cosmological constraints on the Etherington relation are briefly discussed as well. This poster is based on the paper by F. P. Schuller & M. C. Werner: Etherington's distance duality with birefringence, Universe 3, 52 (2017), arXiv:1707.01261[gr-qc]."

36. **Yang**, Runqiu (KIAS)

Strong energy condition and action growth rate bound in holographic complexity

"Based on the information theory, the complexity growth rate of the same energy has an upper bound. I proves that if eternal neutral black holes satisfy some general conditions and matter fields only appear in the outside of the Killing horizon, the strong energy condition is a sufficient condition to insure that the vacuum Schwarzschild black hole has the fastest action growth of the same total energy. This result is consistent with the bound of computational complexity growth rate and gives a strong evidence for the holographic complexity-action conjecture. "

37. **Yaraie**, Emad (Semnan)

Evolution of entanglement entropy for small size regions in holographic boundary for Gauss-Bonnet gravity

"We study the evolution of entanglement entropy after a global quench happened at CFT boundary in the context of ADS/CFT duality. We consider a non-Einstein-Hilbert form for the gravitation model which its definition of entanglement entropy not simply followed by RT(HRT) proposal. By considering only small regions we can use on shell solutions of Euler-Lagrange equations which leads to a perturbative model and enable us having an analytically solution for entanglement entropy evolution. By this limit entanglement tsunami would not be longer valid. We also study if the shape of region could change the continuity of saturation phase or not."

38. **Yoon**, Junggi (ICTS)

SYK and SYK-like Models

"We present two types of simple quantum mechanical models which exhibit maximal chaos: SYK models and SYK-like tensor models. These models share a common feature: emergent reparametrization symmetry at strong coupling limit. This reparametrization is broken spontaneously and explicitly, which leads to the saturation of chaos bound. We also discuss generalizations of these models such as lattice, flavor and supersymmetry."

39. **Zhang**, Yingli (TUS)

Oscillations of power spectrum from non-minimally coupled fields of R^2 inflation

40. **Zhang**, Yun-Long (APCTP)

Bell Inequality in Holographic EPR Pair

We study the Bell inequality in a holographic model of EPR pair at the boundary, with an ER bridge on the string worldsheet in the bulk gravity. We identify the holographic Schwinger-Keldysh correlator as that in the CHSH formula of Bell inequality. After the perturbation, the string in the bulk is expected to be broken up, which would be dual to the decoherence of EPR pair after the measurement.