Fudan Student Workshop on Theoretical Physics 2025

Report of Contributions

https://indico.ihep.ac.cn/e/27983

Contribution ID: **1** Type: **not specified**

2D Kagome Antiferromagnets: Quantum Spin Liquids and beyond

2D strong correlated system has been a center topic in strong correlated electrons system for nearly a center. However, concrete understanding is obstacled by computational complexity and non-perturbative nature of quantum many body system. This talk focuses on 2D spin system with geometrical frustrations that forms a exotic state termed “Quantum Spin Liquid”. Specifically on Kagome lattice, frustration has induced fractionalize, Dirac type massless excitation whose excitation is described by a low-energy effective U(1) gauge theory, however, a concrete top-down proof of it’s validity is lacking. Here we used Monte Carlo methods to test the energy of Dirac Spin Liquid ground state and investigate it’s non-perturbative behaviour under magnetic fields. These properties might be observed in real Kagome antiferromagnets materials.

Presenter: 夏, 轩哲 (复旦大学)

Contribution ID: **2** Type: **not specified**

From UV to IR, tracking information loss in open quantum systems

The unification of quantum information science and high energy physics has created a new experimental frontier, where understanding environmental decoherence is a critical challenge. We present a novel framework that, for the first time, formulates the problem of calculating decoherence of spin-spin correlation from final state radiation as a systematically improvable effective field theory calculation. Our central discovery is that renormalization group evolution itself constitutes a quantum channel, driving a Markovian loss of information. This work yields the first analytical, all orders prediction for entanglement suppression at colliders as a function of detector resolution, providing an essential tool for future precision tests of quantum mechanics at the energy frontier.

Presenter: LIN, Shi-Jia (Fudan University, University of Chicago)

Contribution ID: **3** Type: **not specified**

Irregular states and surface defects in AGT correspondence

We developed the analogue of Gaiotto-Whittaker state in 2d WZW CFT. In the generalized AGT correspondence, this theory is dual to the 4d Argyres-Douglas theories with codimension 2 defects. We evaluated the inner product of the irregular state with primary state, which should correspond to the partition function of AD theory with defect.

Presenter: ZANG, Yichi (Fudan University)

Contribution ID: **4** Type: **not specified**

superconducting quantum simulation for honeycomb model

Contribution ID: **5** Type: **not specified**

Bootstrapping Yang-Mills matrix integrals

In this talk, we revisit the large N limit of bosonic D-matrix Yang-Mills integrals using two complementary bootstrap methods.
In the positivity bootstrap, we obtain bounds for $\langle \mathrm{Tr} XX \rangle$ and $\langle \mathrm{Tr} XXXX \rangle$ at various length cutoff $L_{\max}$. The precision of some $L_{\max} = 12$ islands is comparable to that of Monte Carlo estimates. For a fixed $L_{\max}$, the allowed region also shrinks with D and converges to the large D expansion results. We further deduce the analytic expressions of various types of trajectories and eigenvalue distributions at large D. Based on these explicit formulas, we propose some ansatz for the analytic trajectory bootstrap and obtain accurate results for finite D.

Presenter: 苏, 歆然

Contribution ID: **6** Type: **not specified**

Gauge Theories and Fiber Bundles

1) The basic mathematical framework of fiber bundles;
2) The correspondence between gauge symmetries and fiber bundle structures;
3) The application of fiber bundles in QED and QCD.

Contribution ID: **7** Type: **not specified**

Noether's Theorem and Holographic Gravitational Anomaly

In this work, we present a systematic study of asymptotic symmetries and conserved charges in Topological Massive Gravity(TMG) within asymptotically Anti-de Sitter(AdS_3) spacetimes. By rigorously applying Noether's theorem to the holographically renormalized action, we establish a robust framework that resolves long-standing ambiguities regarding boundary effects in the covariant phase space formalism. First, we demonstrate that the asymptotic diffeomorphisms are indeed physical symmetries of the theory in the strict Noether sense, as they preserve the action up to well-defined boundary terms. Second, we develop a unified holographic method to derive the central charges and anomalies; specifically, we explicitly calculate the holographic Weyl anomaly and the gravitational anomaly, as well as the mixed anomaly between them. Finally, we establish the equivalence between the derived Noether charges and the results obtained from the boundary stress tensor method. A distinguishing feature of our approach is its ability to naturally capture configuration-independent anomaly terms, which are often obscure in the conventional covariant phase space formalism, thereby offering a precise Noether's theorem resolution to the problem of holographic gravitational anomalies
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Presenter: FENG, Zhe (Institute of Theoretical Physics, Chinese Academy of Sciences)