Focus Week on Quantum Mechanical Systems at Large Quantum Number

Report of Contributions

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

Comments on Large Charge and Holography

Friday 3 September 2021 15:30 (1 hour)

I will discuss three topics on the large charge limit and holography. First, I will discuss general features of the large-charge limit of superconformal field theories at large N. In particular, I will point out a simple setup to analyze the large charge expansion of the planar N=4 super Yang-Mills and discuss its holographic interpretation. Second, I will point out the hidden symmetry of the double-scaling limit of N=4 super Yang-Mills at large charge. Third I will discuss the large-charge limit of the defect CFT on the Wilson line and its relation to the matrix model.

Presenter: KOMATSU, Shota (CERN)

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

Large quantum number expansion in O(2N) vector model and Resurgence

Thursday 2 September 2021 17:30 (30 minutes)

In this talk I will discuss the O(2N) model at criticality in three dimensions in the limit where the charge Q and N are taken to be large. The large-charge expansion turns out to be an asymptotic series and resurgent methods can be applied to obtain an unambiguous semi-classical reconstruction of this expansion. It contains non-perturbative corrections and it allows to extend the validity of the EFT to any value of the charge. Otherwise, this reconstruction can be emanated from a saddle point expansion of worldline path integrals for free particles moving on spheres.

Presenter: KALOGERAKIS, Ioannis (University of Bern)

Contribution ID: **8** Type: **not specified**

The O(N) model at large charge and the quartic/cubic equivalence

Wednesday 1 September 2021 17:30 (30 minutes)

The large-charge expansion can be employed to find and test dualities in QFT. I illustrate this point by investigating the quartic O(N) model between four and six dimensions, where it develops a metastable UV fixed point that is believed to be equivalent to the IR fixed point of an O(N) model featuring cubic interactions. By focusing on the cubic model just below six dimensions, I show how large-charge methods allow matching an infinite series of terms between the two descriptions, reinforcing the conjectured equivalence. Next, I analyze the stability of the large-charge sector of the two models by discussing the onset of complex CFT dynamics above a critical value of the charge.

Presenter: BERSINI, Jahmall (Ruđer Bošković Institute)

Contribution ID: **9** Type: **not specified**

Transition of Large R-Charge Operators on a Conformal Manifold

Tuesday 31 August 2021 17:30 (30 minutes)

We study a 3d N=2 supersymmetric conformal manifold using the large-charge expansion. The exactly marginal operator is shown to continuously interpolate between the "free" phase and the "superfluid" phase in the large-charge limit. We also discuss some novel aspects of the large-charge limit which appear in this model.

Presenter: SHARON, Adar (Weizmann Institute of Science)

Contribution ID: **10** Type: **not specified**

Operator spectrum of nonrelativistic CFTs at large charge

Monday 30 August 2021 17:30 (30 minutes)

I will discuss the large-charge expansion of the conformal dimension Δ_Q of the lowest operator of charge Q in nonrelativistic CFTs using the state-operator correspondence. The latter requires coupling the theory to an external harmonic trap that confines the particles to a spherical cloud, at the edge of which the effective theory breaks down and leads to divergences. Only recently has this issue been overcome by constructing appropriate counterterms at the edge of the cloud. I will show how to extend these results by systematically analyzing the degree of divergence of operators in the effective action and show that there always exist appropriate edge counterterms that make the final contributions to Δ_Q finite. On the other side of the correspondence, this also provides new corrections to the Thomas-Fermi approximation of the unitary Fermi gas, and I will comment on their relevance for ultracold atom physics.

Presenter: PELLIZZANI, Vito (University of Bern)

Contribution ID: **11** Type: **not specified**

The large charge sector of 3d parity-violating CFTs

Friday 3 September 2021 17:30 (30 minutes)

For CFTs that become superfluids at finite density, we show that there exists a single one-derivative term in the Goldstone EFT that has a quantized coefficient. This term requires the ground state on a sphere to have vortices, and results in a spectrum of operators that is remarkably different from CFTs that are parity invariant. We will show how the properties predicted by the Goldstone EFT are realized in the spectrum of monopole operators in a weakly coupled Chern-Simons matter theory. Based on arxiv:2102.05046 with Luca Delacretaz and Gabriel Cuomo.

Presenter: MEHTA, Umang (Kadanoff Center for Theoretical Physics, University of Chicago)

Contribution ID: **12** Type: **not specified**

Thermal one-point functions and single-valued polylogarithms: a spurious remark or something deeper?

Thursday 2 September 2021 16:30 (1 hour)

I present an overview on some recent progress in thermal one-point function in CFTs for general odd dimensions. On the one hand, they can be calculated using an extension to finite temperature of analytic bootstrap techniques. On the other hand, they are associated to single-valued polylogarithms which represent multiloop amplitudes in gauge theories. Some possible implications of the latter observation will be discussed.

Presenter: PETKOU, Anastasios (University of Thessaloniki)

Contribution ID: **13** Type: **not specified**

Convexity of Charged Operators in CFTs and the Weak Gravity Conjecture

Wednesday 1 September 2021 16:30 (1 hour)

In this talk I will introduce a particular formulation of the Weak Gravity Conjecture in AdS space in terms of the self-binding energy of a particle. The holographic CFT dual of this formulation corresponds to a certain convex-like structure for operators charged under continuous global symmetries. Motivated by this, we proposed a conjecture that this convexity is a general property of all CFTs, not just those with weakly-curved gravitational duals. While we lack an understanding of why this may be true from the CFT side, it is possible to test it in simple CFTs. The conjecture passes all the tests performed so far.

Presenter: PALTI, Eran (Ben Gurion University)

Contribution ID: **14** Type: **not specified**

BCFT at Large Charge

Tuesday 31 August 2021 15:30 (1 hour)

We compute the spectrum of large charge operators in boundary conformal field theories (BCFTs) using the superfluid effective field theory (EFT). We verify the EFT predictions in weakly coupled examples, where computations can be done in the microscopic description. We end with a discussion of large charge phases of bulk and boundary CFTs beyond the superfluid paradigm. The talk is based on work with G. Cuomo and A. Raviv-Moshe.

Presenter: MEZEI, Mark (Simons Center for Geometry and Physics, Stony Brook)

Contribution ID: **15** Type: **not specified**

Regge trajectories for N=(2,0) superconformal field theories

Friday 3 September 2021 16:30 (1 hour)

We discuss the structure of Regge trajectories of 6d N=(2,0) SCFTs combining analyticity in spin with supersymmetry. Focusing on the four-point function of supermultiplet we show how "analyticity in spin" holds for all spins greater than -3. Through the Lorentzian inversion formula we then describe an iterative procedure to "bootstrap" this four-point function starting from protected data, and compare the results with the numerical bootstrap bounds. This procedure works best at large but finite central charge, where non-protected contributions are suppressed by the inversion formula.

Presenter: LEMOS, Madalena (Durham University)

Contribution ID: **16** Type: **not specified**

Conformal Dimensions in the Subleading Large Charge Sector of the O(4) model

Monday 30 August 2021 16:30 (1 hour)

Presenter: CHANDRASEKHARAN, Shailesh (Duke University)

Contribution ID: **17** Type: **not specified**

Solving (Q)FTs via CFTs: From Weak Gravity Conjecture to Pandemics

Wednesday 1 September 2021 15:30 (1 hour)

Presenter: SANNINO, Francesco (Federico II University, Napoli and University of Southern Denmark)

Contribution ID: **18** Type: **not specified**

Charged spinning operators in the O(2) model

Monday 30 August 2021 15:30 (1 hour)

Large charge operators in CFTs invariant under internal symmetry can be generically associated with a superfluid phase of the theory. Therefore their correlation functions can be computed systematically within the effective field theory for the superfluid Goldstone mode. Focusing on the critical O(2) model in three dimensions, I will review this construction and extend it to include also operators with both large charge and large spin. I will discuss the results for the scaling dimension of the lightest charged operator, describing the transition from the superfluid phase to the large spin multi-trace operator regime described by the bootstrap. Based on 1711.02108 with A. de la Fuente, A. Monin, D. Pirtskhalava, R. Rattazzi and on a work in progress with Z.Komargodski.

Presenter: CUOMO, Gabriel (SCGP/YITP Stony Brook)

Contribution ID: **19** Type: **not specified**

Bulk-boundary correspondence of topologically trivial insulators

Thursday 2 September 2021 14:00 (1 hour)

Topological insulators are materials in which the bulk part is insulating but the surface is metallic because of protected gapless states on the surface. The correspondence between the bulk topology and the gapless surface states is called the bulk-boundary correspondence. Recently, higher-order topological insulators with gapless states localizes at hinges and corners of a crystal, rather than at surfaces, have been actively studied.

On the other hand, it has been found that even topologically trivial insulators may also exhibit a kind of bulk-boundary correspondence. These materials are characterized by electric multipole moments in the bulk and feature fractionally quantized electric charges at hinges and corners of a crystal. In this talk, I will review these recent developments and show that, in fact, a crystal of sodium chloride (NaCl) is the simplest example of octupole insulators which have 1/8 of the elementary charge e at corners.

Ref: HW and Hoi Chun Po, arXiv:2009.04845

Presenter: WATANABE, Haruki (The University of Tokyo)

Contribution ID: **20** Type: **not specified**

Large charge and higher rank N=2 SCFTs

Tuesday 31 August 2021 14:30 (1 hour)

Presenter: ARGYRES, Philip (University of Cincinnati)