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Carrollian Conformal Field Theories in Flat Space Holography

It is more than 20 years since the advent of the famed AdS/CFT correspondence, which has given a firm footing to the idea of holography. Our physical world is, however, clearly not AdS. For many applications, especially astrophysical ones, the universe can be approximated by an asymptotically flat spacetime. It is thus of great importance to extend the notion of holography from its original setting in asymptotically AdS spacetimes to flat backgrounds.
A natural way to construct a holographic quantum field theory for a general gravitational theory is to consider the symmetry structure at the spacetime boundary in which the gravitational theory lives. The Asymptotic Symmetry Group (ASG) and its associated algebra, the Asymptotic Symmetry Algebra, are formally given by these symmetries at the boundary. One can then propose that the dual field theory lives on the asymptotic boundary of the spacetime and inherits the symmetry of the ASG. For Einstein gravity in 3 and 4 dimensional Minkowski spacetime, the asymptotic symmetries at the null boundary of flat spacetime are given, not by the Poincare group but by the infinite-dimensional Bondi-Metzner-Sachs (BMS) groups. Drawing inspiration from AdS/CFT, holography in asymptotically flat spacetimes involves these infinite-dimensional symmetry algebras. The putative dual theories should be non-gravitational quantum field theories living on the null boundary and invariant under the infinite extended BMS algebras. Also, a natural avenue to explore flat holography is to investigate the singular limit where the bulk theory goes from AdS to flat space, i.e. taking the radius of AdS to infinity. This leads to an ultra-relativistic contraction of the boundary CFT, resulting in the Carrollian Conformal Field Theory (CCFT). These conformal versions of Carrollian theories are putative duals of flat space. It has also been known that the Carrollian Conformal symmetries are isomorphic to BMS symmetries. This poster focuses on aspects of Carrollian Conformal (BMS invariant) field theories in boundary dimensions d=2 and 4.

We will discuss the preliminaries (ultra-relativistic limit of CFT, finite and infinite Carrollian Conformal Algebra (CCA), its representation theory and geometric interpretation) in d=2 and higher. Then we will discuss about 2d CCFTs on the torus and its modular properties. We will show the asymptotic structure constants for general states in theory and match them with a calculation on an asymptotically flat FSC (Flat Space Cosmology) bulk. Later, we will focus on constructing CCFTs in d=4 primarily from two different approaches, namely limiting and intrinsic process. We will end this poster with a discussion on the supersymmetric formulation of CCA in d=4 and propose that the isomorphism between CCA and BMS can be extended for the supersymmetric case as well.

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