

Timelike boundaries in classical and quantum gravity

December 10, 2025

0.1 Samanta Saha (Case Western U.)

Title: Hidden Conformal Symmetry of the Discrete Series Scalars in dS_2

Abstract: In D -dimensional de Sitter space, a scalar field has an infinite tower of special tachyonic mass values at which enhanced shift symmetries arise. Upon gauging (modding out) these symmetries, the resulting fields correspond to unitary irreducible representations of the de Sitter group, known as the discrete series scalars.

For a particular mass outside this series (except the massless scalar in $D = 2$), the massive scalar field is known to possess a global conformal symmetry. In this talk, I will show that discrete series scalars in $D = 2$ also exhibit global conformal symmetry, albeit in an unconventional form.

Except in the massless case, these theories lack a stress tensor, and the conformal symmetry does not act in the usual way on the scalar field. Instead, we uncover the symmetry by explicitly computing correlators of shift-invariant local operators and demonstrating that they take conformally invariant forms.

0.2 Antonia Seifert (Perimeter Institute)

Title: Disentangling local boundaries: Gauge, Constraints and Physical Modes

Abstract: To better understand the Boundary-Value problem in General Relativity, we formulate boundary conditions based on gauge, constraint and physical degrees of freedom. Given this framework, we aim to examine the inclusion of local boundary conditions recently formulated.

0.3 Xinkang Wang (Chicago U.)

Title: Boundary Conditions in Anti-de Sitter Spacetime

Abstract: Boundary conditions of field theories in anti-de Sitter (AdS) spacetime is essential to our understanding of field dynamics in AdS. In this work, we build upon the formalism of Ishibashi & Wald (2004), which systematically examined and classified the boundary conditions for scalar field theory, Maxwell theory, as well as linearized gravity in AdS that give well-posed dynamics. We show that in the electromagnetic and gravitational cases in four-dimensional spacetime, there are precisely two local boundary conditions that preserve the full AdS symmetry. In the gravitational case, one of these conditions corresponds to boundary conditions previously given in the 1980s, by A. Ashtekar & A. Magnon (1984) and by M. Henneaux & C. Teitelbaum (1985). The alternative boundary conditions allow for a change in the conformal geometry on the AdS boundary. We elucidate the properties of these alternative boundary conditions.

0.4 Themistoklis Zikopoulos (Perimeter Institute)

Title: Timelike Boundaries in Gauss-Bonnet Gravity

Abstract: We extend the conformal boundary conditions to higher curvature gravity. We discuss aspects of the problem in the explicit example of Gauss-Bonnet gravity, both in Euclidean and in Lorentzian signature.