MP 2: Gravity, Amplitudes, AdS/CFT

Time: Monday 16:15–18:35 Location: MP-H5

Invited Talk MP 2.1 Mon 16:15 MP-H5

The Page curve from quantum error correction — •Daniel Harlow — Massachusetts Institute of Technology, Cambridge, Massachusetts, USA

The "Page curve", meaning the von Neumann entropy of the radiation of a black hole plotted as a function of time, is one of the main tools for diagnosing the black hole information problem. Recently semiclassical calculations of this curve were given, but they have several mysterious features. In particular, it is not so clear how they can be interpreted from a Hilbert space point view, as one would like in a real theory of quantum gravity. In this talk I'll explain how these calculations can be given such an interpretation through a novel generalization of quantum error correction to "non-isometric" codes.

Invited Talk MP 2.2 Mon 16:45 MP-H5

Classical black hole scattering from a worldline quantum field theory — •Jan Plefka — Humboldt Universität zu Berlin, Germany

When two massive, gravitationally interacting bodies (black holes, neutron stars or stars) fly past each other they are deflected and emit gravitational Bremsstrahlung. I shall discuss how this classical two-body problem in general relativity can be efficiently described using worldline quantum field theory methods. Including spin (i.e. Kerr Black Holes or spinning neutron stars) leads to an effective N=2 supersymmetric description valid up to quadratic order in spins. The emitted gravitational waveform, scattering angle and spin-kick may be efficiently computed in a weak gravitational field (post Minkowskian) expansion and represent state of the art results. The worldline quantum field theory approach innovates over traditional approaches and imports modern technology from perturbative quantum field theory to classical perturbative GR.

MP 2.3 Mon 17:15 MP-H5

Sustained convergence of hydrodynamics in rapidly spinning quark-gluon plasma — •Matthias Kaminski[1], Casey Cartwright[1], Markus Garbiso Amano[1], Jorge Noronha[2], and Enrico Speranza[2] — [1]Department of Physics and Astronomy, University of Alabama,514 University Boulevard, Tuscaloosa, AL 35487, USA — [2]Illinois Center for Advanced Studies of the Universe, Department of Physics, University of Illinois at Urbana-Champaign, Urbana, IL 61801, USA

We compute the radius of convergence of the linearized relativistic hydrodynamic gradient expansion around a non-trivially rotating strongly coupled $\mathcal{N} = 4$ Super-Yang-Mills plasma. Our results show that the validity of hydrodynamics is sustained and can even get enhanced in a highly vortical quark-gluon plasma, such as the one produced in intermediate-energy heavy-ion collisions. The hydrodynamic dispersion relations are computed using a rotating background that is an analytical solution of the ideal hydrodynamic equations of motion with non-vanishing angular momentum and large vorticity gradients, giving rise to a particular boost symmetry. Analytic equations for the transport coefficients of the rotating plasma as a function of their values in a plasma at rest are given.

MP 2.4 Mon 17:35 MP-H5

Scalar flat holography — •Lorenzo Iacobacci[1,2] and Massimo Taronna[1,2,3] — [1]Dipartimento di Fisica Ettore Pancini, Università degli Studi di Napoli Federico II Via Cintia, 80126 Napoli, Italy — [2]Istituto Nazionale di Fisica Nucleare, Sezione di Napoli Via Cintia, 80126 Napoli, Italy — [3]Scuola Superiore Meridionale, Università degli Studi di Napoli Federico II, Largo San Marcellino 10, 80138 Napoli, Italy

Recently, flat space holography has played a central role in the study of scattering amplitudes. In particular, the (d+2)-dimensional holographic flat space-time is closed in the far past and in the far future by a d-dimensional boundary, called celestial sphere. On this boundary, a d-dimensional conformal field theory lives; therefore, researchers have been studying the imprint of the d-dimensional conformal symmetry in (d+2)-dimensional scattering amplitudes.

Further, it is well-known that the (d+2)-dimensional Minkowski space-time can be sliced in (d+1)-dimensional AdS spaces inside the light-cone and by (d+1)-dimensional dS spaces outside. This suggests us that a connection between flat, dS and AdS holography should exist.

In our talk, we shall see the strict connection between the holography realized on AdS, dS and Minkowski. By analogy with the AdS case, we will arrive to write down a dictionary to pass between AdS, dS and flat holography. Moreover, these stringent connections will allow us to exploit the results obtained in AdS holography to compute scattering amplitudes both in flat and dS holography.

MP 2.5 Mon 17:55 MP-H5

Hyperbolic tilings and discrete holography — •Giuseppe Di Giulio — Julius-Maximilians-Universität Würzburg

The AdS/CFT correspondence is one of the most important breakthroughs of the last decades in theoretical physics. A recently proposed way to get insights on various features of this duality is achieved by discretising the Anti-deSitter spacetime. Within this program, we consider the Poincaré disk (fixed time slice of three-dimensional Anti-deSitter spacetime) discretised by introducing a regular hyperbolic tiling on it. This breaks the isometry group of the Poincaré disk down to a discrete subgroup. In a possible discrete version of the AdS/CFT correspondence, such a discrete group is expected to characterise also the quantum theory living on the boundary of the hyperbolic tiling. In this talk, we discuss the properties that such a boundary theory must have. The bulk tessellation we study induces an aperiodic spatial modulation on any model defined on the boundary. This provides an interesting bridge with the aperiodic quantum chains, well-known systems in the literature of condensed matter theory. Furthermore, in view of examining possibilities for establishing a duality in this setup, we investigate the entanglement properties of the tiled bulk (obtained through a discretised version of the Ryu-Takayanagi formula for the holographic entanglement entropy) and of some possible boundary theories.

MP 2.6 Mon 18:15 MP-H5

Classical and quantum gravitational scattering with Generalized Wilson Lines — Domenico Bonocore, Anna Kulesza, and •Johannes Pirsch — Institut für Theoretische Physik, WWU Münster, Münster, Germany

The all-order structure of scattering amplitudes is greatly simplified using Wilson line operators, describing eikonal emissions from straight lines extending to infinity. A generalization at subleading powers in the eikonal expansion, known as Generalized Wilson Line (GWL), has been proposed some time ago, and has been applied both in QCD phenomenology and in the high energy limits of gravitational amplitudes. In this talk I discuss the construction of the gravitational GWL starting from first principles in the worldline formalism. This includes identifying the correct Hamiltonian, which leads to a simple correspondence between the soft expansion and the weak field expansion. The resulting path integral representation of the GWL makes it possible to isolate the relevant contributions to the classical limit.