

Positivity and the Bootstrap

Report of Contributions

Contribution ID: 1

Type: **not specified**

Positivity without Boosts: UV/IR Relations for Cosmology

Monday, 31 May 2021 14:30 (40 minutes)

Positivity bounds are a powerful tool which can connect IR phenomenology with the underlying fundamental physics in the UV, but to date their implementation has required Lorentz invariance at all scales.

This talk describes recent progress in removing this assumption, deriving a set of bounds which can be applied to systems in which boosts are spontaneously broken, such as cosmology.

For example, these new bounds place UV constraints on the shapes of cosmological correlators in the CMB which can arise from the effective field theory of single-field inflation.

Presenter: MELVILLE, Scott

Contribution ID: 2

Type: **not specified**

A Timeless History of Time

Monday, 31 May 2021 15:30 (40 minutes)

Cosmological observations give us the unique opportunity to probe the fundamental laws of physics at very high energies as well as the perturbative regime of quantum gravity. Unfortunately, due to the creativity of theorists and the paucity of data about the primordial universe, there is a huge number of models compatible with all measurements, featuring a wide variety of mechanisms, symmetries, and spectra of particles. The reason can be traced back to the fact that we don't observe the time evolution during inflation, but only its final outcome.

In this talk I will report on the recent progress in developing a completely new “bootstrap” approach to derive predictions from the very early universe that make no reference to time and the un-observable time evolution. The bootstrap approach builds directly upon the fundamental pillars of physics. In particular, I will present the recent breakthroughs in understanding the consequence of unitarity for cosmological correlators to all orders in perturbation theory, as well as the footprint of (bulk) locality. I will show how these principles can be used to derive many classical and new inflationary predictions associated with primordial non-Gaussianity in a way that is both computationally simpler and conceptually more transparent. This includes a reconstruction formula that relates de Sitter correlators to amplitudes for massless particles, cosmological partial-energy recursion relations and a “timeless” differential representation of the perturbative wavefunction. This approach makes no reference to de Sitter boosts, which are broken by a large amount in models that predict large non-Gaussianity. Finally I speculate on how these results give us a handle on non-perturbative effects in cosmology either from cosmological positivity bounds or from de Sitter holography.

Presenter: PAJER, Enrico (University of Cambridge)

Contribution ID: 3

Type: **not specified**

On analytic properties of cosmological correlators

Monday, 31 May 2021 16:30 (40 minutes)

Presenter: GORBENKO, Viktor

Contribution ID: 4

Type: **not specified**

Discussion

Monday, 31 May 2021 17:30 (30 minutes)

Presenter: DE RHAM, Claudia (Imperial College London)

Positivity and t ... / Report of Contributions

TBA

Contribution ID: 5

Type: **not specified**

TBA

Presenter: MELVILLE, Scott

Contribution ID: 6

Type: **not specified**

TBA

Presenter: MELVILLE, Scott

Contribution ID: 7

Type: **not specified**

TBA

Presenter: PAJER, Enrico (University of Cambridge)

Contribution ID: 8

Type: **not specified**

TBA

Presenter: PAJER, Enrico (University of Cambridge)

Contribution ID: 9

Type: **not specified**

TBA

Presenter: GORBENKO, Viktor

Contribution ID: **10**

Type: **not specified**

TBA

Presenter: GORBENKO, Viktor

Contribution ID: 11

Type: **not specified**

Discussion

Presenter: DE RHAM, Claudia (Imperial College London)

Contribution ID: 12

Type: **not specified**

Discussion

Presenter: DE RHAM, Claudia (Imperial College London)

Contribution ID: 13

Type: **not specified**

Positivity bounds in SMEFT and the inverse problem.

Tuesday, 1 June 2021 14:30 (40 minutes)

Presenter: ZHANG, Cen (Institute of High Energy Physics, Chinese Academy Sciences)

Contribution ID: 14

Type: **not specified**

The facets of product moments: from EFThedron to Modularhedron

Tuesday, 1 June 2021 15:30 (40 minutes)

Presenter: HUANG, yu-tin

Contribution ID: 15

Type: **not specified**

Positive Moments and Loops

Tuesday, 1 June 2021 16:30 (40 minutes)

Presenter: RIVA, Francesco

Contribution ID: **16**

Type: **not specified**

Discussion

Tuesday, 1 June 2021 17:30 (30 minutes)

Presenter: AUGUSTO PENEDONES FERNANDES, Joao Miguel (EPFL - Ecole Polytechnique Federale Lausanne (CH))

Contribution ID: 17

Type: **not specified**

Rigorous bounds on the analytic S-matrix

Wednesday, 2 June 2021 14:30 (40 minutes)

In this talk I will introduce a complementary approach to the non-perturbative S-matrix Bootstrap based on duality in optimization theory.

In particular, I will focus on the problem of bounding the quartic coupling for gapped theories in 4-dimensions, both from above and below.

The bounds obtained rely solely on proven analyticity properties and the numerical problem can be efficiently solved using SDPB.

Presenter: GUERRIERI, Andrea

Contribution ID: 18

Type: **not specified**

Celestial amplitudes: from UV constraints to conformal blocks

Wednesday, 2 June 2021 15:30 (40 minutes)

Celestial amplitudes describe scattering in a basis of boost eigenstates. In this basis, 4-point scattering is characterized by two variables: the sum over the boost weights β which is dual to the center of mass energy, and a cross ratio z related to the bulk scattering angle. In this talk I will describe two aspects of the physics captured by the β and z dependence. I will first show that the UV behavior of 4-point scattering is encoded in the analytic structure of celestial amplitudes in the complex β plane. The residues of the poles at negative even integer β are related to coefficients of higher-dimension operators in the low-energy effective action hence subject to positivity constraints, while poles at positive even integer β arise from UV asymptotics. I will then show that the z dependence contains information about the celestial spectrum and three-point couplings. For scalar 4-point scattering mediated by massive exchange, the conformal blocks include massive scalar states with positive integer conformal weights, as well as intermediate exchanges of spinning light-ray states.

Presenter: ANA-MARIA, Raclariu

Contribution ID: 19

Type: **not specified**

Positive sum rules in gravitational EFTs

Wednesday, 2 June 2021 16:30 (40 minutes)

We explore constraints on low-energy dynamics which stem from assuming causality of 2->2 scattering at all energy scales. I will review a key ingredient added recently: low-energy crossing symmetry, which bounds the couplings of spinning heavy states and ensures that sum rules are dominated by (unknown) states of low spin. Gravity is special since its tree-level energy growth already requires a UV completion. This implies roughly that gravity is attractive at all scales. I describe model-independent constraints which exploit low-energy crossing to account for the graviton pole.

Presenter: CARON-HUOT, Simon

Contribution ID: 20

Type: **not specified**

Discussion

Wednesday, 2 June 2021 17:30 (30 minutes)

Presenter: TOLLEY, Andrew (Imperial College London)