

Agenda

Vendredi 03/12/2021, 10:00-12:30

Orme des Merisiers Amphi Claude Bloch, Bât. 774

Alexander Zhiboedov (CERN)

The analytic S-matrix

The bootstrap approach asserts that certain physical theories can be strongly constrained, and sometimes even be solved, using general principles only. We review old and new results obtained from applying this approach to scattering of relativistic particles in flat space.

The S-matrix describes transitions between states of freely moving particles in the far past and the distant future. Conventionally such transitions, or scattering amplitudes, are computed in perturbation theory. The S-matrix bootstrap is a program of constructing scattering amplitudes nonperturbatively, based on the general principles of special relativity and quantum mechanics. The aim of the course is two-fold. First, we review the basic concepts of S-matrix theory (analyticity, unitarity, crossing) and their connection to the basic principles of relativistic QFT, such as causality, locality and unitarity. This will lead us to the formulation of the S-matrix bootstrap problem, and to the derivation of various results of S-matrix theory that concern nonperturbative properties of scattering amplitudes. Second, we go over various approaches to constructing scattering amplitudes that satisfy the desired properties, and more humbly obtain rigorous nonperturbative bounds on such amplitudes. These include both ideas from half a century ago (when many of the results were first derived), as well as some of the recent work on the S-matrix bootstrap program.

Plan of the course:

1. Introduction to S-matrix theory.
2. Kinematics (Mandelstam plane, unitarity, crossing, partial waves).
3. Analyticity (field theory analyticity, unitarity extension of analyticity, Landau equations, maximal analyticity).
4. Universal Bounds (Froissart-Gribov formula, Mandelstam kernel, Martin-Froissart bound, Gribov's theorem, Dragt bootstrap).
5. Bootstrap Methods (primal/dual problems, fixed point method, coupling maximization).

course page : <https://courses.ipht.fr/?q=en/node/248>

Livestream on [youtube.com/PhT-TV](https://www.youtube.com/PhT-TV): no subscription required

In-person audience: facial mask compulsory.

Videoconference: subscribe to the course newsletter to receive links
