



Cours de Physique Théorique de l'IPhT, année 2010-2011

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Ecole Doctorale de Physique de la Région Parisienne - ED 107

Introduction to Scattering Amplitudes

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Les vendredis 21/1, 28/1, 4/2, 11/2/2011 à 10h00.

IPhT

Scattering amplitudes take surprisingly simple forms in theories such as quantum chromodynamics (QCD) and general relativity. This simplicity indicates deep symmetry. Recently, it has become possible to explain and use some of this symmetry. I will describe these insights and show how to derive amplitudes efficiently and elegantly. Key new ideas involve using complexified momentum, exploring singular behavior, and seeking clues in so-called twistor geometry. Complete amplitudes can be produced recursively. This streamlined approach is being applied in searches for new physics in high-energy particle colliders.

1. QCD and the spinor-helicity formalism: Color quantum numbers can be set aside. Helicity amplitudes have elegant expressions in terms of spinors. MHV (maximally helicity violating) amplitudes are the simplest.
2. On-shell (BCFW) recursion relations: Tree amplitudes can be reconstructed from their residues at complex poles, which correspond exactly to their propagators. These recursion relations tend to give the most compact forms of amplitudes and are applicable in a variety of theories.
3. Twistor space and N=4 SYM: N=4 supersymmetry implies conformal symmetry in Yang-Mills theory, and together these symmetries give strong constraints on amplitudes. Moreover, there is an additional dual superconformal symmetry. QCD at tree level inherits many of the same symmetries.
4. Loop amplitudes: Unitarity and generalized unitarity methods allow the construction of loop amplitudes from their branch cuts, bypassing the enumeration of Feynman diagrams and working with on-shell quantities only.

Horaires : les vendredis de 10h00 à 12h15.

Lieu : IPhT, CEA Saclay, Orme des Merisiers, Bât. 774, p.1A Salle C. Itzykson.

Accès : Par lignes de bus publics (269.02 et 91.06) ou

- navettes CEA: RER B Le Guichet vers CEA Orme Bât. 774, toutes les 15 min de 8h00 à 9h45;

- navette CEA: CEA Orme Bât. 774 vers RER B Le Guichet à 12h36.

Renseignements : <http://ipht.cea.fr> ou ipht-lectures@cea.fr