ExtreMe Matter Institute EMMI

EMMI Special Lectures

Bound states in gauge theories, from QED to QCD

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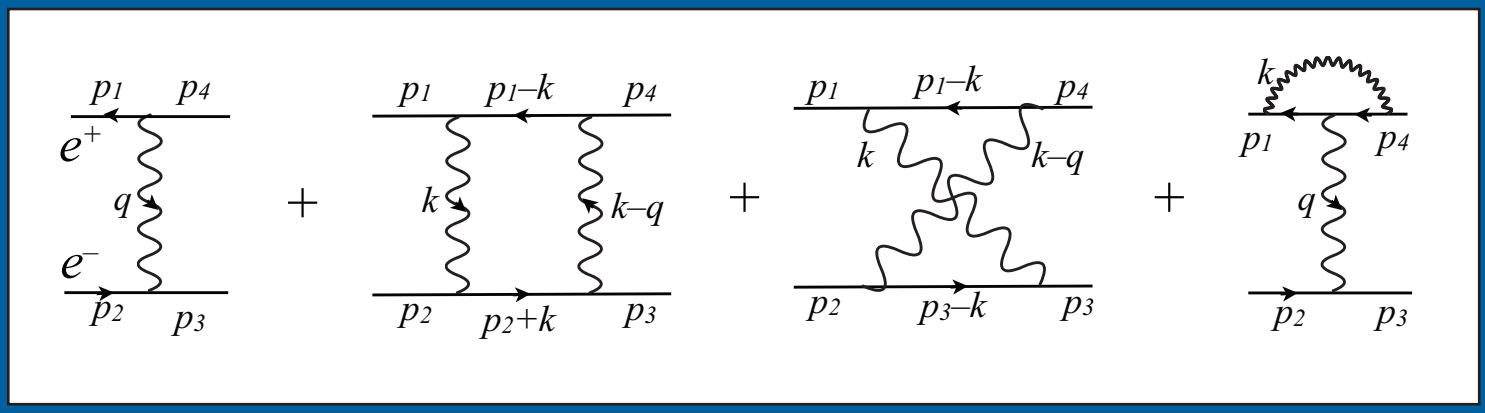
March 05, 06, 12 and 13, 2015, 10:00h
GSI Darmstadt, KBW Lecture Hall (1.17)



Abstract

Perturbative methods allow accurate calculations of QED bound states (atoms). Hadrons have atom-like features, even though their quark and gluon constituents are highly relativistic and confined. The possibility that analytic Hamiltonian methods may be useful also for QCD bound states merits careful attention. The first lecture will be an overview of the motivations, challenges and status of a Hamiltonian approach to gauge theory bound states. There is a tantalizing possibility that confinement is described by a classical gauge field (Born approximation), with loop corrections being perturbatively calculable. The A^0 potential of mesons is linear when the boundary condition on the homogeneous solutions of Gauss' law is fixed by \Lambda_{QCD}.

Bound states are spatially extended objects which transform non-trivially under boosts (c.f. the classical Lorentz contraction). Relativistic dynamics involves pair creation, giving sea quark distributions. The Born level bound states also feature parton - hadron duality. Scattering amplitudes are defined using the bound states as zeroth order "in" and "out" states of the perturbative expansion.

Previous lecture notes can be found at http://arxiv.org/abs/1402.5005 and a summary of results at http://arxiv.org/abs/1409.4703.

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