Contribution ID: **237** Type: **Talk**

Effective-particle approach to bound states of quarks and gluons in QCD

Monday, 25 September 2017 14:55 (20 minutes)

A general approach to the construction of bound states in quantum field theory, called the renormalization group procedure for effective particles (RGPEP), is applied to single heavy-flavor QCD in order to study its utility beyond illustration of its general features. This heavy-flavor QCD is chosen as the simplest available context in which the dynamics of quark and gluon bound states can be studied with required rigor using the Minkowski-space Hamiltonian operators in the Fock space, taking the advantage of asymptotic freedom [1]. The effective quarks and gluons differ from the point-like canonical ones by having a finite size s. Their size plays the role of renormalization group parameter. However, instead of integrating out high energy degrees of freedom, our RGPEP procedure is based on a transformation of the front-form QCD Hamiltonian from its canonical form with counterterms to the renormalized, scale dependent operator that acts in the Fock space of effective quanta of quark and gluon fields, keeping all degrees of freedom intact but accounting for them in a transformed form. We discuss different behavior of effective particles interacting at different energy scales, corresponding to different size s. Namely, we cover phenomena ranging from asymptotic freedom at highest energies down to the scales at which the formation of bound states occurs. We briefly present recent applications of the RGPEP to quarks and gluons in QCD, which have been developed using expansion in powers of the Fock-space Hamiltonian running coupling. After observing that the QCD effective Hamiltonian satisfies the requirement of producing asymptotic freedom [1], we derive the leading effective interaction between quarks in heavy-flavor QCD [2]. An effective confining effect is derived as a result of assuming that the non-Abelian and non-perturbative dynamics causes effective gluons to have mass. This talk provides a theoretical background to the talk whose proposed abstract is submitted by Kamil Serafin to HADRON 2017[3].

References:

[1] M. Gómez-Rocha and S. D. Głazek, Phys. Rev. D92 (2015) 065005.

[2] S.D. Głazek, M. Gómez-Rocha, J. More, K. Serafin. arXiv:1705.07629

[3] K. Serafin's abstract submitted to HADRON2017.

Primary author: Dr GÓMEZ-ROCHA, María (ECT*)

Co-authors: Prof. GLAZEK, Stanislaw D. (University of Warsaw); Mr SERAFIN, Kamil (University of Warsaw); Dr MORE, Jai (Indian Institute of Technology Bombay)

Presenter: Dr GÓMEZ-ROCHA, María (ECT*)

Session Classification: QCD and hadron structure

Track Classification: QCD and hadron structure