Probing transverse nucleon structure at high momentum transfer

Monday, April 18, 2016 - Friday, April 22, 2016

Trento/ECT*

Scientific Program

Context

Recent experimental measurements using electron- and photon-nucleon elastic scattering – the simplest exclusive processes – are revealing reaction mechanisms much more subtle than previously or naively assumed. For example, the two-photon exchange contribution appears to be essential for a robust description of electron-nucleon scattering at large momentum transfers and recent Wide Angle Compton Scattering (WACS) results clearly confirm that non-perturbative effects are still dominant at the large (relative to Λ QCD) Mandelstam variables so far explored. Moreover, recent Jefferson Lab data at relatively high momentum transfer has, for the first time,made possible a quark flavour decomposition of the nucleon elastic electromagnetic form factors (FFs) and the emerging theoretical framework hints at possible diquark correlations inside the nucleon. These efforts complement the significant experimental and theoretical progress that is beginning to provide insights into the multidimensional partonic structure of the nucleon.

In this exciting context, perturbative QCD has proven successful at describing certain reaction observables, however at current momentum transfers it is still unable to predict elastic scattering data. This may change however, with the forthcoming Jefferson Lab experiments at larger momentum transfers which may observe the predicted transition to the perturbative scaling regime. New approaches based on the Dyson-Schwinger and Faddeev equations appear successful at describing FFs at high momentum transfer and are a promising tool with which to study WACS. The recent Soft Collinear Effective Theory, with the introduction of a new universal form factor, may also help develop a better understanding of WACS processes. Lattice QCD and Nambu-Jona-Lasinio effective theory offer further insights into the flavour dependence of these observables. The relationship between WACS FFs and elastic FFs, which can be explored using the DSE approach, are key issues in understanding the complementarity of the two processes and for the extraction of information on the transverse structure of the nucleon.

Scientific Focus

This workshop will focus on nucleon structure and the related quark-gluon dynamics, in light of the upcoming experimental opportunities provided by Jefferson Lab. The 12 GeV energy upgrade of the
polarized electron beam, combined with very high luminosity achievable by new targets and equipment, provides many new possibilities for probing nucleon structure. In fact, the Super BigBite Spectrometer in Hall A will for the first time provide unprecedented access to these observables in the
large energy and momentum transfer domain, and thereby expose crucial aspects of the quark-gluon
dynamics that govern nucleon structure. It is also possible that the nature of the transition from the non-
perturbative to the perturbative regime will be explored with unprecedented precision.

The workshop intents to bring together experimentalists and theorists from the international hadron physics community in order to facilitate discussions on what is needed in terms of theoretical approaches and experimental data to better understand, in particular:

Nucleon structure
Quark-gluon dynamics

Nucleon form factors
Exclusive electron and photon elastic scattering on the nucleon

The main goal would be to identify new ideas in theory and experiment which will provide the greatest
insight into the quark and gluon structure of the nucleon.

Organizers

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