

Workshop on Radiative Effects in Precision Electron Scattering

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Introduction

A majority of approved physics experiments [1] that will be running with 12-GeV electron beams at JLab require at least a per-cent accuracy in the measurements of differential cross sections and polarization asymmetries. This accuracy is comparable with a fine structure constant, $\alpha \approx 1/137$, therefore neglecting electromagnetic corrections of the order $O(\alpha)$ may lead to significant mis-interpretation of data. Extension and further development of the theoretical and computational approaches to higher-order QED effects for electron scattering is an outstanding problem for the upcoming physics analysis effort at JLab.

The workshop on Radiative Effects in Precision Electron Scattering was part of a broader effort by the JLab collaborations to explore the 3D structure of nucleon. The main goal was to address outstanding issues of QED radiative effects for the following critical research areas:

(a) Studies of nucleon's Generalized Parton Distributions (GPDs) and Transverse Momentum Distributions (TMDs); (b) Measurements of the elastic form factors and resonance transition form factors of the nucleon; (c) Effects of nuclear medium on the properties of hadrons; and (d) Search for physics beyond the Standard Model of electroweak interactions.

Workshop Organization

The workshop Radiative Effects in Precision Electron Scattering took place at Jefferson Lab on May 16 - 19, 2016 (<https://www.jlab.org/conferences/radiative2016>). The organizing committee consisted of :

Aleksandr Aleksejevs (Memorial University)
Andrei Afanasev, co-chair (GWU)
Harut Avakian, co-chair (JLab)
Alessandro Bacchetta (Pavia University)
Svetlana Barkanova (Acadia University)
Dave Gaskell, co-chair (JLab)
Hayk Hakobyan (Univ. Frederico SM)
Haiyan Gao (Duke University)
Z.-E. Meziani (Temple)
Peter Schweitzer (UConn)

The workshop was attended by 44 participants from Jefferson Lab, members of US universities, and world experts from Australia, Europe, Canada. The remote workshop connection via Blue Jeans was available for those participants who were not able to come to Jefferson Lab. The workshop was organized into several topical sessions with 35 presentations. The scientific program is attached to this document.

Budget Justification

Funds from the JSA Initiatives Fund Program were used to partially support travel expenses of three invited speakers:

- 1) Igor Akushevich, Duke (\$235.98 travel and \$ 288.32 lodging)
- 2) Petr Zavada, Check Republic (\$ 432.48 lodging)
- 3) Andrea Bressan, Italy (\$ 279.20 lodging)
- 4) Alexander Ilyichev, Belorussia (\$1113.86 with \$846.86 airfare + \$160.00 visa \$107 James River Transportation from Norfolk \$184.44 lodging)

The JSA support of \$2349.84 has been used to cover expenses of key speakers, including travel \$1349.84 (1+4) and lodging \$1000.0 (1+2+3).

The workshop organizers are thankful to Bob McKeown for the Jefferson Lab directorate support of the workshop in the amount of \$2500 (and also thankful for some support received from the experimental Halls A and B).

Workshop Summary

The extraction of Transverse Momentum Distributions (TMDs) and Generalized Parton Distributions (GPDs) from different single and double spin azimuthal asymmetries requires reliable and model independent procedure for flavor decompositions of underlying 3D partonic distributions, and one of the main challenges in precision measurements of hard scattering processes is the detailed understanding of radiative corrections to all involved observables, allowing credible estimates of systematic errors. A new procedure for 3D data analysis has been proposed and discussed, involving self consistent radiative correction in the theoretical analysis stage. Main topics included:

- Radiative corrections to hard scattering in exclusive and semi-inclusive processes.
- Phenomenology of 3D parton distribution and fragmentation functions.
- MC generators for global analysis of TMDs and GPDs with radiative photons.
- Two-photon effects for measurements of elastic and transition form factors.
- Radiative Processes in the Nuclear Medium.
- Physics beyond the Standard Model.

Detailed list of talks is available from the conference web page <https://www.jlab.org/conferences/radiative2016/program.html>

The workshop played an important role in the development of a future physics program to study nucleon's GPDs and TMDs. The workshop fostered collaboration with theorists and attracted people involved in studies of the 3D nucleon structure at different facilities worldwide, including DESY, CERN, BNL and JLab Halls A,B and C and the future Electron Ion Collider. The participating lead researchers in the field contributed to the success of the program, thereby increasing the international support for a multifaceted effort to study the fundamental structure of matter.

Bibliography:

[1] http://www.jlab.org/exp/_prog/PACpage/ExpSum-12GeV.pdf