APCTP Focus Program in Nuclear Physics 2022: Hadron Physics Opportunities with JLab Energy and Luminosity Upgrade

Monday, 18 July 2022 - Saturday, 23 July 2022

APCTP, Pohang

Programme

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Monday, 18 July 2022

Registration - Classroom 308 (08:00 - 08:50)

Opening - Classroom 308 (08:50 - 09:00)

Session: 1 - Classroom 308 (09:00 - 10:20)

-Conveners: Oh, Yongseok (Kyungpook National University)

[16] Hadron physics with CLAS12 at energies up to 24 GeV. (09:00, 30 minutes)

Presenter: BURKERT, Volker (Jefferson Laboratory)

Selected aspects of hadron physics that will be accessible at higher beam energies at JLab will be discussed. Possible solutions to precision particle tracking and the expansion of electron and photon detection to larger polar angles will be discussed.

[21] Applications of the gauge/gravity duality to hadron physics (09:40, 30 minutes)

Presenter: JARVINEN, Matti (APCTP)

After a brief review of the gauge/gravity duality, I will discuss selected applications to hadron physics. These will include holographic studies of Regge physics and the pomeron in soft scattering, as well as the construction of baryonic states in holography. My main focus will be on the V-QCD model, which is a complex bottom-up model for QCD, but I will also comment on progress with other holographic models.

time	[id] title	presenter
09:30	Discussion (10 minutes)	
10:10	Discussion (10 minutes)	

Break - Classroom 308 (10:20 - 10:40)

Session: 2 - Classroom 308 (10:40 - 11:50)

-Conveners: Choi, Ho-Meoyng (Kyungpook National University)

[6] Probing Nuclear Structure at Extreme Conditions (10:40, 30 minutes)

Presenter: SARGSIAN, Misak (Florida International University)

We discuss the new physics which can be accessed with doubling the energies of CEBAF accelerator at Jefferson Lab. This relates to probing three-nucleon short range correlations in nuclei and measuring deep-inelastic nuclear structure at $x>1$ that will allow for the first time to probe the dynamics responsible for generation of super-fast quarks in nuclei. Other venues of research is the probing non-nucleonic structure of NN interaction at distances relevant to the nuclear repulsive core. This can be achieved by measuring deuteron inclusive cross section at large x and very large Q^2 or probing exclusive electro-disintegration of the deuteron at internal momenta above 1 GeV/c. Different models that describe the generation of such a large internal momenta will be discussed including effects of intermediate resonance state and hidden-color component.

[5] Photo- and electro-production of φ meson on the nucleon and 4He (11:20, 20 minutes)

Presenter: KIM, Sangho (Soongsil University)

We investigate φ meson photoproduction on the nucleon and 4He targets within a dynamical model approach based on a Hamiltonian which describes the production mechanisms by the Pomeron exchange, meson exchange, φ radiation, and nucleon resonance excitation mechanisms. The final φN interactions are included and described by the gluon-exchange, direct φN couplings, and the box diagrams. Our results are in good agreement with the CLAS and LEPS data. We extend our approach to the electroproduction of φ meson on the nucleon.

time	[id] title	presenter
11:10	Discussion (10 minutes)	
11:40	Discussion (10 minutes)	

Lunch (12:00 - 14:00)

Free Discussion: PCR test for international travelers - Classroom 308 (14:00 - 18:30)

Workshop Reception (18:30 - 20:00)

Tuesday, 19 July 2022

Session: 3 - Classroom 308 (09:00 - 10:20)

-Conveners: Hayward, Timothy (University of Connecticut)

[35] TBA (09:00, 30 minutes)

[30] Transverse-Momentum-Dependent Proton Structures from Lattice QCD (09:40, 30 minutes)

Presenter: ZHAO, Yong (Argonne National Laboratory)

The transverse-momentum-dependent parton distributions (TMDs) are key quantities that describe the 3D proton structure seen in high-energy scatterings. The TMDs can be extracted from hard processes where a TMD factorization formula applies, while the key challenges faced by global analyses include the non-perturbative effects when the parton transverse momentum is at the QCD scale $\Lambda_{\rm QCD}$. This situation can be substantially improved with the first-principles calculation of such non-perturbative information from lattice QCD. In recent years, motivated by large-momentum effective theory (LaMET), there have been rapid progress in the theoretical method and numerical study of TMDs from the lattice QCD. Now it is known that the quark and gluon TMDs of arbitrary flavor and spin dependence can be obtained from the factorization of quasi-TMDs within the LaMET framework, and first lattice results have shown encouraging signs of making phenomenological impacts. In this talk, I will review all the progress in this direction.

time	[id] title	presenter
09:30	Discussion (10 minutes)	
10:10	Discussion (10 minutes)	

Break - Classroom 308 (10:20 - 10:40)

Session: 4 - Classroom 308 (10:40 - 12:00)

-Conveners: Mokeev, Victor (Thomas Jefferson National Accelerator Facility)

[29] Nucleon spin structure studies at COMPASS: recent results and prospects (10:40, 30 minutes)

Presenter: PARSAMYAN, Bakur (CERN, Turin section of INFN)

Nucleon spin structure studies at COMPASS: recent results and prospects COMPASS is a fixed target high energy physics experiment located at the M2 beamline (SPS, North Area) at CERN. The experiment is collecting data since 2002 covering a broad range of physics topics. Experimental results obtained by COMPASS during phase-I (2002-2011) for spin (in)dependent azimuthal azimuthal effects in semi-inclusive deep inelastic scattering (SIDIS) measurements, play an important role in the general understanding of the three-dimensional nature of the nucleon. Giving access to the entire “twist-2” set of transverse momentum dependent (TMD) parton distribution functions (PDFs) and fragmentation functions (FFs), COMPASS data triggers constant theoretical interest and are being widely used in phenomenological analyses and global data fits. In 2015 and 2018 COMPASS performed measurements of the Sivers and other transverse azimuthal asymmetries in Drell-Yan process. Those measurements serve as a complementary input to the TMD studies. Combined with existing SIDIS data, they provide a unique possibility to study the nucleon spin-structure using an alternative channel and to test predicted in QCD (pseudo-)universal features of the TMD PDFs. In 2022 COMPASS is going to accomplish the series of measurements performed in phase-I using 190 GeV/c muon beam and polarized targets, by collecting largest ever sample of SIDIS events with transversely polarized deuteron. This last round of measurements is particularly important for constraining the d-quark transversity and other TMD PDFs In this talk COMPASS SIDIS and Drell-Yan results on azimuthal asymmetries, obtained from transversely polarized deuteron and proton data will be reviewed along with relevant phenomenological studies and global fits. The details on COMPASS 2022 data-taking will be presented.

[18] The SoLID Science Program at 12 GeV and Beyond (11:20, 30 minutes)

Presenter: MEZIANI, Zein-Eddine (Argonne National Laboratory)

I will present the scientific case of the solenoidal large intensity device (SoLID) using the 12 GeV upgrade of Jefferson Lab with the three pillar experiments, namely, the semi-inclusive deep inelastic scattering (SIDIS), the parity violation deep inelastic scattering (PVDIS), and the near-threshold J/psi production. I will also discuss the unique scientific reach, not presently accessible, a further modest energy upgrade to about 20 GeV of Jefferson Lab would enable when combined with SoLID.

time	[id] title	presenter
11:10	Discussion (10 minutes)	
11:50	Discussion (10 minutes)	

Lunch - Classroom 308 (12:00 - 14:00)

Session: 5 - Classroom 308 (14:00 - 16:00)

-Conveners: Joo, Kyungseon (University of Connecticut)

[25] JLab Upgrade Opportunities for SIDIS Dihadrons at CLAS (14:00, 30 minutes)

Presenter: DILKS, Christopher (Duke University)

Measurements in SIDIS provide a wide range of insights into nucleon structure and hadronization. Recent measurements of beam spin asymmetries of $\pi^+\pi^-$ dihadron production at CLAS provide the first opportunity to extract $e(x)$, a collinear twist-3 distribution function. Ongoing and future experiments at 12 GeV will grant access to other collinear twist-3 distributions, such as $h_L(x)$. Moments of these twist-3 distributions correlate quark spin and color Lorentz forces. On the fragmentation side, the Dihadron Fragmentation Functions (DiFFs) are accessible, and their partial waves relate the fragmenting quark spin to the relative dihadron angular momentum. In particular, recent CLAS measurements indicate the helicity-dependent DiFF $G_1^\perp$ is significant, with a sign change around the ρ-meson mass. A summary of recent measurements and opportunities from SIDIS dihadrons will be presented, along with prospects for measurements with an upgraded energy and luminosity at CLAS.

[24] Nuclear hadronization studies JLab: present and future (14:40, 30 minutes)

Presenter: HAKOBYAN, Hayk (Universidad Tecnica Federico Santa Maria)

During the Eg2 run, the CLAS detector collected experimental data on a wide range of nuclear targets, including a nucleus as heavy as Lead and as light as Carbon or Deuterium. These data allowed us to study various aspects of the nuclear hadronization process, nuclear color transparency, short-range nuclear collations, two-pion correlations, and others. In particular, varying sizes of nuclei allowed us to study the phenomenon of nuclear hadronization as a function of the nuclear medium size. The types of final hadrons studied included charged and neutral pions, protons with very high statistics, and with fewer statistics kaons, etas, omegas, and lambdas. During the next couple of years, the CLAS Run Group E experiment will be repeated on CLAS12 with CEBAF12 with a wider kinematical range and with higher statistics for a variety of hadrons. During the talk, I´ll present the previous experiment, the upcoming 12 GeV experiment, and the perspectives and scientific interest for a 24 GeV experiment.

[12] Fixed targets at LHC (15:20, 30 minutes)

Presenter: DI NEZZA, Pasquale (INFN, Frascati)

New physics frontiers can be opened by using internal gas targets at the LHC. The various collision systems like pp, pA, and PbA at energies varying from √s_NN=72 GeV to √s=115 GeV, and the implicit forward kinematic of the collisions, make accessible a broad program of measurements, from the large-x frontier for particle and astroparticle physics to spin and heavy-ion physics. A first step into this new technology has been tested successfully at LHCb, specifically designed for Drell-Yan, quarkonia, and heavy-flavour studies, with the SMOG system. Based on a storage cell (SMOG2), an improved gas target has been installed in the LHC Long Shutdown 2. This will pave the way for quantitative searches in QCD through the study of the nucleon's internal dynamics in terms of both quarks and gluons' degrees of freedom. Furthermore, in LHCb, final states with c- or b-quarks (e.g. inclusive quarkonia production) will be efficiently reconstructed, thus providing precious information on the so-far unknown gluon TMDs. In addition, SMOG2 will also act as R&D for the already proposed Polarised Gas Target (LHCspin). Here, with the use of the transversely polarized H and D targets, among several measurements, the quark TMDs in pp collisions, at unique kinematic conditions, can be determined. The status of the LHCb project and proposals related to the ALICE experiment will be presented.

time	[id] title	presenter
14:30	Discussion (10 minutes)	
15:10	Discussion (10 minutes)	
15:50	Discussion (10 minutes)	

Free Discussion - Classroom 308 (16:00 - 18:30)

Dinner (18:30 - 19:30)

Wednesday, 20 July 2022

Session: 6 - Classroom 308 (09:00 - 10:20)

-Conveners: Hakobyan, Hayk (Universidad Tecnica Federico Santa Maria)

[3] Fracture functions formalism for hadron production from the target remnant in hard processes (09:00, 30 minutes)

Presenter: KOTZINIAN, Aram (AANL (YerPhI), Yerevan, Armenia and INFN/Torino, Italy)

Fracture functions describes the hadron production in the target fragmentation region in the hard processes, namely -- the spin and transverse momentum dependent correlations between struck parton in the target and hadron production from target remnant. In this talk I'll shortly describe the leading order formalism and present the theoretical results for SIDIS and Drell-Yan processes. New experimental results on double back-to-back hadron production in SIDIS will be also presented.

[17] Accessing Target Fragmentation: Prospects and Results from CLAS (09:40, 30 minutes)

Presenter: HAYWARD, Timothy (University of Connecticut)

The study of the properties of hadrons produced in the target fragmentation region (TFR) serve as a test of our complete understanding of the production mechanisms in SIDIS and provide additional information on QCD dynamics that are not accessible in the current fragmentation region (CFR). We report first results for a number of TFR sensitive measurements that can be interpreted in terms of fracture functions, the conditional probability for the target remnant to form a specific hadron given an ejected quark. Measurements related to single hadron production, where a clear sign change is observed that captures the transition between both hemispheres, and back-to-back dihadron production, which provide access to the complete list of leading-twist fracture functions, will be presented. Finally, prospects for polarized target measurements at CLAS12 and future measurements at CLAS24 will be discussed.

time	[id] title	presenter
09:30	Discussion (10 minutes)	
10:10	Discussion (10 minutes)	

Break - Classroom 308 (10:20 - 10:40)

Session: 7 - Classroom 308 (10:40 - 12:00)

-Conveners: Avagyan, Harut (Jefferson Lab)

[10] Confinement, Color Vortices and Nonperturbative Structures in QCD (10:40, 30 minutes)

Presenter: SIVERS, Dennis (Portland Physics Institut, University of Michigan)

Various nonperturbative aspects of quantum chromodynamics share a common feature combining orbital angular momentum with coherence at a hadronic scale. Nonperturbative fluctuations involving triplet P-zero quark-antiquark pairs play a significant role in the isospin structure of proton sea, in the flux-rupture of the Collins function, and in the nonperturbative final-state interaction leading to the Qiu-Sterman-Sivers effect. These nonperturbative dynamic effects can be studied directly using TMD fracture functions for SIDIS events with two hadrons detected in the final state.

[26] Matching of fracture functions for SIDIS in target fragmentation region (11:20, 30 minutes)

Presenter: TONG, Xuanbo (The Chinese University of Hong Kong, Shenzhen)

In the target fragmentation region of Semi-Inclusive Deep Inelastic Scattering, the diffractively produced hadron has small transverse momentum. If it is at order of $\Lambda_{\rm QCD}$, it prevents to make predictions with the standard collinear factorization. However, in this case, differential cross-sections can be predicted by the factorization with fracture functions, diffractive parton distributions. If the transverse momentum is much larger than $\Lambda_{\rm QCD}$ but much smaller than Q which is the virtuality of the virtual photon, both factorizations apply. In this case, fracture functions can be factorized with collinear parton distributions and fragmentation functions. In this talk, we will present a study on this factorization up to twist-3 level. The gauge invariance of the results will be addressed. This study is helpful for modeling fracture functions and useful for resummation of large logarithm of the transverse momentum appearing in collinear factorization.

time	[id] title	presenter

11:10	Discussion (10 minutes)	
11:50	Discussion (10 minutes)	

Lunch (12:00 - 14:00)

Tour to Gyeongju (14:00 - 18:30)

Banquet (18:30 - 20:00)

Thursday, 21 July 2022

Session: 8 - Classroom 308 (09:00 - 10:20)

-Conveners: Meziani, Zein-Eddine (Argonne National Laboratory)

[2] Theoretical simulation of the virtual meson production in the forward direction (09:00, 30 minutes)

Presenter: JI, Chueng-Ryong (North Carolina State University)

I discuss a theoretical simulation of the virtual meson production amplitude in the forward direction using a simple scalar field model. Taking advantage of the light-front dynamics in 1+1 dimensions, I present the analysis of all the contributions including both “handbag” and “cat’s ears” for the entire kinematic regions of $Q^2>0$ and $t<0$ in the one loop level. The result from the GPD formulation is benchmarked for the estimation of the deeply virtual $-t/Q^2$ values and the GPD sum rule to provide the corresponding electromagnetic form factor is discussed.

[20] Radiative effects in polarized SiDIS (09:40, 30 minutes)

Presenter: ILYICHEV, Alexander (INP BSU)

Radiative corrections to polarized SiDIS are calculated exactly and within the leading log approximation. Analytical and numerical comparisons of RC in both approaches as well as the results of other groups are presented and discussed. The contribution of exclusive radiative tail for polarized initial particles are estimated for the first time. Numerical analysis is performed in the frame of the modern JLab kinematic conditions within Wandzura-Wilczek model for SiDIS structure functions and the exclusive radiative tail is estimated using Maid 2007.

time	[id] title	presenter
09:30	Discussion (10 minutes)	
10:10	Discussion (10 minutes)	

Break - Classroom 308 (10:20 - 10:40)

Session: 9 - Classroom 308 (10:40 - 12:10)

-Conveners: Sargsian, Misak (Florida International University)

[13] Light quark distribution functions in the heavy baryon within a chiral quark-soliton approach (10:40, 20 minutes)

Presenter: SON, Hyeon-Dong (Korea University, Inha University)

We present our recent study on the light-quark distribution functions in a heavy baryon within the chiral quark-soliton model. We mainly consider the twist-2 isoscalar unpolarized and isovector longitudinally polarized quark distributions which are large in the limit $N_c \to \infty$. We discuss the sum rules and the behavior of the x-dependences of the distributions when the heavy-quark mass is varied. Compared with those in the nucleon, it is observed that the light-quark distributions in a heavy baryon are concentrated at the smaller x region, which is also predicted in the case of the naive parton-model picture.

[15] Analysis of the virtual meson production in a (1+1)-dimensional scalar field model (11:10, 20 minutes)

Presenter: CHOI, Yongwoo (Korea University, Inha University)

We discuss the deeply virtual meson production in the (1+1)-dimensional scalar field model. To describe the scattering process, two approaches, the one-loop approximation and the leading twist of the scalar loop, are considered for the scalar meson production off the charged scalar target, e.g., $\gamma^{*} + {}^{4}{\rm He} \to f_{0}(980) + {}^{4}{\rm He}$. We particularly focus on the significance of the cat’s ears contribution and the discrepancy of the Compton form factors obtained from two approaches in JLab kinematic regions. It will provide a criterion for how much higher twist contributions are required for hard exclusive processes in specific kinematic regions.

[7] Generalized parton distributions for the Goldstone boson (11:40, 20 minutes)

Presenter: HUTAURUK, Parada Tobel Paraduan (Pukyong National University)

The generalized Parton distributions for the Goldstone boson are investigated in the framework of the quark chiral effective theory. Interesting results for the form factor and Parton distribution functions of the Goldstone boson as well as the Goldstone boson's 3D tomography picture will be presented and discussed.

time	[id] title	presenter
11:00	Discussion (10 minutes)	
11:30	Discussion (10 minutes)	
12:00	Discussion (10 minutes)	

Lunch (12:10 - 14:00)

Session: 10 - Classroom 308 (14:00 - 15:20)

-Conveners: Parsamyan, Bakur (CERN, Turin section of INFN)

[28] Polarized vector meson production in semi-inclusive DIS (14:00, 30 minutes)

Presenter: CHEN, Kai-bao (Shandong Jianzhu University)

We make a calculation for polarized vector meson production SIDIS by considering the general case of neutral current electroweak interactions. We present a kinematic analysis for the process and show that the cross section is expressed by 81 structure functions. We further make a QCD parton model calculation at the leading twist and give the structure functions results in terms of the transverse momentum dependent parton distribution functions and fragmentation functions. There are 27 nonzero structure functions at this level, among which 15 are related to the tensor polarization of the vector meson. Thirteen structure functions are generated by parity-violating effects. We also carry out a rough numerical estimate for the spin alignment of the K^{*0} vector meson.

[14] Vector meson production in polarized string fragmentation in Pythia (14:40, 30 minutes)

Presenter: KERBIZI, Albi (INFN Trieste Section)

Being motivated mainly by the LHC physics, the currently used Monte Carlo Event Generators (MCEGs) lack of the quark spin degree of freedom in their hadronization models, and can not reproduce observed transverse spin effects such as the Collins and the dihadron asymmetries, and longitudinal spin effects such as the jet handedness. To guide the interpretation of SIDIS and e^+e^- data as well as to make predictions for experiments at future facilities such as the EIC, a MCEG capable of reproducing quark spin effects in hadronization is necessary. To achieve this goal, we have started a systematic implementation of spin effects in the hadronization part of the Pythia 8 event generator for the polarized SIDIS process via the external package StringSpinner, which is publicly available. Spin effects are enabled for pseudoscalar meson production by using the string+${}^3P_0$ model of polarized quark fragmentation and parametrizations of the transversity PDFs. This talk is dedicated to a recent major development of StringSpinner which allows for the introduction of vector meson production and decay in the polarized Pythia 8 string fragmentation. After being validated, the package is used to simulate the Collins and dihadron asymmetries in SIDIS and a comparison with currently available data is shown.

time	[id] title	presenter
14:30	Discussion (10 minutes)	
15:10	Discussion (10 minutes)	

Break - Classroom 308 (15:20 - 15:40)

Session: 11 - Classroom 308 (15:40 - 16:20)

-Conveners: Kim, Andrey (University of Connecticut)

[9] Extractions of TMD distributions from the SIDIS data (15:40, 30 minutes)

Presenter: VLADIMIROV, Alexey (Universidad Complutense de Madrid)

I present a general discussion on peculiarities of analysis of SIDIS data within the TMD factorization approach. The special emphasis is made on the features of the low-energy experiments and correlation between various ingredients of the TMD framework.

time	[id] title	presenter
16:10	Discussion (10 minutes)	

Free Discussion - Classroom 308 (16:20 - 18:30)

Dinner (18:30 - 19:30)

Friday, 22 July 2022

Session: 12 - Classroom 308 (09:00 - 10:20)

-Conveners: Kotzinian, Aram (AANL (YerPhI), Yerevan, Armenia and INFN/Torino, Italy)

[23] Hard exclusive reactions with baryon number transfer: status and perspectives. (09:00, 30 minutes)

Presenter: SEMENOV-TYAN-SHANSKIY, Kirill (Kyungpook National University)

Nucleon-to-meson Transition Distribution Amplitudes (TDAs) appear as building blocks in the collinear factorized description of amplitudes for a class of hard exclusive reactions prominent examples being hard exclusive pion electroproduction off a nucleon in the backward region and nucleon-antinucleon annihilation into a pion and a lepton pair. We discuss general properties of nucleon-to-meson TDAs and argue that these non-perturbative objects turn to be a convenient complementary tool to explore the structure of hadrons at the partonic level. We present an overview of hard exclusive reactions admitting a description in terms of TDAs. We discuss the first signals from hard exclusive backward meson electroproduction at JLab and explore further experimental opportunities to access TDAs at JLab, PANDA, J-PARC and EIC.

[1] Studies of exclusive processes at JLab Hall-A/C (09:40, 30 minutes)

Presenter: ROCHE, Julie (Ohio University)

Generalized Parton Distribution (GPDs) functions describe the correlation between the spatial distribution of the quarks and their longitudinal momentum fraction. Their definition in the mid-1990s has revolutionized our approach to the description of the internal structure of the nucleon. The study of the GPDs, together with the study of similar quantities, are at the forefront of today hadronic physics enterprise. Exclusive processes, including Deeply Virtual Compton Scattering and Deep Vector Meson Production, are sensitive to GPDS. They have been the subject of intense focus at HERA, COMPASS, and JLab. I will review the approach and results obtained by the JLab Hall A/C DVCS group and speculate on how this approach might benefit from a JLab energy and luminosity upgrade. This work is supported by USA-NSF award # 1913170.

time	[id] title	presenter
09:30	Discussion (10 minutes)	
10:10	Discussion (10 minutes)	

Break - Classroom 308 (10:20 - 10:40)

Session: 13 - Classroom 308 (10:40 - 12:00)

-Conveners: Kirill Semenov-Tyan-Shanskiy

[31] What can we learn on GPDs from Lattice QCD (10:40, 30 minutes)

Presenter: CONSTANTINOU, Martha (Temple University)

Generalized parton distributions (GPDs) are important quantities that characterize the structure of hadrons. They provide information about the partons' momentum distribution and also on their distribution in position space. Most of the information from lattice QCD is on the Mellin moments of GPDs, namely form factors and their generalizations. Recent developments in calculations of matrix elements of boosted hadrons coupled with non-local operators opened a new direction for extracting the x dependence of GPDs. In this talk, we will discuss selected results on GPDs at the twist-2 and twist-3 levels. The latter is only recently explored in lattice QCD and information from experiments is basically non-existing. As we will discuss in the talk, twist-3 GPDs are essential for several reasons.

[27] Deeply Virtual Meson Electroproduction at Jefferson Lab with CLAS12. (11:20, 30 minutes)

Presenter: KIM, Andrey (University of Connecticut)

The measurements of deeply virtual exclusive electroproduction processes are used to access and constrain the Generalized Parton Distributions from experimental observables. Among these exclusive reactions, deeply virtual meson production (DVMP) channels can be used to access chiral-even and chiral-odd GPDs which contain information about correlations between quark longitudinal momentum and transverse spatial distributions. Additionally, the variety of DVMP channels allows to perform the flavor decomposition of the underlying GPDs. The experimental measurements using 10.6 GeV incident electron beam and the CLAS12 spectrometer at Jefferson Lab focus on the forward regime ($t/Q^2\ll1$) with a wide kinematic coverage of x_B in the valence regime and the photon virtualities Q^2 extending up to 8 GeV^2. We will also discuss the study of DVMP channels with upgraded electron beam energy to 24 GeV, and their analysis in terms of Generalized Parton Distributions.

time	[id] title	presenter
11:10	Discussion (10 minutes)	
11:50	Discussion (10 minutes)	

Lunch (12:00 - 14:00)

Session: 14 - Classroom 308 (14:00 - 15:20)

-Conveners: Roche, Julie (OHIO University)

[37] Recent GPD developments obtained with PARTONS framework (14:00, 30 minutes)

Presenter: SZNAJDER, Paweł (National Centre for Nuclear Research, Poland)

We discuss recent developments in the field of generalised parton distributions (GPDs) obtained with the PARTONS framework (https://partons.cea.fr). This includes in particular addressing the problem of model dependency, which spoils both the modelling of GPDs, and the extraction of quantities like D-term and amplitudes of exclusive processes. A bunch of other recent results, and a new Monte Carlo generator called EpIC, will be presented as well.

[33] Deeply Virtual Compton Scattering with CLAS12 at Jefferson Lab (14:40, 30 minutes)

Presenter: HOBART, Adam (IJCLab CNRS-IN2P3)

A key step toward a better understanding of the nucleon structure is the study of Generalized Parton Distributions (GPDs). GPDs are nowadays the object of an intense effort of research since they convey an image of the nucleon structure where the longitudinal momentum and the transverse spatial position of the partons inside the nucleon are correlated. Moreover, GPDs give access, via Ji's sum rule, to the contribution of the orbital angular momentum of the quarks to the nucleon spin, important to the understanding of the origins of the nucleon spin. Deeply Virtual Compton scattering (DVCS), the electroproduction of a real photon off the nucleon at the quark level, is the golden process directly interpretable in terms of GPDs of the nucleon. The GPDs are accessed in DVCS mainly through the measurements of single- or double- spin asymmetries. Combining measurements of asymmetries from DVCS experiments on both the neutron and the proton will allow performing the flavor separation of relevant quark GPDs via linear combinations of proton and neutron GPDs. This talk will mainly focus on recent DVCS measurements off proton in unpolarised hydrogen target and off neutron (and off proton) in unpolarized deuterium target from the CLAS12 experiment at Jefferson Lab with the upgraded ~11 GeV CEBAF polarized electron beam. Details on the data analysis along with results on Beam Spin Asymmetries are presented. Possible implications from the foreseeable 20+ GeV upgrade of JLab will be shortly discussed.

time	[id] title	presenter
14:30	Discussion (10 minutes)	
15:10	Discussion (10 minutes)	

Break - Classroom 308 (15:20 - 15:40)

Session: 15 - Classroom 308 (15:40 - 16:20)

[11] 3D Structure of the Nucleon: from JLab12 to JLab24 (15:40, 30 minutes)

Presenter: AVAGYAN, Harut (Jefferson Lab)

The quark-gluon dynamics manifests itself in a set of non-perturbative functions describing all possible spin-spin and spin-orbit correlations. Single and Dihadron semi-inclusive and hard exclusive production, both in current and target fragmentation regions, provide a variety of spin and azimuthal angle dependent observables, sensitive to the dynamics of quark-gluon interactions. Studies of transverse momentum distributions of partons are currently driving the upgrades of several existing facilities, and the design and construction of new facilities worldwide. In this talk, we present an overview of the current status and some planned measurements of the orbital structure of nucleons at CLAS12, and possible extensions to future physics program of upgraded to 20-24 GeV JLab .

time	[id] title	presenter
16:10	Discussion (10 minutes)	

Free Discussion - Classroom 308 (16:20 - 18:30)

-Conveners: Ilyichev, Alexander (INP BSU)

Dinner (18:30 - 19:30)

Saturday, 23 July 2022

Session: 16 - Classroom 308 (09:00 - 10:30)

-Conveners: Ji, Chueng-Ryong (North Carolina State University)

[19] Insight into Emergence of Hadron Mass in the Exploration of N* Structure at JLab after Energy and Luminosity Increase (09:00, 30 minutes)

Presenter: MOKEEV, Victor (Thomas Jefferson National Accelerator Facility)

The emergence of hadron mass (EHM) represents one of the most challenging and still open problem in the Standard Model. New opportunities to shed light on EHM from the studies of the nucleon resonance electroexcitation amplitudes (or g_vpN^* electrocouplings) in the range of photon virtualities $Q^2<35$ GeV^2 from the measurements of exclusive meson electroproduction with a detector capable of collecting data at luminosities > 10^36 cm^{-2}sec^{-1} of a near 4pi acceptance and with a continuous electron beam of 24 GeV energy will be presented in this talk. Analyses of the Q^2-evolution of the g_vpN^* electrocouplings from the measurements with the CLAS detector within the continuum Schwinger method (CSM) theoretical framework have conclusively demonstrated the capability of gaining insight into the strong interaction dynamics that underlie EHM. The results on the g_vpN^* electrocouplings from CLAS have allowed us to map out the momentum dependence of the dressed quark mass within the quite limited range of quark momenta < 0.7 GeV, while the results on the g_vpN^* electrocouplings expected from the data of the CLAS12 detector will extend insight into the evolution of the dressed quark mass within the range of quark momenta up to 1.3 GeV. The future results on the electrocouplings of all prominent resonances at photon virtualities up to 35 GeV^2 will allow us to map out the momentum dependence of the dressed quark mass within the entire range of quark momenta where the dominant part of hadron mass is expected to be generated up to 2 GeV. Consistent results on the momentum dependence of the dressed quark mass obtained from the CSM analysis of the transition electroexcitation amplitudes to excited states of the nucleon of distinctively different structure will validate credible insight into EHM in a nearly model-independent way. The proposed research addressing key open problems in the Standard Model on the emergence of hadron mass and structure from QCD will make JLab unique after the energy and luminosity increase and the ultimate QCD machine at the luminosity frontier.

[32] Exclusive Processes and GPDs (09:40, 30 minutes)

Presenter: JOO, Kyungseon (University of Connecticut)

Exclusive Processes and GPDs

[34] Concluding Remarks (10:20, 10 minutes)

Presenter: JOO, Kyungseon (University of Connecticut)

time	[id] title	presenter
09:30	Discussion (10 minutes)	
10:10	Discussion (10 minutes)	

Break - Classroom 308 (10:30 - 10:50)

Free Discussion - Classroom 308 (10:50 - 12:00)

Lunch (12:00 - 13:30)