

Diffraction 2012

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Book of Abstracts

Contents

A New, Analytic, Non-Perturbative, Gauge-Invariant Formulation of Realistic QCD . . .	1
AMPLITUDES AND OBSERVABLES IN pp ELASTIC SCATTERING AT 7 TeV	1
Accessing the quark orbital angular momentum with Wigner distributions	1
Accounting for soft cross sections at the LHC	2
All-loop calculations of total, elastic and diffractive cross sections in RFT via the stochastic approach	2
An AdS/QCD holographic wavefunction for the rho meson	2
An Improved Glauber-Gribov Approach to Diffractive Hadron-Nucleus Scattering	3
Associated photon and heavy quark production within k_T -factorization	3
Azimuthal asymmetry of forward neutrons in polarized pp collisions	4
BFKL Evolution as a Communicator Between Small and Large energy Scales	4
Bounds on soft scattering in the TeV-scale	4
CMS results on central exclusive production	5
CMS results on soft and hard diffraction	5
Central Diffraction in Proton-Proton Collisions at $\sqrt{s} = 7$ TeV with ALICE at LHC . .	5
Central Exclusive Production in CDF at the Tevatron p-pbar Collider	6
Central Exclusive Production with the STAR detector at RHIC	6
Color Transparency in Incoherent Electroproduction of ρ Mesons off Nuclei.	6
Combined inclusive diffractive cross sections measured with forward proton spectrometers at HERA	7
Connections between diffraction in DIS and diffraction at the LHC	7
Deeply Virtual Compton Scattering from Gauge/Gravity Duality	7
Description of the ATLAS jet veto measurement using the Banfi-Marchesini-Smye equation	8
Diffractive at HERA	8

Diffraction at the LHC: anomalous couplings and diffractive Higgs	8
Diffractive Dissociation at COMPASS: π^- to $(5\pi)^-$ at 190 GeV/c	9
Diffractive dijet production at CDF	9
Diffractive neutrino interactions	9
Diffractive production of charm quark/antiquark pairs at RHIC and LHC	10
Do we understand elastic scattering up to LHC energies?	10
Energy evolution of the large- t elastic scattering and correlation with multiparticle production	10
Evolution and definition of TMD's	11
Evolution of cusped light-like Wilson loops, TMDs and geometry of the loops space	11
Exclusive meson production at COMPASS	11
Exclusive production at HERA	12
Exclusive production of meson pairs and resonances in proton-proton collisions	12
Fitting DIS data at low values of Bjorken x	13
Forward Physics at LHCb	13
GPD physics with polarized muon beams at COMPASS	13
GPDs at an Electron Ion Collider	14
Have we reached asymptotia in pp scattering?	14
Inclusive DIS at HERA and PDFs	14
Inclusive Diffraction at HERA	15
Inclusive production of a pair of rapidity-separated, high p_t hadrons in proton collisions.	15
Integrability of the BKP equations for multi-reggeon composite states and new solutions for the Odderon problem in LLA	15
J/ψ measurements in ultra-peripheral Pb-Pb collisions with ALICE	16
Jet gap jet at the LHC	16
Lipatov's Effective Action beyond Tree Level	16
Low x : diffusion, screening, fusion	17
Low-mass Drell-Yan production at the LHC; and treatment of the infrared region in pQCD	17
Low-mass, single- and double diffraction dissociation at the LHC	17
Low- x Physics results from CMS	18

Measurement of the inelastic pp Cross Section with the ATLAS detector	18
Measurements of Diffractive and Inelastic Cross Section with ALICE at the LHC	18
Measurements of Inelastic pp Interactions at the LHC	19
Measurements of Proton-Proton Elastic Scattering and Total Cross-Section at the LHC by TOTEM	19
Momentum space dipole amplitude for DIS and inclusive hadron production	19
Mueller-Navelet jets in high energy hadron collisions	20
NEW RESULTS OBTAINED WITH TRANSVERSELY POLARIZED PROTONS IN P-P COL- LISIONS AT RHIC	20
NLO BFKL kernel for the adjoint representation of the gauge group	20
NLO forward jet vertex	21
Neutral meson production with ALICE at the LHC	21
New results on central exclusive production at hadron colliders	21
News from the LHC	22
Next-to-leading order corrections to the BKP evolution	22
Nuclear Modification factor for gluon jet	22
On an evidence of higher twist emergence in DDIS at HERA	23
On the use of the high energy effective action for low x phenomenology	23
Orbital Angular Momentum in Nucleon	23
Overview of Spin Structure Program at Jefferson Lab	24
Overview of Spin Studies at COMPASS	24
Overview of structure function measurements at Jefferson Lab	24
PDF Studies of Hadronization Mechanisms using Pion Electroproduction in Deep Inelastic Scattering from Nuclei	25
Parton distributions with LHC data	25
Partonic description of soft high energy pp interactions	25
Photon impact factor and k_T -factorization for DIS in the next-to-leading order	26
Photoproduction of vector mesons: from gamma proton to nucleus nucleus collisions	26
Physics Updates from HERMES	26
Polarizing Helium-3 for down quark spin enrichment	27
Postcards from the High Energy Frontier	27

Predictions of diffractive cross sections in proton-proton collisions	27
Probing the phase of the elastic pp scattering amplitude with vortex proton beams	28
Production of one and two $c\bar{c}$ pairs at LHC	28
Quarkonium+ γ production in γ -proton interactions at LHC	28
Recent Results from the PHENIX Spin Program	29
Recent results from low-x and forward physics at HERA	29
Recent results on the gluon polarization and W production program in polarized p + p collisions at RHIC	30
Regge trajectories in QCD	30
Reggeometry of lepton- and hadron-induced exclusive diffractive processes	30
Results on diffraction from the ATLAS experiment	31
Running Coupling Corrections to Nonlinear Evolution for Diffractive Dissociation	31
STAR: Characterizing Hot Quark Matter	31
Single spin asymmetries in inclusive DIS and in hadronic collisions	32
Spin and diffractive physics with A Fixed-Target Experiment at the LHC (AFTER@LHC)	32
Status and Perspectives of ALICE at the LHC	33
Status of the ATLAS AFP project	33
Status of the CMS High Precision Spectrometer Project	33
The Color Dipole Picture	34
The current stage of understanding and description of hadronic elastic diffraction	34
Transverse spin asymmetries in the CNJ region in polarized proton-proton elastic scattering at STAR	34
Transversity: theory and phenomenology	35
Violent Collisions of Spinning Protons: Past, Present & Perhaps at Fermilab	35
Where does the spin of the proton come from?	35
Where is the proton missing spin?	36

Saturation / 31**A New, Analytic, Non-Perturbative, Gauge-Invariant Formulation of Realistic QCD**Herbert Fried¹¹ *Brown University***Corresponding Author(s):** fried@het.brown.edu**Summary:**

This presentation will describe in some detail each of the adjectives of the title. This approach is less than three years old; it is analytic in the sense that QCD amplitudes can be estimated using pencil and paper, or calculated in terms of Meijer G-functions; formal gauge invariance can be assured by a long-overlooked rearrangement of the Schwinger Generating Functional, and is made explicit as all gauge-dependent gluon propagators cancel as the sum of all gluon exchanges between any pair of quark lines is performed. Two, new non-perturbative properties appear, Effective Locality, and a need for Transverse Imprecision. Quark-quark and nucleon-nucleon binding potentials are easily found.

Diffraction in Hadron-Hadron Collisions (II) / 73**AMPLITUDES AND OBSERVABLES IN pp ELASTIC SCATTERING AT 7 TeV****Author(s):** Erasmo Ferreira¹**Co-author(s):** Anderson Kendi Kohara ¹ ; Takeshi Kodama ¹¹ *Universidade Federal do Rio de Janeiro***Corresponding Author(s):** erasmo@if.ufrj.br**Summary:**

A complete analysis is performed of the recent pp elastic data at 7 TeV in terms of its real and imaginary amplitudes, that are fully disentangled, consistently with dispersion relations for amplitudes and for slopes. Real and imaginary slopes B(R) and B(I), treated as independent quantities, influence the whole t-range and the determination of the total cross section. The treatment includes prediction for the universal perturbative tail at large |t|. New generalized expression is derived for the Coulomb phase. Comparison is made of the values of total cross section and B(I) obtained in forward and full-t approaches.

Spin Physics (II) / 40**Accessing the quark orbital angular momentum with Wigner distributions**Cedric Lorce¹¹ *IPNO and LPT Orsay, Universite Paris-Sud*

Summary:

The quark orbital angular momentum (OAM) has been recognized as an important piece of the proton spin puzzle. A lot of effort has been invested in trying to extract it quantitatively from the generalized parton distributions (GPDs) and the transverse-momentum dependent parton distributions (TMDs), which are accessed in high-energy processes and provide three-dimensional pictures of the nucleon. Recently, we have shown that it is more natural to access the quark OAM from the phase-space or Wigner distributions. We discuss the concept of Wigner distributions in the context of quantum field theory and show how they are related to the GPDs and the TMDs. We summarize the different definitions dis

Diffraction in Hadron-Hadron Collisions (II) / 42**Accounting for soft cross sections at the LHC**

Author(s): Errol Gotsman¹ ; Evgeny Levin¹

Co-author(s): Uri Maor¹

¹ *Tel Aviv University*

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Summary:

We show that the full GLM model with a tuned Pomeron intercept $\alpha_{\{P\}} = 0.23$ provides a good description of all available pp and $\bar{p}p$ data for $\sigma_{\{tot\}}$, $\sigma_{\{el\}}$, $\sigma_{\{sd\}}$, $\sigma_{\{dd\}}$ and $B_{\{el\}}$, over the energy range $20 < W < 7000$ GeV. We compare our results with experimental data and other models on the market, with emphasis on recent LHC results.

Diffraction in Hadron-Hadron Collisions (III) / 30**All-loop calculations of total, elastic and diffractive cross sections in RFT via the stochastic approach**

Author(s): Rodion Kolevatov¹

Co-author(s): Konstantin Boreskov²

¹ *SUBATECH/UiO/SPbSU*

² *ITEP*

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Summary:

The evolution equations for the exact Green functions of the Reggeon Field Theory (RFT) are equivalent to those for the inclusive probability distributions for a reaction-diffusion system of classical particles. This equivalence can be used to obtain numerically the RFT Green functions and amplitudes with account of all loops and enhanced graphs. We developed a numerical approach based on this equivalence which allows us to compute the elastic scattering amplitude and its single-diffractive cut. Using it we perform all-loop calculation of the total, elastic and single diffractive (high- and low-mass) cross sections and compare results with the experimental data.

Diffraction in e-p Collisions (III) / 34

An AdS/QCD holographic wavefunction for the rho meson

Author(s): Ruben Sandapen¹

Co-author(s): Jeff Forshaw²

¹ *Université de Moncton*

² *University of Manchester*

Corresponding Author(s): ruben.sandapen@umoncton.ca

Summary:

We show that AdS/QCD generates predictions for the rate of diffractive ρ -meson electroproduction that are in agreement with data collected at the HERA electron-proton collider.

Diffraction in Nuclear Physics / 68

An Improved Glauber-Gribov Approach to Diffractive Hadron-Nucleus Scattering

Claudio Ciofi Degli Atti¹

¹ *PG*

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Summary:

By introducing nucleon short-range correlations and summing inelastic shadowing by the dipole representation [1], the cross sections for a variety of diffractive processes in proton-nucleus scattering, associated with large gaps in rapidity, are calculated at the energies of HERA-B, RHIC and LHC [2, 3]. Whereas Gribov inelastic shadowing makes nuclear matter more transparent, nucleon correlations act in the opposite direction.

[1] B. Z. Kopeliovich, Phys. Rev. C68 (2003) 044906

[2] M. Alvioli, C. Ciofi degli Atti, B. Z. Kopeliovich, I. K. Potashnikova and I. Schmidt, Phys. Rev. C81 (2010) 0252; C84 (2011) 025205

[3] C. Ciofi degli Atti, talk given at QNP12, Palaiseau, France. PoS 2012

Progress in QCD (I) / 56

Associated photon and heavy quark production within k_T -factorization

A.V Lipatov^{None} ; M.A. Malyshev^{None} ; N.P. Zotov^{None}

Summary:

In the framework of the k_T -factorization approach, the production of prompt photons in association with a heavy (charm or beauty) quarks at high energies is studied.

The analysis covers the total and differential cross sections and extends to specific angular correlations between the produced prompt photons and muons originating from the semileptonic decays of associated heavy quarks.

Our numerical predictions are compared with the recent experimental data taken by the D0 and CDF collaborations at the Tevatron. Finally, we extend our results to LHC energies.

Spin Physics (II) / 13**Azimuthal asymmetry of forward neutrons in polarized pp collisions**Boris Kopeliovich¹¹ *UTFSM***Corresponding Author(s):** boris.kopeliovich@usm.cl**Summary:**

Recent data on the single-spin asymmetry of leading neutrons from the PHENIX experiment cannot be explained by the pion pole, even corrected for the strong absorption effects. We found a large spin effects from interference of the pion pole with the rho-pion Regge cut, whose parameters are fixed using data on diffractive 3-pion production, and the current algebra relations. The numerical results of the parameter-free calculation of A_N are in excellent agreement with the PHENIX data.

Progress in QCD (I) / 2**BFKL Evolution as a Communicator Between Small and Large energy Scales****Author(s):** Douglas Ross¹**Co-author(s):** Henri Kowalski²; Lev Lipatov³¹ *Southampton University*² *DESY*³ *Petersburg Nuclear Physics Institute***Corresponding Author(s):** doug@soton.ac.uk**Summary:**

We show that the eigenfunctions of the BFKL kernel with running coupling are sensitive to the presence of new physics at very high energies and that this in turn affects the behaviour of the BFKL amplitude at energies way below the threshold for such new physics.

LHC and Post-LHC (I) / 78**Bounds on soft scattering in the TeV-scale**Uri Maor¹¹ *Tel Aviv University***Corresponding Author(s):** maor@post.tau.ac.il**Summary:**

A conceptual issue which is re-vitalized every few years is the rate at which the elastic p-p amplitude is getting closer to saturation. Our expectations for a decisive new experimental information are very low. AUGER has delivered, thus far, data of interest at 57 TeV from which block has calculated the value of σ_{inel} .

Having no better option, I have scanned a few updated phenomenological models and have reached the conclusion that, unless some unexpected feature of soft scattering will be discovered, the elastic p-p amplitude is not expected to ever become saturated.

Forward physics in Hadron-Hadron Collisions (II) / 44

CMS results on central exclusive production

Wenbo Li¹

¹ *Peking University*

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Summary:

We present a search for central exclusive diphoton production and the measurement of central exclusive dilepton production, based on a data sample recorded by the CMS experiment at the LHC in 2010 with low-pileup condition. An upper limit on the diphoton production cross section is set at 95% confidence level, and a comparison between the measurement and the QED prediction is discussed for dielectron production. The measured cross section of exclusive dimuon production is compared with the theoretical QED prediction evaluated with the event generator LPAIR.

Forward physics in Hadron-Hadron Collisions (I) / 52

CMS results on soft and hard diffraction

Ada Maria Solano¹

¹ *TO*

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Summary:

The talk will cover CMS recent results on soft and hard diffraction, including inclusive diffraction, hard-diffractive dijet production, and W and Z boson events with pseudorapidity gaps.

LHC and Post-LHC (II) / 80

Central Diffraction in Proton-Proton Collisions at $\sqrt{s} = 7$ TeV with ALICE at LHC

Felix Reidt¹

¹ *Physikalisches Institut - University of Heidelberg*

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Summary:

Felix Reidt for the ALICE Collaboration

In this analysis ALICE detectors covering the pseudorapidity region $-3.7 < \eta < 5.1$, were used to identify central diffractive events through a double-pseudorapidity-gap topology. Central diffraction is characterized experimentally by two pseudorapidity gaps accom-

panied by hadronic activity in the central pseudorapidity region between the gaps. This talk will summarize the latest results on properties of double-gap events with different gap sizes.

Forward physics in Hadron-Hadron Collisions (I) / 93

Central Exclusive Production in CDF at the Tevatron p-pbar Collider

Michael Albrow¹

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Summary:

I present results on exclusive central production in p-pbar collisions, at the Tevatron in the CDF experiment. The reactions are in the class G-X-G, where G stands for a large rapidity gap ($\Delta y > 4$) and X stands for a well-defined and measured central state. I present results on photon-photon collisions ($X = e+e-$ and $\mu+\mu-$), photon-pomeron collisions ($X = J/\psi$, $\psi(2S)$) and pomeron-pomeron collisions ($X = \pi+\pi-$, $K+K-$, χ_c , $\gamma+\gamma$ and $\text{Jet}+\text{Jet}$).

Diffraction in Nuclear Physics / 69

Central Exclusive Production with the STAR detector at RHIC

Leszek Adamczyk¹

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Summary:

In this talk we shall present recent results on Central Exclusive Production from the STAR experiment at the RHIC in pp and AuAu collisions. We shall present the measurement of vector meson production in gold-gold ultra peripheral collisions. Comparisons to model calculations involving different initial conditions are discussed. We shall also present the preliminary result on invariant mass distribution of the pion production in proton-proton scattering with forward protons tagged using Roman Pots. The non-exclusive background estimated from events with like-sign track pairs does not exceed few percent. Plans for the future will also be discussed.

Diffraction in e-p Collisions (III) / 19

Color Transparency in Incoherent Electroproduction of ρ Mesons off Nuclei.

Author(s): Jan Nemchik¹

Co-author(s): Boris Kopeliovich²; Irina Potashnikova²

¹ *Czech Technical University in Prague, Prague, Czech Republic & Institute of Experimental Physics, Kosice, Slovakia*

² *Universidad Técnica Federico Santa María, Valparaiso, Chile*

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Summary:

Color transparency (CT) phenomena in elastic electroproduction of vector mesons off nuclei are usually infected by the onset of coherence length (CL) effects. We analyze the problem of CT-CL separation at different energies and find that at low CLAS energies at Jefferson Lab (JLab), one can study practically the net CT effects, since

CL is much shorter than the nuclear radius. We investigate various manifestations of CT effects using rigorous quantum mechanical approach based on the path integral technique. Motivated by the last data from the CLAS experiment at JLab, we predict the A , Q^2 and L_c dependence of nuclear transparency for ρ mesons produced incoherently off nuclei.

Diffraction in e-p Collisions (II) / 85

Combined inclusive diffractive cross sections measured with forward proton spectrometers at HERA

Marta Ruspa¹

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Summary:

A combination of the inclusive diffractive cross section measurements made by the H1 and ZEUS Collaborations at HERA is presented. The analysis uses diffractive deep inelastic scattering data measured by means of proton spectrometers. Correlations of systematic uncertainties are taken into account by the combination method, resulting in improved precision. The combined data cover the range $2.5 < Q^2 < 200$ GeV² in photon virtualities, $0.00035 < x_{IP} < 0.09$ in fractional momentum losses, $0.09 < |t| < 0.55$ GeV² in four momentum transfer at the proton vertex and $0.0018 < \beta < 0.56$ in $\beta = x/x_{IP}$, where x is the Bjorken scaling variable.

Diffraction in e-p Collisions (II) / 107

Connections between diffraction in DIS and diffraction at the LHC

Marcella Capua¹

¹ *Universita' della Calabria & INFN, Cosenza*

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Summary:

We review the HERA results and their unique contribution for the LHC program on diffraction.

Diffraction in e-p Collisions (III) / 15

Deeply Virtual Compton Scattering from Gauge/Gravity Duality

Marko Djuric¹ ; Miguel Costa¹

¹ *University of Porto*

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Summary:

We use gauge/gravity duality to study deeply virtual Compton scattering (DVCS) in the low x limit, where the process is dominated by the exchange of the pomeron. At strong coupling, the pomeron is described as the graviton Regge trajectory in AdS space, with a hard wall to mimic confinement effects. This model agrees with HERA data in a large kinematical range. The behavior of the DVCS cross section for very high energies, inside saturation, can be explained by a simple AdS black disk model. In a restricted kinematical window, this model agrees with HERA data as well.

Progress in QCD (III) / 53

Description of the ATLAS jet veto measurement using the Banfi-Marchesini-Smye equation

Cyrille Marquet¹

¹ *University of Santiago de Compostela*

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Summary:

We present a new QCD description of the ATLAS jet veto measurement, using the Banfi-Marchesini-Smye equation to constrain the inter-jet QCD radiation. Applying alternative experimental cuts, we explore the possibilities for testing BFKL evolution with such a measurement.

Diffraction in e-p Collisions (I) / 94

Diffraction at HERA

Henri Kowalski¹

¹ *DESY*

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Summary:

In this talk I will review of the diffractive measurements at HERA with the focus on their physics message.

LHC and Post-LHC (II) / 4

Diffraction at the LHC: anomalous couplings and diffractive Higgs

Christophe Royon¹

¹ *IRFU-SPP, CEA Saclay*

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Summary:

After giving the QCD topics which can be studied at the LHC using proton tagging, we will describe the main topics concerning diffraction at high luminosity, namely diffractive Higgs production and its uncertainty and well as the search for anomalous couplings between photons and W/Z bosons.

Forward physics in Hadron-Hadron Collisions (II) / 86

Diffractive Dissociation at COMPASS: π^- to $(5\pi)^-$ at 190 GeV/c

Suh-Urk Chung¹

¹ *E18/TU Muenchen*

Summary:

The very first partial-wave decomposition of the $(5\pi)^-$ system at COMPASS will be presented. We observe three new resonances, $a_1(1900)$, $a_1(2200)$ and $\pi_2(2100)$. Details of the analysis and the future prospects for the $(5\pi)^-$ systems will be presented.

Forward physics in Hadron-Hadron Collisions (I) / 50

Diffractive dijet production at CDF

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Summary:

We present a measurement of dijet production at CDF from $p\bar{p}$ -p collisions at 1.96 TeV at the Fermilab Tevatron using data collected by triggering on a high transverse momentum jet in coincidence with a recoil antiproton detected in a roman pot spectrometer. Results are presented for antiproton momentum loss fraction 0.03-0.1 and 4-momentum transfer squared $t > -4 \text{ GeV}^2$ in the kinematic range of Bjorken- x 0.001-0.1 and jet transverse energy 10-100 GeV.

Diffraction in e-p Collisions (II) / 12

Diffractive neutrino interactions

Boris Kopeliovich¹

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Summary:

Diffractive neutrino-production of pions at low virtuality Q^2 is dominated by the axial current, which is partially conserved. PCAC in the form of the Adler relation connects diffractive diagonal and off-diagonal transitions in the axial channel. This is why high-energy neutrino interactions are usually

considered as a sensitive test of the PCAC hypothesis. Final state interactions, known as absorption corrections, lead to a dramatic breakdown of the Adler relation.

Diffraction in Hadron-Hadron Collisions (I) / 87

Diffractive production of charm quark/antiquark pairs at RHIC and LHC

Antoni Szczurek¹ ; Marta Luszczak¹

¹ *Institute of Nuclear Physics PAN, Cracow*

Summary:

We have discussed single and central diffractive production of $c\bar{c}$ pairs in the Ingelman-Schlein model. In these calculations we have included diffractive parton distributions obtained by the H1 collaboration at HERA and absorption effects neglected in some early calculations in the literature. The absorption effects which are responsible for the naive Regge factorization breaking cause that the cross section for diffractive processes is much smaller than that for the fully inclusive case, but could be measured at RHIC and LHC by imposing special condition on rapidity gaps. We discuss also a fully exclusive diffractive production of $c\bar{c}$. It was advocated recently that the cross section ...

Diffraction in Hadron-Hadron Collisions (II) / 72

Do we understand elastic scattering up to LHC energies?

Jacques Soffer¹

¹ *Temple University, Philadelphia, PA, USA*

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Summary:

The measurements of high energy $\bar{p}p$ and pp elastic at ISR, SPS, and Tevatron colliders have provided useful informations on the behavior of the elastic scattering amplitude. A large step in energy domain is accomplished with the LHC collider presently running, giving a unique opportunity to improve our knowledge on the asymptotic regime of the elastic scattering amplitude and to verify the validity of our theoretical approach, to describe the total cross section $\sigma_{tot}(s)$, the total elastic cross section $\sigma_{el}(s)$, the ratio of the real to imaginary parts of the forward amplitude $\rho(s)$ and the differential cross section $d\sigma(s, t)/dt$.

Diffraction in Hadron-Hadron Collisions (III) / 1

Energy evolution of the large- t elastic scattering and correlation with multiparticle production

Author(s): Sergey Troshin¹

Co-author(s): Nikolay Tyurin¹

¹ *IHEP, Protvino, Russia*

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Summary:

We discuss functional dependencies of the large- t elastic scattering and those energy evolution up to the LHC energies. Recent experimental data of the TOTEM experiment and their role in the discrimination of the possible scattering mechanisms are considered. Vanishing the helicity-flip amplitudes would result in the appearance of the oscillations at the large- t differential cross-section. This oscillating behavior would provide evidence for the s-channel helicity conservation in pp-collisions.

Spin Physics (II) / 14

Evolution and definition of TMD's

Ignazio Scimemi¹

¹ *Universidad Complutense de Madrid*

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Summary:

Recently we have come out with a definition of TMD's which formally solves many of the formal problems of Collins' one. In this talk I will discuss the evolution and definition of the TMD's, providing results which are as much as possible model independent at NNLL.

Progress in QCD (III) / 25

Evolution of cusped light-like Wilson loops, TMDs and geometry of the loops space

Author(s): Igor Cherednikov¹

Co-author(s): Frederik Van der Veken¹ ; Tom Mertens¹

¹ *Universiteit Antwerpen*

Corresponding Author(s): igor.cherednikov@ua.ac.be

Summary:

We discuss a relationship of geometrical properties of the loops space described by means of the Polyakov-Makeenko-Migdal (PMM) approach with energy/rapidity evolution of cusped Wilson loops on the light-cone. We propose to consider the renormalization properties of the light-cone cusped Wilson loops from the point of view of the universal geometrical PMM approach that corresponds to the Dyson-Schwinger set of equations for the loop space. We discuss the relevance of the PMM to energy/rapidity evolution of some phenomenologically significant objects, e.g., TMD and collinear PDFs, etc.

Spin Physics (III) / 75

Exclusive meson production at COMPASS

Pawel Sznajder¹

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Summary:

In this talk we will summarize recent measurements of exclusive meson production performed by the COMPASS Collaboration. In particular, recent results on the transverse target spin asymmetry $A_{UT}^{\sin(\phi-\phi_s)}$ for exclusive ρ^0 production will be presented. This asymmetry is sensitive to the 'elusive' GPD E , which is related to the orbital angular momentum of quarks. Also, planned measurements of exclusive meson production, which are a part of the approved COMPASS-II proposal, will be discussed.

Diffraction in e-p Collisions (III) / 101

Exclusive production at HERA

Dorota Szuba¹

¹ *UH Hamburg*

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Summary:

The exclusive photoproduction reaction $\gamma p \rightarrow \text{Upsilon}(1S) p$ has been studied with the ZEUS detector in ep collisions at HERA. The exponential slope, b , of the t dependence of the cross section, where t is the squared four-momentum transfer at the proton vertex, has been measured. This constitutes the first measurement of the t dependence of the $\gamma p \rightarrow \text{Upsilon}(1S) p$ cross section. The differential cross sections as a function of t at lower energies were studied in exclusive diffractive photoproduction of J/ψ mesons with the H1 detector. The exclusive electroproduction of two pions was measured by the ZEUS experiment. The two-pion invariant-mass distribution is interpreted in terms of the pion electromagnetic form factor, assuming that the studied mass range includes the contributions of the ρ , ρ' and ρ'' vector-meson states.

Diffraction in Hadron-Hadron Collisions (III) / 67

Exclusive production of meson pairs and resonances in proton-proton collisions

Author(s): Piotr LEBIEDOWICZ¹

Co-author(s): Antoni SZCZUREK¹

¹ *IFJ PAN*

Summary:

We shall present results for the exclusive production of $\pi^+\pi^-$ and K^+K^- pairs mediated by Pomeron and Reggeon exchanges, which constitute an irreducible background to resonance states (e.g. $f_0(980)$, $f_2(1270)$, $f_0(1500)$, χ_{c0}). We include absorption effects due to proton-proton interaction, pion/kaon rescattering and discuss differences between vectorial and tensorial Pomeron for exclusive diffractive production of mesons.

We compare the results with the existing experimental data and present predictions for the RHIC, Tevatron and LHC colliders.

Diffraction in e-p Collisions (II) / 11

Fitting DIS data at low values of Bjorken x

Agustín Sabio Vera¹ ; Clara Salas¹ ; Martin Hentschinski²

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² *Nuclear Theory Group, BNL*

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Summary:

The proton structure function F_2 is analyzed in the low x regime using BFKL evolution. We present an analytic study at next to leading logarithmic (NLL) accuracy. Higher order corrections are taken into account through an all-orders resummation introduced to improve the collinear behavior of the NLL BFKL result. We emphasize the importance of the running coupling effects and use a model for the coupling that freezes in the infrared and is consistent with power corrections to jet observables. A comparison to the latest HERA data for both F_2 and the dependence of the pomeron intercept on x is presented.

LHC and Post-LHC (II) / 59

Forward Physics at LHCb

Dmytro Volyankasy¹

¹ *MPI Heidelberg*

Summary:

Due to its unique pseudorapidity coverage and the possibility of providing measurements at low transverse momenta, LHCb allows a unique insight into particle production in the forward region at the LHC. We report on electroweak boson production at $\sqrt{s}=7\text{TeV}$, and Drell-Yan production, which is sensitive to Bjorken- x values as low as 1×10^{-5} . We show results for exclusive dimuon production, both for muon pairs production through two photon fusion and observations of exclusive J/ψ , $\psi(0)$ and χ_{c0} . We present results on forward energy flow for inclusive minimum bias interactions, hard scattering processes and events with enhanced or suppressed fractions of diffractive contributions

Diffraction in e-p Collisions (III) / 62

GPD physics with polarized muon beams at COMPASS

Andrea Ferrero¹

¹ *CEA-Saclay Irfu/SPhN*

Summary:

A major part of the future COMPASS program is dedicated to the investigation of the nucleon structure through Generalised Parton Distributions (GPD).

COMPASS will measure DVCS and DVMP reactions with a high intensity muon beam of 160 GeV and a 2.5 m-long liquid hydrogen target surrounded by a new TOF system. The availability of muon beams with high energy and opposite charge and polarization will allow to access the Compton form factor related to the dominant GPD H and to study the x_B -dependence of the t -slope of the pure DVCS cross section and to study nucleon tomography. Projections on the achievable accuracies and preliminary results of pilot measurements will be presented.

Diffraction in e-p Collisions (III) / 9

GPDs at an Electron Ion Collider

Dieter Mueller¹ ; Salvatore Fazio²

¹ Ruhr-University Bochum, Bochum, D-44780, Germany

² Brookhaven National Laboratory

Corresponding Author(s): sfazio@bnl.gov

Summary:

The feasibility for a precise determination of the Generalized Parton Distribution (GPDs) functions at an Electron Ion Collider (EIC) has been explored. The high luminosity of the machine, together with the large resolution and rapidity acceptance of a newly designed dedicated detector, will open an opportunity for very high precision measurements of GPDs. We report on the access of GPDs from deeply virtual Compton scattering (DVCS) and Vector Meson Production (VMP) measurements. We also point out that such measurements at a proposed EIC provide insight to both the transverse distribution of sea quarks and gluons as well as the proton spin decomposition.

Diffraction in Hadron-Hadron Collisions (III) / 63

Have we reached asymptotia in pp scattering?

Author(s): Giulia Pancheri¹

Co-author(s): Agnes Grau² ; Simone Pacetti³ ; Yogendra N. Srivastava³

¹ LNF

² University of Granada

³ INFN and U. Perugia

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Summary:

We discuss recent LHC data for total, inelastic and elastic pp scattering collected at 7 TeV. We use our Kt-resummation model to discuss the total and the inelastic cross-section, within the framework of a two component eikonal model. We then discuss the asymptotic properties of the scattering amplitude, such as saturation of the Froissart bound, the black disk and the Pomplin limit, the vanishing of the rho parameter. A simple model with two exponentials and a phase is used to describe the elastic differential cross-section for both pp and pbarp and test two asymptotic rules derived from the hypothesis of total absorption.

Diffraction in e-p Collisions (I) / 100

Inclusive DIS at HERA and PDFs

Enrico Tassi¹

¹ *Universita' della Calabria & INFN-Cosenza*

Corresponding Author(s): tassi@cs.infn.it

Summary:

We review the H1 and ZEUS results on the measurements of the inclusive cross sections and structure functions in DIS at HERA. Particular emphasis will be given to the determination of the proton's PDFs obtained from the combined measurements of the HERA experiments.

Diffraction in e-p Collisions (II) / 84

Inclusive Diffraction at HERA

David Salek¹

¹ *IPNP, Charles University, Prague*

Summary:

to be specified

Progress in QCD (III) / 43

Inclusive production of a pair of rapidity-separated, high p_t hadrons in proton collisions.

Author(s): Dmitry Ivanov¹

Co-author(s): Alessandro Papa²

¹ *Sobolev Institute of Mathematics*

² *Universita' della Calabria*

Corresponding Author(s): d-ivanov@math.nsc.ru

Summary:

We consider the inclusive process where the pair of identified hadrons having large transverse momenta is produced in high-energy proton-proton collisions. We concentrate on the kinematics where the two identified hadrons in the final state are separated by a large interval of rapidity. In this case the cross section receives large higher order corrections, which can be resummed in the BFKL approach. We provide a theoretical input for the resummation of such contributions with next-to-leading logarithmic accuracy. This process has much in common with the widely discussed Navelet jets production and can be also used to access the BFKL dynamics at proton colliders.

Progress in QCD (I) / 108

Integrability of the BKP equations for multi-reggeon composite states and new solutions for the Odderon problem in LLA

Lev Lipatov^{None}

Summary:

We review the integrability of the BKP equations in the multi-color QCD and discuss the duality symmetry of the reggeon Hamiltonian. Starting from the Bartels-Lipatov-Vacca solution for the Odderon wave function we construct new solutions of the duality operator using an iterative procedure in the integral of motion.

Diffraction in Nuclear Physics / 109**J/psi measurements in ultra-peripheral Pb-Pb collisions with ALICE**

Daniel Tapia Takaki¹

¹ *IPN Orsay, Paris-sud University*

Corresponding Author(s): daniel.tapia.takaki@cern.ch

Summary:

The ALICE collaboration has studied J/psi photoproduction in ultra-peripheral Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV. The J/psi is measured via its dimuon decay in the forward rapidity region with the muon spectrometer for events where the hadronic activity is required to be minimal. In this talk, ALICE results for coherent J/psi production will be presented and compared to theoretical models.

Diffraction in Hadron-Hadron Collisions (II) / 5**Jet gap jet at the LHC**

Christophe Royon Royon¹

¹ *IRFU-SPP, CEA Saclay*

Corresponding Author(s): christophe.royon@cea.fr

Summary:

We use the BFKL NLL framework to compute jet gap jet cross section at the Tevatron and the LHC and compare our prediction with the existing data.

Progress in QCD (II) / 81**Lipatov's Effective Action beyond Tree Level**

Jose' Daniel Madrigal¹

¹ *Instituto de Fisica Teorica UAM/CSIS, Madrid*

Corresponding Author(s): josedaniel.madrigal@uam.es

Summary:

A consistent procedure avoiding the subtleties related with loops when using Lipatov's high-energy effective action has been recently devised. We explain it with some example computations and discuss its potential reach.

Saturation / 114

Low x : diffusion, screening, fusion

Vladimir Zoller¹

¹ *ITEP Moscow*

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Summary:

A feasible mechanism of unitarization of amplitudes of deep inelastic scattering at small values of Bjorken x is the gluon fusion. However, its efficiency depends crucially on the vacuum color screening effect which accompanies the multiplication and the diffusion of BFKL gluons from small to large distances. From the fits to lattice data on field strength correlators the propagation length of perturbative gluons is $R_c \simeq 0.2 - 0.3$ fermi. The probability to find a perturbative gluon with short propagation length at large distances is suppressed exponentially. It changes the pattern of (dif)fusion dramatically. The magnitude of the fusion effect appears to be controlled by the new dimensionless parameter $\sim R_c^2/8B$, with the diffraction cone slope B standing for the characteristic size of the interaction region. It should slowly $\propto 1/\ln Q^2$ decrease at large Q^2 . Smallness of the ratio $R_c^2/8B$ makes the non-linear effects rather weak even at lowest Bjorken x available at HERA. We report the results of our studies of the non-linear BFKL equation which has been generalized to incorporate the running coupling and the screening radius R_c as the infrared regulator.

LHC and Post-LHC (I) / 47

Low-mass Drell-Yan production at the LHC; and treatment of the infrared region in pQCD

Author(s): Alan Martin¹

Co-author(s): Emmanuel de Oliveira²; Mikhail Ryskin³

¹ *IPPP, Durham University*

² *Instituto de Fisica, San Paulo University*

³ *PNPI, Gatchina, St Petersburg*

Corresponding Author(s): a.d.martin@durham.ac.uk

Summary:

Predictions of low-mass Drell-Yan production at the LHC are known to depend sensitively on the choice of factorization and renormalization scales. The sensitivity can be greatly reduced by fixing the factorization scale of the LO contribution using the known NLO matrix element. So LHC experiments can make direct measurements of PDFs for very low x . A spin-off of this study highlights some problems of the treatment of the infrared region in perturbative QCD.

LHC and Post-LHC (II) / 115

Low-mass, single- and double diffraction dissociation at the LHC

Laszlo Jenkovszky¹

¹ *BIPT Kiev*

Summary:

Low missing mass, single and double diffraction dissociation (DD) is calculated for the LHC energies from a factorized dual-Regge model, with emphasis on the resonance structure in the missing mass channel. Detailed predictions for the missing mass (M) and squared momentum transfer (t) dependence of the differential cross sections for single and double diffraction dissociation as well as for the integrated cross sections are given. The model calculations are compared with the existing data, including those on elastic scattering measured by TOTEM. Various limits and ratios between single and double DD are presented.

Forward physics in Hadron-Hadron Collisions (I) / 104

Low- x Physics results from CMS

Ralf Ulrich¹

¹ *Karlsruhe Institut of Technology*

Summary:

We report on recent results on forward and multiple hard jet production in pp collisions at CMS. Correlations between central and forward jet production are studied as well as additional jet radiation in events with dijets at large rapidity separation. Also the forward and very forward directed energy flow in pp and PbPb collisions are presented. Furthermore the inelastic cross-section measurement are discussed briefly.

LHC and Post-LHC (II) / 77

Measurement of the inelastic pp Cross Section with the ATLAS detector

Tibor Zenis¹

¹ *CU Bratislava*

Corresponding Author(s): tibor.zenis@cern.ch

Summary:

Measurement of the inelastic cross-section for proton-proton collisions at centre-of-mass energy $\sqrt{s} = 7$ TeV using the ATLAS detector at the Large Hadron Collider are presented.

Events are selected by requiring hits on scintillator counters mounted in the forward region of the ATLAS detector with a dataset corresponding to an integrated luminosity of 21 ub^{-1} .

Forward physics in Hadron-Hadron Collisions (II) / 105

Measurements of Diffractive and Inelastic Cross Section with ALICE at the LHC

Orlando Villalobos Baillie¹

¹ *University of Birmingham*

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Summary:

The ALICE collaboration has carried out measurements of the total inelastic and diffractive cross sections in pp interactions, using a van der Meer scan and an analysis based on the distributions of gaps in charged particle pseudorapidity distributions. The results, at $\sqrt{s} = 0.9, 2.76$ and 7 TeV, will be presented. The results will be compared with other experimental results at the LHC and at lower energies, and with recent model calculations.

Forward physics in Hadron-Hadron Collisions (I) / 97

Measurements of Inelastic pp Interactions at the LHC

Risto Orava¹

¹ *Helsinki Inst. of Physics and Univ. of Helsinki, CERN*

Corresponding Author(s): risto.orava@cern.ch

Summary:

A survey of inelastic proton-proton scattering measurements at the LHC is carried out. In the light of recent elastic and total cross section measurements, the individual diffractive scattering processes are of primary importance in understanding the apparent discrepancies of the results.

Forward physics in Hadron-Hadron Collisions (II) / 33

Measurements of Proton-Proton Elastic Scattering and Total Cross-Section at the LHC by TOTEM

Mario Deile¹

¹ *CERN*

Corresponding Author(s): mario.deile@cern.ch

Summary:

TOTEM has measured elastic pp scattering at $\sqrt{s} = 7$ TeV to $|\eta|$ as low as $5 \times 10^{-3} \text{ GeV}^2$. The data were taken in several runs with special beam optics ($\beta^* = 90$ m) and Roman Pot detectors placed as close as 4.8σ from the outgoing beams. In addition, the inelastic rates were recorded with the telescopes T1 and T2 for $5.3 < |\eta| < 6.4$. Thus the total pp cross-section could be measured with 3 different techniques: (1) the luminosity-independent method via the optical theorem (OT); (2) also via the OT but using only $d\sigma(\text{el}) / dt (t=0)$ with the lumi from CMS; (3) as direct sum of elastic and inelastic cross-sections with the lumi from CMS. All results agree within their errors.

Saturation / 83

Momentum space dipole amplitude for DIS and inclusive hadron production

Maria Beatriz Gay Ducati¹

¹ UFRGS

Corresponding Author(s): beatriz.gay@ufrgs.br

Summary:

The AGBS model, originally developed for deep inelastic scattering applied to HERA data on the proton structure function, can also describe the RHIC data on single inclusive hadron yield for $d + Au$ and $p + p$ collisions through a new simultaneous fit. The single inclusive hadron production is modeled through the color glass condensate, which uses the quark (and gluon) condensate amplitudes in momentum space. The Color Glass Condensate (CGC) is the description of the properties of saturated gluons in the infinite momentum frame in the Regge-Gribov limit. The effective degrees of freedom in this framework are color sources at large Bjorken- x variable and gauge fields at small- x . At high energies

Progress in QCD (III) / 65

Mueller-Navelet jets in high energy hadron collisions

Alessandro Papa¹ ; Beatrice Murdaca¹ ; Dmitry Yu. Ivanov² ; Francesco Caporale¹

¹ *Universita' della Calabria and INFN, Cosenza*

² *Sobolev Institute of Mathematics, Novosibirsk*

Corresponding Author(s): caporale@fis.unical.it

Summary:

We study the production of Mueller-Navelet jets in proton-proton collision using QCD collinear factorization. In particular we analyse the dependence of the differential cross section and the azimuthal decorrelation on the rapidity separation of the two tagged jets. The hard part of the observables is calculated in the complete next-to-leading order BFKL approach, taking the convolution of the BFKL Green's function with the jet vertices calculated in the "small cone" approximation.

Spin Physics (III) / 21

NEW RESULTS OBTAINED WITH TRANSVERSELY POLARIZED PROTONS IN P-P COLLISIONS AT RHIC

George Igo¹

¹ *University of California, Los Angeles*

Corresponding Author(s): igo@physics.ucla.edu

Summary:

STAR has released new mid-rapidity measurements of: the Collins effect in jets, interference fragmentation functions (IFFs) and the first clear signatures of quark transversity in $p+p$ collisions at RHIC. Knowledge about Transversity Distributions is essential for a complete picture of the spin structure of the protons. In proton-proton collisions, the spin dependent azimuthal distributions of hadrons inside of jets is sensitive to the convolution of the transversity and Collins distributions. Existing asymmetry measurements obtained prior to year 2012 will be presented. These measurements are limited by statistical and systematic errors. They will be improved substantially in the future.

Progress in QCD (I) / 8

NLO BFKL kernel for the adjoint representation of the gauge group

Victor Fadin¹

¹ *Budker Institute of Nuclear Physics*

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Summary:

It is shown that in the next-to-leading order the BFKL kernel for the adjoint representation of the gauge group with subtracted gluon trajectory does not contain infrared divergencies. An explicit form of this kernel in physical transverse momentum space is presented and its conformal properties are discussed. Conformal invariance of the kernel in the N=4 supersymmetric Yang-Mills model permits to calculate its eigenvalues and to obtain the high energy behavior of the remainder function for the 6-point scattering amplitude with the maximal helicity violation in the kinematical regions containing the Mandelstam cut contribution.

Progress in QCD (III) / 76

NLO forward jet vertex

Alessandro Papa¹ ; Amedeo Perri¹ ; Beatrice Murdaca¹ ; Dmitry Ivanov² ; Francesco Caporale¹

¹ *Universita' della Calabria and INFN, Cosenza*

² *Sobolev Institute of Mathematics, Novosibirsk*

Corresponding Author(s): beatrice.murdaca@fis.unical.it

Summary:

We calculate in the BFKL approach the jet vertex relevant for the production of Mueller-Navelet jets in proton-proton collisions. We consider both cases of incoming quark and gluon and show explicitly that all infrared divergences cancel when renormalized parton densities are considered.

LHC and Post-LHC (II) / 60

Neutral meson production with ALICE at the LHC

Alexander Borissov¹

¹ *Wayne State University, CERN*

Corresponding Author(s): alexander.borissov@cern.ch

Summary:

π^0 and η meson production cross sections are presented for pp collisions at $\sqrt{s} = 0.9, 2.76$ and 7 TeV. NLO perturbative QCD calculations overestimate π^0 and η mesons cross sections at $\sqrt{s} = 7$ TeV, but agree with the measured π^0/η ratio. π^0 production cross section is measured in Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV. The spectrum and the nuclear modification factor (R_{AA}) of the π^0 production at different centralities show a strong suppression with respect to pp collisions. Imbalance parameter x_E is presented for leading isolated π^0 meson associated to a jet in opposite direction and compared with NLO calculations for pp collisions at $\sqrt{s} = 7$ TeV.

LHC and Post-LHC (I) / 6**New results on central exclusive production at hadron colliders**Valery Khoze¹¹ *IPPP, University of Durham, UK***Summary:**

Central exclusive production (CEP) processes in high-energy hadron collisions provide an especially clean environment in which to study the nature and quantum numbers of the new resonance states. In this talk we discuss selected topics on the CEP, from the so-called diffractive Higgs to heavy resonance production within the formalism developed by the Durham group. We present the new results on the CEP of heavy quarkonia, diphotons and dimesons. We compare the theoretical expectations with the existing experimental results from the Tevatron and the LHC and present further predictions for the CEP processes at the RHIC and LHC colliders.

LHC and Post-LHC (I) / 91**News from the LHC**Albert De Roeck¹¹ *CERN***Summary:**

Recently the experiments at the LHC announced the the discovery of a new particle, a first of a kind ever seen. In this presentation we will come back to the data that led to the discovery of this particle and also discuss some possible diffractive measurements that can lead to further insight on the nature of this particle.

Progress in QCD (I) / 111**Next-to-leading order corrections to the BKP evolution**Joachim Bartels¹¹ *University Hamburg***Summary:**

I report on the new calculation of a 3-body kernel. It is a part of the NLO corrections to the evolution of multi-gluon states.

Saturation / 95**Nuclear Modification factor for gluon jet**Eugene Levin¹

¹ *UTFSM and Tel Aviv University*)

Corresponding Author(s): leving@post.tau.ac.il

Summary:

It is shown that the nuclear modification factor can be smaller than unity for jet production at small x and at large transverse momentum without any violation of the factorization theorem and the initial state effects lead to the value of the nuclear modification factor which is considerably smaller than unity.

Diffraction in e-p Collisions (II) / 89

On an evidence of higher twist emergence in DDIS at HERA

Leszek Motyka¹

¹ *Jagiellonian University*

Summary:

The HERA DDIS data on the diffractive structure functions at the lowest x and Q^2 show a strong deviation from a twist-2 description, based on DGLAP fits. This deviation grows rapidly with decreasing x and Q^2 , in consistence with an emergence of a significant higher twist contributions to diffractive proton structure functions. It is argued that the data provide an evidence for higher twist contributions to DDIS at HERA.

Progress in QCD (II) / 23

On the use of the high energy effective action for low x phenomenology

Martin Hentschinski¹

¹ *BNL*

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Summary:

We present recent results on the high energy effective action proposed by Lipatov in 1995. After a short introduction we show how the effective action can be used to calculate next-to-leading order (NLO) corrections to cross-sections in the high energy limit. As explicit examples we consider NLO corrections for the forward jet impact factor from the effective action and real NLO corrections to the Mueller-Tang impact factor, where the latter is needed to describe jet events with rapidity gaps. In a second part we discuss applications of the effective action to the description of amplitudes with multiple (reggeized) gluon exchange and discuss its relation to other approaches.

Spin Physics (II) / 28

Orbital Angular Momentum in Nucleon

Firooz Arash¹

¹ *Physics Department, Tafresh University, Tafresh, Iran*

Summary:

We use Ji's decomposition of nucleon spin and calculate the Orbital Angular Momentum of quarks and gluon in the nucleon. Calculations are carried out in the next to leading order utilizing the so-called valon model. It is found that the average quark orbital angular momentum is positive, but small, and the average gluon orbital angular momentum is negative and large. We also report on some regularities about the total angular momentum of the quarks and the gluon, as well as on the orbital angular momentum of the separate partons.

Spin Physics (III) / 74

Overview of Spin Structure Program at Jefferson Lab

Yelena Prok¹

¹ *Old Dominion University*

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Summary:

An extensive experimental program to study spin physics at low and moderate four-momentum transfer, Q^2 , has been pursued by Jefferson Lab during the last 15 years, with complementary measurements taking place in all 3 experimental halls. Our inclusive and semi-inclusive data with high statistical precision and extensive kinematic coverage allow us to better constrain the polarized parton distributions, to accurately determine various moments of spin structure functions, to test the spin content of valent quarks, and to investigate the effects of resonance excitations and higher twist, dominant in this kinematic regime. Highlights from 6 GeV experimental program will be shown

Spin Physics (III) / 57

Overview of Spin Studies at COMPASS

Fabienne Kunne¹

¹ *CEA Saclay IRFU / SPbN*

Corresponding Author(s): fabienne.kunne@cea.fr

Summary:

Recent results on the spin structure of the nucleon from the COMPASS experiment at CERN will be presented.

The gluon polarization in the nucleon was determined using open charm production and high transverse momentum hadron pair production in polarized muon scattering off longitudinally polarized target. The helicity distributions for the three lightest quark and antiquark flavours were extracted. Progress in the determination of quark fragmentation functions were also made via the measurement of pion and kaon multiplicities. Using transversely polarized deuteron and proton targets, the quark transversity distributions as well as the Sivers function and other Transverse Momentum Dependent

Diffraction in e-p Collisions (I) / 103

Overview of structure function measurements at Jefferson Lab

Wally Melnitchouk¹

¹ *Jefferson Lab*

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Summary:

We review recent results on structure functions measured in inclusive deep-inelastic scattering at Jefferson Lab. Both spin-averaged and spin-dependent structure functions are summarized, covering the deep-inelastic and nucleon resonance regions, at intermediate and large values of x . Finally, we discuss the implications of the new data for global fits of parton distribution functions.

Diffraction in Nuclear Physics / 22

PDF Studies of Hadronization Mechanisms using Pion Electroproduction in Deep Inelastic Scattering from Nuclei

Hayk Hakobyan¹ ; William Brooks¹

¹ *Universidad Tecnica Federico Santa Maria*

Corresponding Author(s): hayk.hakobyan@usm.cl

Summary:

Results for data analysis of Jefferson Lab experiment E02-104 will be presented. These data give an opportunity to investigate the modifications of fragmentation functions in the nuclear medium, and the energy loss of quarks in the in-medium hadronization process. The first observable measured is the hadronic multiplicity ratio, which is a measure of the modification of the medium-modified fragmentation functions. The second observable is the broadening of the distributions in hadron transverse momentum, the transverse momentum broadening. It is expected that the hadron production time can be estimated from this variable within certain kinematic regions.

Diffraction in e-p Collisions (I) / 36

Parton distributions with LHC data

Valerio Bertone¹

¹ *Freiburg University and CERN*

Corresponding Author(s): valerio.bertone@cern.ch

Summary:

I will present the first determination of parton distributions of the nucleon at NLO and NNLO based on a global data set which includes LHC data: NNPDF2.3. I will also present some preliminary results coming from the introduction of an intrinsic charm component in PDF determination.

Diffraction in Hadron-Hadron Collisions (II) / 46

Partonic description of soft high energy pp interactions

Alan Martin¹

¹ *IPPP, Durham University*

Corresponding Author(s): a.d.martin@durham.ac.uk

Summary:

Alternative s- and t-channel definitions of diffraction. Why study diffraction? Partonic description of “soft” high energy pp interactions, including diffraction. Possibility of including this model in the SHERPA Monte Carlo framework, forming the SHRiMPS MC = Soft-Hard Reactions involving Multi-Pomeron Scattering.

Progress in QCD (III) / 70

Photon impact factor and k_T -factorization for DIS in the next-to-leading order

Ian Balitsky¹

¹ *ODU/JLab*

Corresponding Author(s): balitsky@jlab.org

Summary:

The photon impact factor for the BFKL pomeron is calculated in the next-to-leading order (NLO) approximation using the operator expansion in Wilson lines. The result is represented as a NLO k_T -factorization formula for the structure functions of small- x deep inelastic scattering.

Diffraction in Nuclear Physics / 79

Photoproduction of vector mesons: from gamma proton to nucleus nucleus collisions

Wolfgang Schaefer¹

¹ *Institute of Nuclear Physics PAN*

Corresponding Author(s): wolfgang.schaefer@ifj.edu.pl

Summary:

Experiments on vector meson photoproduction have been a testbed of ideas on the production mechanism, the QCD Pomeron exchange. High energy protons or ions are the source of a flux of Weizsäcker-Williams photons, which can be utilized to study the photoproduction of vector mesons also at colliders. We discuss how information on the small- x gluon distribution in protons and nuclei can be obtained. We present our calculations based on a k_{\perp} -factorization approach which allows us to construct the unintegrated glue of a nucleus from the free-nucleon one. Saturation effects are incorporated by an explicit treatment of the qqbar-Fock state. We also discuss incoherent diffraction.

Diffraction in e-p Collisions (I) / 113

Physics Updates from HERMES

Morgan Murray¹

¹ *University of Glasgow*

Summary:

Recent DIS and exclusive results from the HERMES collaboration will be discussed. Of particular interest are the latest results on A2 and deeply virtual Compton scattering on a Hydrogen target. We also include the first measurement of the associated DVCS result on Hydrogen and its potential impact on previous HERMES results.

Diffraction in Nuclear Physics / 90

Polarizing Helium-3 for down quark spin enrichment

Nigel Buttimore¹

¹ *Trinity College Dublin*

Summary:

The successful acceleration of unpolarized Helium-3 nuclei by the AGS at BNL heralds the possibility of achieving polarized He-3 ions at the AGS and RHIC. Assessing the level of polarization will be a challenge at high energy as the inelastic channels associated with He-3 scattering off a carbon target in the electromagnetic hadronic interference region may dilute expectations by comparison with the successful use of this method for proton polarimetry. The large anomalous magnetic moment of He-3 is helpful however, though the greater hadronic elastic cross section reduces the optimal analyzing power. Encouragement may be drawn from measurements indicating little high energy spin ...

LHC and Post-LHC (I) / 99

Postcards from the High Energy Frontier

James Pinfeld¹

¹ *University of Alberta*

Corresponding Author(s): jpinfeld@ualberta.ca

Summary:

I will discuss what is new and important in terms of experiments, detectors, and results at the high-energy frontier defined by astroparticle and collider physics. I will concentrate where possible on the synergy between these two areas with regards to ultra high-energy cosmic ray physics, the search for dark matter and the search for new physics.

Diffraction in Hadron-Hadron Collisions (II) / 51

Predictions of diffractive cross sections in proton-proton collisions

Konstantin Goulios¹

¹ *The Rockefeller University*

Corresponding Author(s): dino@rockefeller.edu

Summary:

Predictions for diffractive proton-proton cross sections at high energies are presented in terms of unitarized expressions and compared with results from the LHC and cosmic ray experiments. An implementation in PYTHIA8, which includes single diffraction, double diffraction and central diffraction is also presented and predictions are compared with features of available LHC results.

Diffraction in Hadron-Hadron Collisions (III) / 38

Probing the phase of the elastic pp scattering amplitude with vortex proton beams

Igor Ivanov¹

¹ *University of Liege and Institute of Mathematics, Novosibirsk*

Corresponding Author(s): igor.ivanov@ulg.ac.be

Summary:

I show that by colliding vortex proton beams (that is, non-plane-wave states with spiral phase fronts associated with non-zero orbital angular momentum) one can probe the phase of the elastic pp scattering amplitude in a novel way, which is inaccessible in the usual plane wave collisions. I will describe the main idea and list the requirements that need to be satisfied for a proof-of-principle experiment realizing this suggestion.

Progress in QCD (I) / 66

Production of one and two $c\bar{c}$ pairs at LHC

Antoni Szczurek¹

¹ *Institute of Nuclear Physics PAN*

Summary:

We discuss charm production at LHC. The production of single $c\bar{c}$ pairs is calculated in the k_t -factorization approach. We use several unintegrated gluon distributions from the literature. Some of them include effect of small- x saturation and fulfill Balitsky-Kovchegov evolution equation. The hadronization is included with the help of fragmentation functions found for the production of c (\bar{c}) in e^+e^- collisions. Differential distributions for several charmed mesons will be presented and compared to recent results of the ALICE and LHCb collaborations. Some missing strength is identified. Different schemes of fragmentation are discussed. (...)

Diffraction in Hadron-Hadron Collisions (I) / 20**Quarkonium+ γ production in γ -proton interactions at LHC****Author(s):** Mairon Melo Machado¹**Co-author(s):** Victor Gonçalves²¹ *IF FARROUPILHA, Campus São Borja*² *IFM - UFPel (Instituto de Física e Matemática da Universidade Federal de Pelotas)***Corresponding Author(s):** maironmachado@sb.iffarroupilha.edu.br**Summary:**

The quarkonium plus photon production in coherent hadron - hadron interactions at LHC is studied using the non-relativistic QCD (NRQCD) factorization formalism. Considering two different sets of NRQCD matrix elements we estimate the rapidity distribution and total cross sections for $J/\Psi + \gamma$ and $\Upsilon + \gamma$ production. Our results demonstrate that the experimental analysis of this process is feasible and that it can be used to constrain the matrix elements.

Spin Physics (II) / 49**Recent Results from the PHENIX Spin Program**Kenneth Barish¹¹ *UC Riverside***Corresponding Author(s):** kenneth.barish@ucr.edu**Summary:**

The PHENIX experiment utilizes longitudinally and transversely polarized proton collisions with up to 510 GeV center of mass energy at the Relativistic Heavy Ion Collider (RHIC) to study the spin structure of the proton. Topics include the measurement of anti-quark helicity distribution functions via W production, the measurement of gluon helicity distribution functions, and the investigation of different mechanisms for the generation of transverse single spin asymmetries. We have reached an era of high enough luminosity and polarization (RHIC-II) to begin our investigation of low cross-section channels, such as the W . In this talk I will show recent results and discuss future prospects.

Diffraction in e-p Collisions (I) / 96**Recent results from low-x and forward physics at HERA**Lidia Goerlich¹¹ *Institute of Nuclear Physics PAN, Cracow***Summary:**

The production of forward jets in inclusive as well as diffractive deep-inelastic scattering at HERA is studied with the H1 detector.

Inclusive deep-inelastic events at low photon virtuality Q^2 with a forward jet, produced at small angles with respect to the proton beam, are measured with the H1 detector at HERA. A subsample of events with an additional jet in the central region is also studied. For both samples differential cross sections and normalised distributions are

measured as a function of the azimuthal angle difference, Delta phi, between the forward jet and the scattered positron. The sensitivity to QCD evolution mechanisms is tested by comparing the data to ...

Spin Physics (III) / 112

Recent results on the gluon polarization and W production program in polarized p + p collisions at RHIC

Bernd Surrow¹

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Summary:

The PHENIX and STAR experiments at the Relativistic Heavy-Ion Collider at Brookhaven National Laboratory are carrying out a spin physics program in high-energy polarized proton collisions at $\sqrt{s} = 200$ GeV and 500 GeV to gain a deeper insight into the spin structure and dynamics of the proton.

One of the main objectives of the spin physics program at RHIC is the precise determination of the polarized gluon distribution function. Recent results will be shown on the measurement of jet production and hadron production at $\sqrt{s} = 200$ GeV suggesting a small, but non-zero spin contribution of gluons to the proton spin. Recent results on the first measurements of W-/W+ boson production in polarized p-p collisions will be shown along with a discussion of future prospects involving upgraded PHENIX and STAR detector systems.

Progress in QCD (I) / 18

Regge trajectories in QCD

Author(s): ANATOLII Efremov¹

Co-author(s): Anatoly Radyushkin²; Ilya Ginzburg³

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Summary:

For soft nonsinglet binary processes in diffractive region $t \ll S$ we show that summing the contributions of the lowest twist operators and all logarithms in QCD leads to a Regge-like amplitude and a fixed singularity in j-plane. The situation in singlet channel is also discussed.

Diffraction in e-p Collisions (III) / 10

Reggeometry of lepton- and hadron-induced exclusive diffractive processes

Author(s): Laszlo Jenkovszky¹

Co-author(s): Adelmo Lavorini ² ; Andriy Saliy ³ ; Roberto Fiore ² ; Salvatore Fazio ⁴

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⁴ *BNL*

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Summary:

A unified approach to exclusive diffractive lepton- and hadron- induced processes based on a unique pomeron containing two terms, a “soft” and a “hard” one, is suggested. The relative weight of the two terms is controlled by relevant $\tilde{Q}^2=Q^2+M_V^2$ -dependent factors, where Q^2 is the virtuality of the external photon (or proton, $Q_p^2=m_p^2$) and M is the mass of the produced vector meson. The t dependence of the residue is controlled by the slopes (inverse radii) of the colliding particles, thus jus

Forward physics in Hadron-Hadron Collisions (I) / 41

Results on diffraction from the ATLAS experiment

Marek Tasevsky¹

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Summary:

Available results on diffraction from the ATLAS experiment are summarized.

Saturation / 54

Running Coupling Corrections to Nonlinear Evolution for Diffractive Dissociation

Yuri Kovchegov¹

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Summary:

We present a new derivation of the non-linear evolution equation for the cross section of single diffractive dissociation in high energy DIS on a nucleus or a proton, resumming all multiple rescatterings and all leading logarithms of energy. We then determine running coupling corrections to the kernel of this non-linear evolution equation. The running coupling kernel for diffractive evolution is found to be exactly the same as the kernel of the rcBK evolution equation.

Diffraction in Nuclear Physics / 88

STAR: Characterizing Hot Quark Matter

Gene Van Buren¹

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Summary:

With discovery of Quark Gluon Plasma well-established at RHIC, the STAR Experiment continues to work towards a more complete understanding of properties of the produced matter, and the conditions necessary for the phase change. We will present recent progress on characterizing quark matter at high temperature through a wide variety of measurement techniques in STAR's repertoire: from observing species suppression and correlations, to determining statistical moments and prospecting for symmetry-breaking.

RHIC has further embarked on a program to study this matter through a range of conditions achieved by varying the collision energies, which are hoped to span and locate the QCD critical poi

Spin Physics (I) / 17

Single spin asymmetries in inclusive DIS and in hadronic collisions

Author(s): Andreas Metz¹

Co-author(s): Andreas Schaefer² ; Daniel Pitonyak¹ ; Jian Zhou² ; Marc Schlegel³ ; Werner Vogelsang³

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Summary:

Transverse single spin asymmetries (SSAs) in inclusive DIS can be generated through two-photon exchange. We mostly focus on the case where two photons couple to different quarks. Such a contribution involves a quark-photon-quark correlator in the nucleon, which has a relation to the ETQS quark-gluon-quark correlator T_{F} , where T_{F} plays a key role in the description of transverse SSAs in hadronic collisions. Using different parameterizations for T_{F} we compute the transverse target SSA in DIS for both a proton and a neutron target and compare the results to recent data. In particular, we also discuss the implications on our understanding of SSAs in hadronic collisions.

Diffraction in Hadron-Hadron Collisions (III) / 61

Spin and diffractive physics with A Fixed-Target Experiment at the LHC (AFTER@LHC)

Andry Rakotozafindrabe¹ ; Bernard Genolini² ; Cedric Lorce³ ; Cynthia Hadjidakis² ; Elena G. Ferreira⁴ ; Enrico Scomparin⁵ ; Frederic Fleuret⁶ ; Ingo Schienbein⁷ ; Jean-Philippe Lansberg² ; Jean-Pierre Didelez² ; Philippe Rosier² ; Roberta Arnaldi⁵ ; Stanley J. Brodsky⁸ ; Ulrik Uggerhøj⁹ ; Valerie Chambert²

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⁹ *Department of Physics and Astronomy, University of Aarhus, Denmark*

Summary:

We report on the spin and diffractive physics at a future multi-purpose fixed-target experiment with the p or Pb LHC beams extracted by a bent crystal. The LHC multi-TeV beams allow for the most energetic fixed-target experiments ever performed, opening new domains of particle and nuclear physics and complementing that of collider physics, in particular that of RHIC and the EIC projects. The luminosity achievable with AFTER using typical targets would surpass that of RHIC by more than 3 orders of magnitude. The fixed-target mode has the advantage to allow for measurements of single-spin asymmetries with polarized target as well as of single-diffractive processes in the target region.

LHC and Post-LHC (II) / 110

Status and Perspectives of ALICE at the LHC

Gerardo Herrera Corral¹

¹ *CINVESTAV*

Summary:

ALICE is one of the four large detectors at the LHC. It focuses on the study of heavy ion collisions at ultra-relativistic energies. Its main goal is to study in great detail the properties of matter under extreme energy densities. We discuss some aspects of the ALICE research program, the experiment future plans as well as some general items of the ALICE upgrade.

The present detector allows some studies on diffractive physics and photon photon induced processes. A new set of scintillation pad stations is successfully providing now beam diagnostic information. Integrating these detectors in the read out of the experiment would increase the efficiency for diffractive processes in proton proton collisions. These scintillation pads would tag the diffractive gap at larger rapidity values than those of the present coverage.

Forward physics in Hadron-Hadron Collisions (II) / 106

Status of the ATLAS AFP project

Ladislav Chytka^{None}

Summary:

The ATLAS Forward Proton (AFP) project plans to add a set of detectors - silicon 3D pixel tracking detectors and QUARTIC time of flight detectors - in the ATLAS forward region around 210 m from the interaction point. The detectors are meant to detect protons outgoing from diffractive processes.

The detectors are to be housed in so called Hamburg beam pipe - a movable beam pipe allowing horizontal movement of the detectors.

The AFP is currently under approval with possible installation in 2013/14.

Forward physics in Hadron-Hadron Collisions (II) / 92

Status of the CMS High Precision Spectrometer Project

Michael Albrow¹

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Summary:

We have proposed to add proton detectors at +/- 240m, and later +/- 420m, with high precision silicon tracking (1 μ rad in angle) to measure the momenta of leading protons in central exclusive production: $p + X + p$. In Stage 1 (240m) X can be a W-pair, a jet-pair or (e.g) a high mass MSSM Higgs. In Stage 2 (420m) X can be a H(125) produced with no other particles, and its properties can be measured in a unique way. High pile-up background will be reduced by kinematics and precision timing (10ps). We hope for approval this year for installation of Stage 1 in 2014 (LS1).

Saturation / 37

The Color Dipole Picture

Dieter Schildknecht¹

¹ *Universitaet Bielefeld*

Summary:

I review the CDP approach to DIS at low $x \cong Q^2/W^2 < 0.1$. All essential experimental results can be theoretically obtained model-independently, i.e. without a specific free-parameter-dependent ansatz for the dipole cross section. The limits of color transparency and saturation, in terms of the Compton-forward-scattering amplitude, correspond to a two-channel versus a one-channel interaction of the color dipole with the gluon field in the nucleon. The connection with the pQCD-improved parton model is elaborated on. Compare also my recent review talks arXiv: 1112.2885 and my presentation given at the International Summer School of Subnuclear Physics 2012 (Erice, 23 June – 2 July 2012),

Diffraction in Hadron-Hadron Collisions (III) / 45

The current stage of understanding and description of hadronic elastic diffraction

Anton Godizov¹

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Summary:

The current situation with the phenomenological description of the high energy diffractive elastic nucleon-nucleon scattering is reviewed. Comparison of various model predictions with the recent D0 and TOTEM data on the total and differential cross-sections is presented.

Spin Physics (III) / 29

Transverse spin asymmetries in the CNJ region in polarized proton-proton elastic scattering at STAR

Wlodek Guryn¹

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Summary:

We shall present the result on single spin asymmetry (A_N) in polarized proton-proton scattering at $\sqrt{s} = 200$ GeV in small four momentum transfer region. With the Roman Pots of the pp2pp experiment, installed at the STAR detector at RHIC, a data sample of about 20 million elastic events in $-t$ range of $0.005 - 0.035 - (\text{GeV}/c)^2$ was analyzed. A fit of t -dependence of A_N indicates that a hadronic spin-flip amplitude is comparable to zero. The preliminary result from the same data sample on double spin asymmetries A_{NN} and A_{SS} is that they are of the order of 10^{-3} , which implies negligible hadronic double spin-flip amplitude and disfavors contribution Reggeons other than the Pomeron. Pla

Spin Physics (I) / 16

Transversity: theory and phenomenology

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¹ CA

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Summary:

Transversity distribution encodes a basic piece of information on the internal structure of nucleons, sharing the same status with the more familiar unpolarized and helicity distributions. On the other hand its chiral-odd nature makes it much harder to measure. In this talk I will review its properties and discuss different ways to access it, with their highlights and limitations. Recent phenomenological extractions and perspectives are also presented.

Spin Physics (II) / 27

Violent Collisions of Spinning Protons: Past, Present & Perhaps at Fermilab

Alan Krisch¹

¹ University of Michigan

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Summary:

First will be a review of the history of elastic scattering and polarized proton beams, and the unexpected and still unexplained large transverse spin effects found in high energy proton-proton spin experiments at the ZGS, CERN, AGS, Fermilab and RHIC. Next, will be a discussion of possible transverse spin experiments on violent elastic and inclusive collisions of polarized protons at Fermilab's new high-intensity Main Injector.

Spin Physics (I) / 7

Where does the spin of the proton come from?

Keh-Fei Liu¹

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Summary:

The progress of lattice calculations toward the study of the quark and glue momenta and angular momenta is reviewed. I will show a complete calculation which includes quark contributions in both the connected and disconnected insertions as well as the contribution from the glue.

Spin Physics (I) / 71

Where is the proton missing spin?

Bo-Qiang Ma¹

¹ *Peking University*

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Summary:

It has been over 20 years for the proton spin “crisis”, i.e., the puzzle of where is the proton missing spin. Here I make a review on the explanation that the proton missing spin is due to the relativistic effect of quark transversal motions.

More generally, the transversal motions of quarks play a significant role in various physical quantities related to the proton spin structure, such as the helicity and transversity distributions, and the transverse-momentum-dependent (TMD) or three-dimensional parton distributions (3dPDFs). It is shown that the relativistic effect due to quark transversal motions plays a crucial role to understand the proton spin puzzle.