

# **EDS Blois 2019: The 18th Conference on Elastic and Diffractive Scattering**



## **Report of Contributions**

Contribution ID: 1

Type: **not specified**

## PPS results and prospects from CMS/TOTEM

*Monday, 24 June 2019 15:45 (30 minutes)*

We will present the first results and the physics prospects from the CMS Precision Proton Spectrometers namely the observation of exclusive dileptons at high mass, and the search for quartic anomalous couplings and axion like particles at high masses at the LHC in the CMS collaboration.

### Additional comments

**Primary author:** WILLIAMS, Justin Andrew (The University of Kansas (US))

**Co-author:** CMS COLLABORATION

**Presenters:** WILLIAMS, Justin Andrew (The University of Kansas (US)); CMS COLLABORATION

**Session Classification:** Session 2

**Track Classification:** Diffraction and Central Exclusive Production

Contribution ID: 2

Type: **not specified**

## **Latest results on Soft QCD and DPS from the CMS experiment**

*Thursday, 27 June 2019 15:35 (25 minutes)*

Here we present overview of the recent results on the Soft QCD and Double Parton Scattering

### **Additional comments**

**Primary author:** CMS COLLABORATION

**Presenter:** GUPTA, Rajat (Panjab University (IN))

**Session Classification:** Session 7

**Track Classification:** Diffraction and Central Exclusive Production

Contribution ID: 3

Type: **not specified**

## **Recent CMS and CMS-TOTEM results on diffraction and exclusive production**

*Monday, 24 June 2019 11:20 (30 minutes)*

Here we present overview of the results on diffractive and exclusive measurements with CMS only and CMS-TOTEM data.

### **Additional comments**

**Presenter:** SURANYI, Oliver (Eötvös Loránd University)

**Session Classification:** Session 1

**Track Classification:** Diffraction and Central Exclusive Production

Contribution ID: 4

Type: **not specified**

## Photoproduction in pPb/PbPb collisions

*Tuesday, 25 June 2019 09:35 (25 minutes)*

his talk covers the results on photoproduction in pPb and PbPb collision with CMS experiment

### **Additional comments**

**Primary author:** Dr CHUDASAMA, Ruchi (Eotvos Lorand University (HU))

**Co-author:** CMS COLLABORATION

**Presenters:** Dr CHUDASAMA, Ruchi (Eotvos Lorand University (HU)); CMS COLLABORATION

**Session Classification:** Session 4

Contribution ID: 5

Type: **not specified**

## Overview of COMPASS results on spin

*Thursday, 27 June 2019 08:55 (25 minutes)*

Nucleon structure has been a major subject of study in the recent decades. Its composition in terms of quarks and gluons and how it depends on the momentum, position and spin has been one of the main fields of research of the COMPASS Collaboration. The COMPASS experiment is in operation at CERN since 2002 and presently approved to continue at least till 2021. During these years several different measurements were performed, among them the measurement of Semi Inclusive Deep Inelastic Scattering using longitudinal and transversely polarised NH<sub>3</sub> and LiD targets and a high energy/intensity muon beam and the study of the Drell-Yan reaction using transversely polarised NH<sub>3</sub> target and a negative pion beam. These measurements give us access to several parton distribution functions, the best known objects to describe the nucleon structure in momentum space. The main results on spin obtained by the COMPASS Collaboration in the last years will be presented.

### Additional comments

**Primary author:** Dr QUARESMA, Marcia (Academia Sinica (TW))

**Presenter:** Dr QUARESMA, Marcia (Academia Sinica (TW))

**Session Classification:** Session 6

**Track Classification:** Spin Physics

Contribution ID: 6

Type: **not specified**

## Exclusive Drell-Yan for studying GPDs at J-PARC

*Thursday, 27 June 2019 11:55 (25 minutes)*

It is well known that the DIS and Drell-Yan processes are two key experimental approaches to reveal the partonic structure of nucleons via either the space-like or time-like virtual photons. Conventionally the nucleon GPDs are explored by DVCS and DVMP processes using lepton beam. In this talk I will introduce a complementary measurement of nucleon GPDs by the exclusive pion-induced Drell-Yan process  $\pi^- p \rightarrow \gamma^* n \rightarrow \mu^+ \mu^- n$ . A feasibility study using E50 high-resolution spectrometer in the coming high-momentum beam line of Hadron Hall at J-PARC has been carried out [PRD 93, 114034]. A clean signal of exclusive Drell-Yan process can be identified in the missing-mass spectrum of triggered dimuon events. Realization of such measurement at J-PARC will open up a new way of accessing nucleon GPDs as well as provide the fundamental test of the universality of GPDs.

### Additional comments

**Primary author:** CHANG, Wen-Chen (Academia Sinica (TW))

**Presenter:** CHANG, Wen-Chen (Academia Sinica (TW))

**Session Classification:** Session 6

**Track Classification:** Generalized Parton Distributions

Contribution ID: 7

Type: **not specified**

## Results on Total and Elastic Cross Sections in Proton-Proton Collisions at $\sqrt{s} = 200$ GeV Obtained with the STAR Detector at RHIC.

*Tuesday, 25 June 2019 11:30 (30 minutes)*

Bogdan Pawlik for the STAR Collaboration

We report the first results on differential, total and elastic cross sections in proton-proton collisions at the Relativistic Heavy Ion Collider (RHIC) at  $\sqrt{s} = 200$  GeV. The data were obtained with the Roman Pot Detector subsystem of the STAR experiment. The data used for this analysis cover the four-momentum transfer squared ( $t$ ) range  $0.045 \geq -t \geq 0.135$  (GeV/c)<sup>2</sup>. The Roman Pot system was placed downstream of the STAR detector at vertical distance of about  $8\sigma_y$  from the beam and operated during standard data taking. The results include values of the exponential slope parameter ( $B$ ), elastic cross section ( $\sigma_{el}$ ) and the total cross section ( $\sigma_{tot}$ ) obtained by extrapolation of the elastic differential cross section ( $d\sigma/dt$ ) to the optical point at  $-t = 0$  (GeV/c)<sup>2</sup>. The detector setup and analysis procedure are reviewed. All results are compared with the world data.

### Additional comments

**Primary authors:** PAWLIK, Bogdan (Institute of Nuclear Physics PAS); GURYN, Wlodek (Brookhaven National Laboratory)

**Presenter:** PAWLIK, Bogdan (Institute of Nuclear Physics PAS)

**Session Classification:** Session 3

**Track Classification:** Elastic Scattering and Total Cross Section

Contribution ID: 8

Type: **not specified**

## Measurements of jet substructure at ATLAS

*Wednesday, 26 June 2019 08:30 (30 minutes)*

Theoretical calculations for jet substructure observables with accuracy beyond leading-logarithm have recently become available. Such observables are significant not only for probing a new regime of QCD at a hadron collider, but also for improving the understanding of jet substructure properties that are used in many searches for physics beyond the Standard Model. In this talk, we present precision measurements that probe the internal structure of jets using data collected by the ATLAS experiment at  $\sqrt{s} = 13$  TeV. The soft drop mass is measured in dijet events. We also present a measurement of substructure variables in  $t\bar{t}$  and inclusive jet events. If available, a measurement of jet substructure observables performed using charged particles is also presented. Each of these measurements are performed with large-radius jets. We also present two measurements that probe jet fragmentation and  $g \rightarrow b\bar{b}$  splitting. All of the measurements are corrected for detector effects, represented as particle-level distributions and are compared to the predictions of various Monte Carlo event generators. New event generator configurations for the modelling of jet production, derived using ATLAS data will also be presented.

### Additional comments

**Primary author:** CAMPANELLI, Mario (University College London (UK))

**Co-author:** ATLAS COLLABORATION

**Presenters:** CAMPANELLI, Mario (University College London (UK)); ATLAS COLLABORATION

**Session Classification:** Session 5

**Track Classification:** High pT physics

Contribution ID: 9

Type: **not specified**

## Measurements of multi-parton interactions at ATLAS

*Thursday, 27 June 2019 16:00 (25 minutes)*

Measurements of multiple parton scattering in proton-proton collisions provide insight into the structure and long-range low-momentum scale interactions of the proton. In this talk we present two recent measurements using proton-proton collision data collected by the ATLAS experiment. The first measurement determines the double-parton scattering contribution to four-lepton events at  $\sqrt{s}=8$  TeV. An artificial neural net is used to optimise the analysis and an upper limit on the double-parton scattering fraction is set at 0.042, which corresponds to an effective cross section of 1mb. In the second measurement, the underlying event activity is studied in events containing a Z-boson in  $\sqrt{s}=13$  TeV data. Unfolded differential cross sections are presented for charged particle multiplicity and charged particle transverse momentum in regions of azimuth measured with respect to the Z-boson direction. The data are compared to a wide variety of predictions from Monte Carlo event generators.

### Additional comments

**Presenter:** ASTALOS, Robert (Comenius University (SK))

**Session Classification:** Session 7

**Track Classification:** High pT physics

Contribution ID: 10

Type: **not specified**

## Determination of proton parton distribution functions using ATLAS data

*Thursday, 27 June 2019 14:15 (25 minutes)*

We present fits to determine parton distribution functions (PDFs) using top-antitop, inclusive W/Z-boson, as well as W<sup>+</sup> and W<sup>-</sup> boson production measurements in association with jets from ATLAS, in combination with deep-inelastic scattering data from HERA. The ATLAS W and Z boson data exhibit sensitivity to the valence quark distributions and the light quark sea composition, whereas the top-quark pair production data have sensitivity to the gluon distribution. The impact of the top-antitop production data is increased by fitting several distributions simultaneously, with the full information on the systematic and statistical correlations between data points. The parton distribution functions extracted using W+jets data show an improved determination of the high-x sea-quark densities, while confirming the unsuppressed strange-quark density at lower  $x < 0.02$  found by previous ATLAS analyses.

### Additional comments

**Primary author:** POWNALL, Gavin (University of Oxford (GB), DESY (DE))

**Co-author:** ATLAS COLLABORATION

**Presenter:** POWNALL, Gavin (University of Oxford (GB), DESY (DE))

**Session Classification:** Session 7

**Track Classification:** PDFs and hadronic final states

Contribution ID: 11

Type: **not specified**

## Measurement of photon production at ATLAS

The production of prompt isolated photons at hadron colliders provides stringent tests of perturbative QCD and can be used to evaluate probability density functions of partons in the proton. In this talk, we present the measurements of the isolated-photon plus two jets and the inclusive isolated-photons cross sections, both measured using proton-proton collision data collected by the ATLAS experiment at  $\sqrt{s}=13$  TeV. A ratio of photon cross sections at  $\sqrt{s}=8$  and  $\sqrt{s}=13$  TeV will also be presented. The results are compared with state-of-the-art theory predictions, indicating several interesting discrepancies.

### Additional comments

**Primary author:** ATLAS COLLABORATION

**Presenter:** ATLAS COLLABORATION

**Session Classification:** Session 5

**Track Classification:** PDFs and hadronic final states

Contribution ID: 12

Type: **not specified**

## Measurements of single diffraction using forward proton tagging at ATLAS

*Monday, 24 June 2019 10:50 (30 minutes)*

Inclusive single diffractive dissociation ( $pp \rightarrow pX$ ) is studied using data collected by the ATLAS experiment at the LHC. The intact proton is reconstructed and measured in the ALFA forward spectrometer, while charged particles from the dissociative system ( $X$ ) are reconstructed and measured using the ATLAS inner tracking detector and calorimeters. Differential cross sections are presented as a function of the proton fractional momentum loss, the four-momentum transfer squared, and the size of a rapidity gap measured from the edge of the ATLAS calorimeters. The results are interpreted in the framework of Regge phenomenology. If available, measurements of the charged particle multiplicity in single-diffractive events will also be presented, using protons reconstructed in the AFP detectors.

### Additional comments

**Primary authors:** ADAMCZYK, Leszek (AGH University of Science and Technology (PL)); ADAMCZYK, Leszek (AGH University of Science and Technology (PL))

**Presenters:** ADAMCZYK, Leszek (AGH University of Science and Technology (PL)); ADAMCZYK, Leszek (AGH University of Science and Technology (PL))

**Session Classification:** Session 1

**Track Classification:** Diffraction and Central Exclusive Production

Contribution ID: 13

Type: **not specified**

## Measurements of the total cross section and the rho parameter using ATLAS

A measurement of the ratio of the real to imaginary elastic scattering amplitude at zero momentum transfer (the rho parameter), and the total proton-proton scattering cross section are presented at  $\sqrt{s}=8$  TeV. The measurement is made using the differential elastic cross section as a function of the Mandelstam momentum transfer variable, which is reconstructed using the ALFA forward spectrometer in special runs with beta\*=1km optics.

### Additional comments

**Primary author:** ATLAS COLLABORATION

**Presenter:** ATLAS COLLABORATION

**Session Classification:** Session 3

**Track Classification:** Elastic Scattering and Total Cross Section

Contribution ID: 14

Type: **not specified**

## Measurement of V+jets production at ATLAS

Measurements of weak boson production in association with jets are presented. First, differential cross sections for Z-boson and W-boson production in association with jets are presented, with the measurements performed using proton-proton collisions at  $\sqrt{s} = 8$  TeV. The data are compared to next-to-leading order QCD calculations and predictions from a variety of different parton distribution functions. In addition, if available, differential cross sections are presented for Z-boson production in association with heavy-flavour jets at  $\sqrt{s} = 13$  TeV. The data are compared to theoretical predictions provided by various Monte Carlo event generators.

### Additional comments

**Primary author:** ATLAS COLLABORATION

**Presenter:** ATLAS COLLABORATION

**Session Classification:** Session 5

**Track Classification:** PDFs and hadronic final states

Contribution ID: 15

Type: **not specified**

## Measurement of W and Z boson production at ATLAS

*Wednesday, 26 June 2019 09:00 (30 minutes)*

Precision measurements of the production cross sections of W and Z bosons in proton-proton collisions provide stringent tests of perturbative QCD and yield important information about the parton distribution functions (PDFs) for quarks within the proton. We report measurements of fiducial integrated and differential cross sections for inclusive W<sup>+</sup>, W<sup>-</sup> and Z boson production, analysed in the electron and muon decay channels, using data collected at center-of-mass energies of 2.76 and 5.02 TeV. The measurement of the W<sup>+</sup> and W<sup>-</sup> cross sections, in bins of the absolute lepton rapidity, and the associated charge asymmetry are also presented. The study is performed using data collected at  $\sqrt{s} = 8$  TeV. If available, measurements of the transverse momentum distribution of Drell-Yan lepton pairs will be presented, including for low-mass Drell-Yan pairs. The measurements are compared with state-of-the-art QCD cross-section calculations.

### Additional comments

**Co-author:** ATLAS COLLABORATION

**Presenter:** EZHILOV, Aleksei (NRC Kurchatov Institute PNPI (RU))

**Session Classification:** Session 5

**Track Classification:** PDFs and hadronic final states

Contribution ID: 16

Type: **not specified**

## **Result for Pomeron and Odderon parameter using IR regulators**

*Monday, 24 June 2019 15:20 (25 minutes)*

We will present new results for the Pomeron and Odderon Slope, Intercept and Wave functions using Infra-red regulator, in particular the Wilsonian ERG ideas.

### **Additional comments**

I would like to give a Talk in the teoretical develops

**Primary author:** Dr CONTRERAS, Carlos (Santa Maria University)

**Co-authors:** Dr VACCA, Gian Paolo (INFN Bologna Italy); Dr BARTELS, Jochen (Hamburg University)

**Presenter:** Dr CONTRERAS, Carlos (Santa Maria University)

**Session Classification:** Session 2

**Track Classification:** Recent theoretical developments

Contribution ID: 17

Type: **not specified**

## Using photon collisions to search for dark matter

*Monday, 24 June 2019 14:00 (25 minutes)*

We outline a novel search strategy for scalar leptons and dark matter targeting a key area of phase space favoured by cosmological observations and muon  $g-2$  anomalies. This region is experimentally challenging and currently inaccessible at the LHC. By using the LHC protons to source photon-photon interactions and detecting the intact protons with forward detectors, recently installed by the ATLAS and CMS experiments, we have access to new experimental information. We exploit this information to powerfully discriminate against WW backgrounds and gain sensitivity in this challenging LHC blind spot. This is joint work with Jesse Liu.

### Additional comments

**Primary authors:** BERESFORD, Lydia Audrey (University of Oxford (GB)); LIU, Jesse (University of Oxford)

**Presenter:** BERESFORD, Lydia Audrey (University of Oxford (GB))

**Session Classification:** Session 2

**Track Classification:** Diffraction and Central Exclusive Production

Contribution ID: 18

Type: **not specified**

## Review of Predictions for Production of Hard Probes in p+Pb Collisions at $\sqrt{s_{NN}} = 5.02$ and 8.16 TeV and Comparison With Data

*Tuesday, 25 June 2019 10:00 (30 minutes)*

Predictions have been compiled for the  $p$ +Pb LHC runs, focusing on production of hard probes in cold nuclear matter [1-3]. These predictions were first made for the  $\sqrt{s_{NN}} = 5.02$  TeV  $p$ +Pb run [1] and were later compared to the available data in Ref. [2]. A similar set of predictions were published for the 8.16 TeV  $p$ +Pb run in Ref. [3].

In this talk, we review a selection of the predictions at the two energies, comparing them to the available data and with each other to study the quality of the predictions as well as their energy dependence.

[1] J. Albacete *et al.*, Int. J. Mod. Phys. E **22** (2013) 1330007.

[2] J. Albacete *et al.*, Int. J. Mod. Phys. E **25** (2016) 1630005.

[3] J. Albacete *et al.*, Nucl. Phys. A **972** (2018) 18.

### Additional comments

Invited abstract

**Primary author:** VOGT, Ramona (LLNL)

**Presenter:** VOGT, Ramona (LLNL)

**Session Classification:** Session 4

**Track Classification:** Heavy Ions

Contribution ID: 19

Type: **not specified**

## Pomeron and Odderon: J/psi and eta\_c electroproduction

*Tuesday, 25 June 2019 14:00 (30 minutes)*

I will discuss exclusive J/psi and eta\_c production in electron-proton collisions, mediated in the lowest order QCD by 2- and 3-gluon exchanges. In the recently developed model, we relate the amplitudes for those processes to the correlators of the quark current in the light-cone wave function of the proton. We obtain new estimates of eta\_c cross-section at the energy  $\sqrt{s} \sim 10$  GeV.

### Additional comments

**Primary author:** STEBEL, Tomasz (Institute of Nuclear Physics PAN)

**Co-author:** DUMITRU, Adrian (Baruch College (City University of New York))

**Presenter:** STEBEL, Tomasz (Institute of Nuclear Physics PAN)

**Session Classification:** Session 3

**Track Classification:** Recent theoretical developments

Contribution ID: 20

Type: **not specified**

## Size and Shape of Hadrons: From Pion Cloud to Pomeron/Odderon, and AdS/CFT

*Tuesday, 25 June 2019 14:30 (30 minutes)*

Proton-proton differential and total cross sections provide information on the energy dependence of proton shape and size. This will be discussed both from a phenomenological and theoretical perspectives. This will include the role of pion cloud, (e.g., Jenkowsky, Szanyi and Tan, hep-ph:1710.10594), new phenomenology based on AdS/CFT, (e.g., Watanabe, et al., hep-ph:1901.09564), and the non-perturbative theoretical foundation of Pomeron/Odderon, (e.g., Brower, Costa, Djuric, Raben and Tan, hep-th:1409.2730).

### Additional comments

**Primary author:** TAN, Chung-I (Brown University)

**Presenter:** TAN, Chung-I (Brown University)

**Session Classification:** Session 3

**Track Classification:** Elastic Scattering and Total Cross Section

Contribution ID: 21

Type: **not specified**

## Searches for Dark Matter at the LHC in forward proton mode

*Monday, 24 June 2019 14:25 (30 minutes)*

We analyze in detail the LHC prospects at the center-of-mass energy of 14 TeV for charged electroweakino searches, decaying to leptons, in compressed supersymmetry scenarios, via exclusive photon-initiated pair production. This provides a potentially increased sensitivity in comparison to inclusive channels, where the background is often overwhelming. We pay particular attention to the challenges that such searches would face in the hostile high pile-up environment of the LHC, giving close consideration to the backgrounds that will be present. The signal we focus on is the exclusive production of same-flavour muon and electron pairs, with missing energy in the final state, and with two outgoing intact protons registered by the dedicated forward proton detectors installed in association with ATLAS and CMS. We present results for slepton masses of 120-300 GeV and slepton-neutralino mass splitting of 10-20 GeV, and find that the relevant backgrounds can be controlled to the level of the expected signal yields. The most significant such backgrounds are due to semi-exclusive lepton pair production at lower masses, with a proton produced in the initial proton dissociation system registering in the forward detectors, and from the coincidence of forward protons produced in pile-up events with an inclusive central event that mimics the signal. We also outline a range of potential methods to further suppress these backgrounds as well as to enlarge the signal yields.

### Additional comments

**Primary author:** Dr HARLAND-LANG, Lucian (University of Oxford)

**Presenter:** Dr HARLAND-LANG, Lucian (University of Oxford)

**Session Classification:** Session 2

**Track Classification:** Diffraction and Central Exclusive Production

Contribution ID: 22

Type: **not specified**

## Recent Elastic and Total Cross-Section Measurements by TOTEM

*Tuesday, 25 June 2019 12:00 (30 minutes)*

The TOTEM experiment at the interaction point 5 of the LHC has measured the total, elastic and inelastic proton-proton cross sections in a centre-of-mass energy range from 2.76 to 13 TeV, mostly in dedicated fills with special beam optics.

Most recently, TOTEM has performed a series of detailed measurements at  $\sqrt{s} = 13$  TeV. The total, elastic and inelastic proton-proton cross-sections were determined using the luminosity-independent method based on the optical theorem.

Elastic scattering data in the Coulomb-nuclear interference region, at squared four-momentum transfers down to  $|t| \sim 8 \times 10^{-4} \text{ GeV}^2$  allowed the first measurement of the rho parameter at  $\sqrt{s} = 13$  TeV, where rho is the ratio between the real and the imaginary part of the nuclear elastic scattering amplitude at  $t = 0$ . This measurement, combined with the TOTEM total cross-section results, led to the exclusion of all the models classified and published by COMPETE. The rho and sigma\_tot results obtained by TOTEM are compatible with predictions of a colourless 3-gluon bound state exchange in the t-channel of proton-proton elastic scattering, as postulated by alternative theoretical models both in the Regge-like framework and in the modern QCD framework.

On the large  $|t|$  side the elastic differential cross-section measurement was pushed to  $4 \text{ GeV}^2$ . Thanks to very high statistics, the dip-bump structure between  $0.4$  and  $0.8 \text{ GeV}^2$  was surveyed with unprecedented precision. At higher  $|t|$ -values up to the end of the observed range no further structure is present.

The presentation will conclude with an outlook on measurements planned for LHC Run 3.

### Additional comments

**Primary author:** DEILE, Mario (CERN)

**Presenter:** DEILE, Mario (CERN)

**Session Classification:** Session 3

**Track Classification:** Elastic Scattering and Total Cross Section

Contribution ID: 23

Type: **not specified**

## Diffractive onium - nucleus scattering and genealogy of partonic evolution

*Monday, 24 June 2019 12:15 (25 minutes)*

We present a partonic picture for diffractive onium - nucleus scattering from which the distribution of rapidity gap in a certain kinematic region can be deduced. This picture allows us to draw a parallel between diffractive dissociation and the genealogy of partonic evolution, the latter being essentially similar to a branching - diffusion process. In particular, we show that the rapidity gap distribution corresponds to the distribution of the splitting time of the most recent common ancestor of the partons whose transverse momenta are larger than the nuclear saturation scale, when the scattering process is viewed in the restframe of the nucleus. Numerical calculations are also implemented to support the analytical predictions.

### Additional comments

**Primary authors:** Mr LE, Anh Dung (CPhT - Polytechnique); MUNIER, Stéphane (CNRS and École polytechnique)

**Presenter:** Mr LE, Anh Dung (CPhT - Polytechnique)

**Session Classification:** Session 1

**Track Classification:** Diffraction and Central Exclusive Production

Contribution ID: 24

Type: **not specified**

# gamma gamma production of heavy particle pairs in proton-proton collisions

*Monday, 24 June 2019 11:50 (25 minutes)*

Photon-induced processes in proton-proton interactions have become recently very topical. The large energy at the LHC, when combined with relatively large luminosity at run II, allows starting the exploration of such processes.

We discuss the production of  $W^+W^-$  pairs and  $t\bar{t}$  quark-antiquark pairs in proton-proton collisions induced by two-photon fusion including, for a first time, transverse momenta of incoming photons.

The unintegrated inelastic fluxes (related to proton dissociation) of photons are calculated based on modern parametrizations of deep inelastic structure functions in a broad range of  $x$  and  $Q^2$ .

We focus on processes with single and double proton dissociation.

Highly excited remnant systems hadronize producing particles that can be vetoed in the calorimeter. We calculate the associated effective gap survival factors. The gap survival factors depend on the process, the mass

of the remnant system and collision energy.

The rapidity gap survival factor due to remnant fragmentation for double dissociative (DD) collisions is smaller than that for single dissociative (SD) process.

We observe approximate factorisation:  $S_{R,DD} \approx S_{R,SD}^2$

when imposing rapidity veto. For the  $W^+W^-$  final state, the remnant fragmentation leads to a taming of the cross section when the rapidity gap requirement is imposed. Also for  $t\bar{t}$  quark-antiquark pairs, such a condition reverses the hierarchy observed for the case when such condition is taken into account.

Our results imply that for the production of such heavy objects as  $t$  quark and  $\bar{t}$  antiquark the virtuality of the photons attached to the dissociative system are very large ( $Q^2 < 10^4$  GeV<sup>2</sup>). A similar effect was observed for the  $W^+W^-$  system.

1. M. Luszczak, L. Forthomme, W. Schafer, A. Szczurek, JHEP 1902 (2019) 100.
2. L. Forthomme, M. Luszczak, W. Schafer, A. Szczurek, Phys.Lett. B789 (2019) 300-307.
3. M. Luszczak, W. Schafer, A. Szczurek, JHEP 1805 (2018) 064.
4. M. Luszczak, W. Schafer and A. Szczurek, Phys. Rev. D93 (2016) 7, 074018.
5. M. Luszczak, A. Szczurek, Ch. Royon, JHEP 1502 (2015) 098.

## Additional comments

**Primary author:** LUSZCZAK, Marta (University of Rzeszow)

**Presenter:** LUSZCZAK, Marta (University of Rzeszow)

**Session Classification:** Session 1

Contribution ID: 25

Type: **not specified**

## Searching for odderon exchange in exclusive reactions with $\phi$ meson

*Monday, 24 June 2019 14:55 (25 minutes)*

P. Lebiedowicz, O. Nachtmann and A. Szczurek

Last year results of the TOTEM collaboration suggest that the odderon exchange can be responsible for a disagreement of theoretical calculations and the TOTEM data (recent Nicolescu papers) for elastic proton-proton scattering. Similar conclusion can be drawn when comparing recent  $pp$  result for  $\sqrt{s} = 2.74$  TeV with the Tevatron data.

It is premature to draw definite conclusion. Here we present our recent studies for two related processes where the odderon exchange may show up.

The first one is central exclusive production of pairs of  $\phi$  mesons. Here odderon exchange is not excluded by the WA102 experimental data for high  $\phi\phi$  invariant masses. The process is advantageous [1] as here odderon does not couple to protons (the corresponding coupling constant is probably small). Predictions for the LHC will be presented. The distribution in  $M_{\phi\phi}$  and the rapidity difference  $Y_{\phi\phi}$  seem well suited to identify odderon exchange.

Finally we discuss a possibility to search for odderon exchange for the  $pp \rightarrow pp\phi$  reaction \cite{LNS2019\_phi}. At high energies probably the photon-pomeron fusion is the dominant process. The odderon-pomeron fusion is an interesting alternative. Adding odderon exchange with parameters adjusted for the  $\phi\phi$  final state improves considerably description of the  $pp$  angular correlations measured in the past by the WA102 collaboration at  $\sqrt{s} = 29.1$  GeV. At the low energy we consider also some other subleading processes that turned out to be rather small. Predictions for the LHC will be presented.

[1] P. Lebiedowicz, O. Nachtmann and A. Szczurek, xArxiv:1901.11490, in print in Phys. Rev. D.

[2] P. Lebiedowicz, O. Nachtmann and A. Szczurek, a paper in preparation.

### Additional comments

**Primary author:** Prof. SZCZUREK, Antoni (Institute of Nuclear Physics PAN)

**Presenter:** Prof. SZCZUREK, Antoni (Institute of Nuclear Physics PAN)

**Session Classification:** Session 2

**Track Classification:** Diffraction and Central Exclusive Production

Contribution ID: 26

Type: **not specified**

## From quarkonium wave functions to $\gamma^*\gamma^* \rightarrow \eta_c(1S, 2S)$ transition form factors

*Friday, 28 June 2019 08:30 (25 minutes)*

We discuss  $\gamma^*\gamma^* \rightarrow \eta_c(1S), \eta_c(2S)$  transition form factor for both virtual photons. The general formula is given.

We use different models for the  $c\bar{c}$  wave function obtained from the solution of the Schrödinger equation for different  $c\bar{c}$  potentials: harmonic oscillator, Cornell, logarithmic, power-law, Coulomb and Buchmüller-Tye.

We compare our results to the BaBar experimental data for  $\eta_c(1S)$ , for one real and one virtual photon. We discuss approaching of

$Q_1^2 F(Q_1^2, 0)$  or  $Q_2^2 F(0, Q_2^2)$  to their asymptotic value

$\frac{8}{3} f_{\eta_c}$  predicted by Brodsky and Lepage formalism.

We discuss applicability of the collinear and/or massless limit and delayed onset of asymptotic behaviour.

We present some examples of two-dimensional distributions for  $F_{\gamma^*\gamma^* \rightarrow \eta_c}(Q_1^2, Q_2^2)$ .

A scaling in  $\omega = (Q_1^2 = Q_2^2)/(Q_1^2 + Q_2^2)$  was obtained.

A factorization breaking measure is proposed and factorization breaking effects are quantified and shown

to be weakly model dependent.

The cross section for the  $e^+e^- \rightarrow e^+e^-\eta_c$  reaction are given for double tagging ( $e^+$  and  $e^-$ ) case and the effect of  $(Q_1^2, Q_2^2)$  dependence of the transition form factor is quantified.

I. Babiarz, V. Goncalves, R. Pasechnik, W. Schafer and A. Szczurek,  
a paper in print in Phys. Rev. D (see also arXiv)

### Additional comments

**Primary author:** Prof. SZCZUREK, Antoni (Institute of Nuclear Physics)

**Presenter:** Prof. SZCZUREK, Antoni (Institute of Nuclear Physics)

**Session Classification:** Session 8

**Track Classification:** Recent theoretical developments

Contribution ID: 27

Type: **not specified**

## New CTEQ global analysis with high precision data from the LHC

*Thursday, 27 June 2019 13:50 (25 minutes)*

We present the new CTEQ-TEA global analysis of Quantum Chromodynamics (QCD). In this analysis, parton distribution functions (PDFs) of the nucleon are determined within the Hessian method at the next-to-next-to-leading order (NNLO) in perturbative QCD, based on the most recent measurements from the Large Hadron Collider (LHC) and a variety of world experimental collider data. Next-to-leading order (NLO) and leading order (LO) PDFs are also determined. Because of difficulties in fitting both the ATLAS 7 and 8 TeV W and Z vector boson production cross section data, we present two families of PDFs, named CT18 and CT18Z PDFs respectively, without and with the ATLAS 7 TeV W and Z measurements. We study the impact of the CT18 family of PDFs on the theoretical predictions of standard candle cross sections at the LHC and the role of PDF uncertainties.

### Additional comments

**Primary authors:** HOU, Tie-Jiun (Northeastern University); DULAT, Sayipjamal (Xinjiang University); HUSTON, Joey (Michigan State University); GAO, Jun (Shanghai Jiao Tong University, Center for High Energy Physics, Peking University); GUZZI, Marco (Kennesaw State University); HOBBS, Tim (Southern Methodist University); NADOLSKY, Pavel (Southern Methodist University); PUMPLIN, Jon (Michigan State University); SCHMIDT, Carl (Michigan State University); SITIWALDI, Ibrahim (Xinjiang University); STUMP, Dan (Michigan State University); XIE, Keping (Southern Methodist University); YUAN, C.-P. (Michigan State University)

**Presenter:** HOU, Tie-Jiun (Northeastern University)

**Session Classification:** Session 7

**Track Classification:** PDFs and hadronic final states

Contribution ID: 28

Type: **not specified**

# Gluon polarization measurements from longitudinally polarized proton-proton collisions at STAR

*Thursday, 27 June 2019 10:40 (25 minutes)*

Jets produced in the pseudo-rapidity range,  $-1.0 < \eta < 1.0$ , from  $pp$  collisions at RHIC kinematics are dominated by quark-gluon and gluon-gluon scattering processes. Therefore the longitudinal double-spin asymmetry  $A_{LL}$  for jets is an effective channel to explore the longitudinal gluon polarization in the proton. At STAR, jets are reconstructed in full azimuth, from the charged-particle tracks seen by the Time Projection Chamber and electro-magnetic energy deposited in the Barrel and Endcap electro-magnetic calorimeters at both  $\sqrt{s} = 200$  and 510 GeV. Early STAR inclusive jet  $A_{LL}$  results at  $\sqrt{s} = 200$  GeV provided the first evidence of the non-zero gluon polarization at  $x > 0.05$ . At  $\sqrt{s} = 510$  GeV, the inclusive jet  $A_{LL}$  is sensitive to the gluon polarization as low as  $x \sim 0.015$ . In this talk, we will discuss recent STAR inclusive jet and di-jet  $A_{LL}$  results at  $\sqrt{s} = 510$  GeV and highlight the new techniques designed for this analysis, for example the underlying event correction to the jet transverse energy and its effect on the jet  $A_{LL}$ . Di-jet  $A_{LL}$  results are shown for four topologies in regions of pseudo-rapidity, effectively scanning the  $x$ -dependence of the gluon polarization.

## Additional comments

**Presenters:** Dr CHANG, Zilong (Brookhaven National Laboratory); Dr CHANG, Zilong

**Session Classification:** Session 6

**Track Classification:** Spin Physics

Contribution ID: 29

Type: **not specified**

## Quasi Parton Distribution Functions for Gluons

*Friday, 28 June 2019 09:20 (25 minutes)*

Parton distribution functions (PDFs) are mandatory inputs in high energy scattering and also play an important role in searching for new physics at high energy. The recently proposed large momentum effective theory allows one to access the PDFs from first principle Lattice QCD. In this talk, I will discuss the recent progresses on quasi-PDFs, in particular on the gluon quasi-PDFs.

### Additional comments

**Primary author:** WANG, Wei (SJTU)

**Presenter:** WANG, Wei (SJTU)

**Session Classification:** Session 8

**Track Classification:** Generalized Parton Distributions

Contribution ID: 30

Type: **not specified**

## Extracting jet transport coefficient of cold nuclear matter

*Friday, 28 June 2019 08:55 (25 minutes)*

Quantifying the differences between nuclear and hadronic collisions, phenomenological known as medium modification due to multiple scatterings between the hard probe and medium, can provide a solid baseline for unambiguous identification of the fundamental medium property. In this talk, we consider parton propagation in cold nuclear matter within the framework of high twist expansion, which has been shown to be a successful approach to describe the multiple scattering effect as observed in experiment. Through global analysis of world data on transverse momentum broadening of single particle, transverse momentum imbalance of two particle, as well as nuclear modification factor of single particle in electron-nucleus and proton-nucleus collisions, we perform the first extraction of jet transport coefficient ( $q_{hat}$ ) for cold nuclear matter. This provide the first evidence that the medium transport property, rather than a constant value as commonly used in heavy ion collisions, depends on the probing scale similar to that in standard parton distribution functions of proton.

### Additional comments

**Primary authors:** KANG, Zhongbo; RU, Peng; XING, Hongxi; ZHANG, Benwei

**Presenter:** XING, Hongxi

**Session Classification:** Session 8

**Track Classification:** Recent theoretical developments

Contribution ID: 31

Type: **not specified**

## New insights on the lepton angular distributions in the Drell-Yan process and Z-boson production at the LHC

*Wednesday, 26 June 2019 09:30 (25 minutes)*

The lepton angular distributions of the Drell-Yan process in fixed-target experiments and the Z-boson production at colliders are investigated by an intuitive geometric approach together with perturbative QCD calculations. We show that the main features of the kinematic dependencies of the lepton angular distributions can be well understood in the geometrical approach. Implications of this approach on the rotational invariance of the angular coefficients, the behavior of the coefficients for Z plus jets events, and the angular distributions of other hard processes will be presented. This talk is based on results presented in the following papers:

Phys. Lett. B758 (2016) 384;  
Phys. Rev. D 96 (2017) 054020;  
Phys. Lett. B789 (2019) 356;  
Phys. Rev. D 99 (2019) 014032

### Additional comments

**Primary author:** Prof. PENG, Jen-Chieh (University of Illinois at Urbana-Champaign)

**Presenter:** Prof. PENG, Jen-Chieh (University of Illinois at Urbana-Champaign)

**Session Classification:** Session 5

**Track Classification:** Spin Physics

Contribution ID: 32

Type: **not specified**

## Recent Results of the RHIC Spin Program

*Thursday, 27 June 2019 09:20 (25 minutes)*

The Relativistic Heavy Ion Collider (RHIC) is the only polarized (both longitudinal and transverse) proton collider in the world, capable of reaching center of mass energies of  $\sqrt{s} = 200$  GeV and 510 GeV. At these energies, the dominating processes are quark-gluon and gluon-gluon scattering, allowing the major RHIC experiments probe partons inside the nucleus. The RHIC spin program has provided a great variety of measurements to study the proton structure, in particular the spin composition. Following the measurements that provided the first evidence of non-zero gluon polarization at  $x > 0.05$ , several concurrent measurements of longitudinally polarized proton collisions have been performed to increase precision and reduce the sensitivity down to  $x \sim 10^{-3}$ ; besides estimating the spin contribution of individual sea quarks to the total proton spin. Measurements of transversity distribution of the nucleon and the transversely polarized fragmentation functions are taken at RHIC, due its versatile capability to change the orientation of the colliding protons polarization. Several measurements with different probes are underway, aiming to test universality, constrain evolution of transverse momentum dependence distributions (TMDs) and extract interference fragmentation functions over a wide kinematic range. An overview of the recent physics results of the RHIC spin program and their impact in model calculations is presented. Additionally plans to extend and/or complement these measurements in the near future are discussed.

### Additional comments

**Primary author:** QUINTERO, Amilkar (Temple University)

**Presenter:** QUINTERO, Amilkar (Temple University)

**Session Classification:** Session 6

**Track Classification:** Spin Physics

Contribution ID: 33

Type: **not specified**

## Recent QCD results from the xFitter project

*Thursday, 27 June 2019 14:40 (25 minutes)*

We present the xFitter project which provides an open-source software framework for the determination of the proton's parton distribution functions and for the interpretation of the physics analyses in the context of Quantum Chromodynamics. The project has been used recently for a number of analyses performed by the LHC collaborations and theory community, which are summarized briefly. The xFitter developer's team also performed several studies recently including determination of pion PDFs, studies of impact on PDFs of forward backward asymmetry in Drell Yan, and investigations of treatment of heavy flavors for charged current DIS processes.

### Additional comments

**Primary author:** GLAZOV, Alexander (Deutsches Elektronen-Synchrotron (DE))

**Presenter:** GLAZOV, Alexander (Deutsches Elektronen-Synchrotron (DE))

**Session Classification:** Session 7

**Track Classification:** PDFs and hadronic final states

Contribution ID: 34

Type: **not specified**

## Tensor network in complex scalar theory toward lattice studies of AdS/CFT

*Friday, 28 June 2019 10:45 (30 minutes)*

Sign problem is an obstacle in lattice studies of supersymmetric gauge theories including a numerical verification of AdS/CFT. Tensor network is an attractive approach to overcome this problem. We present a numerical result of the tensor network approach in two-dimensional complex  $\phi^4$  theory with finite chemical potential.

### Additional comments

**Primary authors:** KADOH, Daisuke (Chulalongkorn); SAKAI, Ryo (Kanazawa University); TAKEDA, Shinji (Kanazawa university); NAKAMURA, Yoshifumi; KURAMASHI, Yoshinobu (University of Tsukuba); YOSHIMURA, Yusuke (Tsukuba University)

**Presenter:** KADOH, Daisuke (Chulalongkorn)

**Session Classification:** Session 8

**Track Classification:** Recent theoretical developments

Contribution ID: 35

Type: **not specified**

## Status and prospects of a future Electron-Ion Collider

*Thursday, 27 June 2019 09:45 (25 minutes)*

The 2015 U.S. Nuclear Physics Long-Range Plan recommended the realization of an electron-ion collider (EIC) as the next large construction project in the United States. A U.S.-based EIC has also recently been endorsed by the U.S. National Academy of Sciences. In their report released in July 2018 they find the scientific case “compelling, unique, and timely”. With its high luminosity, wide kinematic reach in center-of-mass-energy and high lepton and proton beam polarization, the EIC is an unprecedented opportunity to reach new frontiers in our understanding of the internal dynamic structure of nucleons. This new collider will provide definite answers to the following questions: How are the sea quarks and gluons, and their spins, distributed in space and momentum inside the nucleon? How the nuclear environment modifies these quark and gluon distributions? At what scale the growth in the distribution of gluons saturates? What is the role of the orbital motion of sea quarks and gluons in building up the nucleon spin? This presentation will report on the project’s status and prospects. It will also highlight several key high precision measurements from the planned broad physics program at the electron-ion collider and the expected impact on our current understanding of the partonic structure of nucleons and nuclei.

### Additional comments

**Primary author:** FAZIO, Salvatore**Presenter:** FAZIO, Salvatore**Session Classification:** Session 6**Track Classification:** Spin Physics

Contribution ID: 36

Type: **not specified**

## Recent results from HERA

*Monday, 24 June 2019 09:30 (50 minutes)*

Recent results from the H1 and ZEUS collaborations will be presented. Topics will include cross sections for prompt photon production,  $J/\psi$  and  $\psi'$  production and  $\rho$  and  $\rho'$  production, a study of collective effects, and a fit to diffractive DIS data.

### **Additional comments**

**Primary authors:** Dr BUSSEY, Peter (University of Glasgow, UK); FOR THE H1 AND ZEUS COLLABORATIONS

**Presenter:** Dr BUSSEY, Peter (University of Glasgow, UK)

**Session Classification:** Session 1

**Track Classification:** Diffraction and Central Exclusive Production

Contribution ID: 37

Type: **not specified**

## Recent IceCube Measurements Using High Energy Neutrinos

*Wednesday, 26 June 2019 10:25 (30 minutes)*

The IceCube Neutrino Observatory, located at the South Pole, is a Cherenkov detector that continuously monitors a cubic kilometer of instrumented glacial ice for neutrino interactions in the sub-TeV to EeV energy range. Its primary design goal is the study of powerful astrophysical objects that could act as natural particle accelerators and thus as sources of (ultra) high energy cosmic rays - in short: to do neutrino astronomy. The first steps have been realized. IceCube has discovered a diffuse flux of high energy astrophysical neutrinos consistent with being extra-galactic in origin. In addition it recently obtained evidence for neutrino emission from the direction of the blazar TXS 0506+056 and thereby possibly identified a first source of high energy cosmic rays. Besides high energy astrophysics, IceCube also contributes to fundamental particle physics through the study of neutrino interactions at these large energies. In this talk I will present recent IceCube results of measurements with high energy neutrinos.

### **Additional comments**

**Primary author:** Dr NIEDERHAUSEN, Hans (Technical University of Munich)

**Presenter:** Dr NIEDERHAUSEN, Hans (Technical University of Munich)

**Session Classification:** Session 5

**Track Classification:** Recent physics reviews and future facilities

Contribution ID: **39**

Type: **not specified**

# Welcome

**Presenter:** TRAN THANH, Van (Rencontres du Vietnam)

Contribution ID: 40

Type: **not specified**

## Quantum Computing and lattice gauge theories

*Friday, 28 June 2019 10:15 (30 minutes)*

to be provided by Richard Brower.

### **Additional comments**

**Presenter:** BROWER, Richard (Boston Univ.)

**Session Classification:** Session 8

**Track Classification:** Recent theoretical developments

Contribution ID: 41

Type: **not specified**

**TBD**

contribution to recent theoretical development session.

**Additional comments**

**Presenter:** Dr HANADA

**Session Classification:** Session 8

Contribution ID: 42

Type: **not specified**

# Quark transverse dynamics in hadrons from Lattice QCD

*Thursday, 27 June 2019 11:05 (25 minutes)*

An ongoing program of evaluating transverse momentum-dependent (TMD) observables in hadrons within Lattice QCD is reviewed, summarizing recent progress with respect to several challenges faced by such calculations. These lattice calculations are based on a definition of TMDs through hadronic matrix elements of quark bilocal operators, including an appropriate gauge connection between the quarks. Results presented include data on the Sivers and Boer-Mulders effects, exhibiting the decisive role of the gauge connection in encoding information about the struck quark in a deep inelastic scattering process. Generalizing these TMD calculations by connecting them with information about quark transverse position in the hadron allows one to access quark orbital angular momentum and provide a new perspective on the proton spin puzzle - the question of how the proton's spin arises from the spins and orbital angular momenta of its constituents.

## Additional comments

Session: Low-x, PDFs and hadronic final states, high pT

**Primary author:** ENGELHARDT, Michael

**Presenter:** ENGELHARDT, Michael

**Session Classification:** Session 6

**Track Classification:** Spin Physics

Contribution ID: 43

Type: **not specified**

## Schwinger based QCD formulation's derivation of elastic pp scattering

*Tuesday, 25 June 2019 11:00 (30 minutes)*

Using previously described functional techniques for some non-perturbative, gauge invariant, renormalized QCD processes, a simplified version of the amplitudes —in which forms akin to Pomerons naturally appear —provides fits to ISR and LHC-TOTEM pp elastic scattering data. Those amplitudes rely on a specific function  $\varphi(b)$  which describes the fluctuations of the transverse position of quarks inside hadrons.

### Additional comments

**Primary authors:** Prof. FRIED, Herbert (Brown University); Dr TSANG, Peter (Brown University); Prof. GABELLINI, Yves (Institut de Physique de Nice); Prof. GRANDOU, Thierry (Institut de Physique de Nice); Dr SHEU, Yeuan-Ming (Brown University)

**Presenter:** Dr TSANG, Peter (Brown University)

**Session Classification:** Session 3

**Track Classification:** Elastic Scattering and Total Cross Section

Contribution ID: 44

Type: **not specified**

## Overview of recent ALICE results

*Tuesday, 25 June 2019 08:50 (45 minutes)*

The existence of a deconfined state of matter (quark-gluon plasma, QGP) in heavy-ion collisions have been shown in large experiments in the past decades. However, it was the CERN LHC Run-2 data taking period that really allowed for precision measurements aimed at the understanding of its properties in detail. The excellent particle identification capabilities of the ALICE experiment provide us with a unique opportunity to study the nature of strongly interacting matter under extreme conditions. A selection of recent ALICE results from pp, p-Pb, Pb-Pb and Xe-Xe collisions, as well as prospects of the upcoming Run-III phase, will be presented in this talk.

### **Additional comments**

Added by EDS organizers

**Primary author:** VERTESI, Robert (Hungarian Academy of Sciences (HU))

**Presenter:** VERTESI, Robert (Hungarian Academy of Sciences (HU))

**Session Classification:** Session 4

**Track Classification:** Heavy Ions

Contribution ID: 45

Type: **not specified**

## TOTEM Results on Odderon

**Presenter:** PASECHNIK, Roman (Lund university)

**Session Classification:** Session 3

Contribution ID: 46

Type: **not specified**

## Application of Conformal Field Theory to High Energy Scattering and Principal Series

we discuss differences and similarities between CFT correlators in Euclidean and Minkowski treatments. As a concrete illustration, we discuss CFT correlators via {it principal series representation} for non-compact Lie groups by focussing on 1-d CFT, and in particular, discuss SYK-like models. Euclidean correlators can be expanded in OPE in terms of an infinite set of conformal primaries, with dimensions  $\Delta_n = h_n = 2\delta_0 + 2n + 1 + \gamma_n$ . In addition, there is a special contribution from a term which saturates to the chaos bound, with  $\Delta_0 = 2$ . The same theory can equivalent be organized in terms of an infinite set of Regge trajectories, with a leading graviton trajectory” with intercept  $j_0 = 2$ . In addition, there exists an infinite set of lower trajectories with intercept  $j_n = -2\delta_0 - 2n - 1 + \epsilon_n$ . These two representations are dual” for 1-d CFT, and can be considered as a “contraction” of  $\Delta - j$  curve from CFT initially defined at  $1 < d$ .

### Additional comments

**Primary authors:** Prof. BROWER, Richard; Dr RABEN, Tmothy; Prof. TAN, Chung-I

**Presenter:** Prof. TAN, Chung-I

Contribution ID: 47

Type: **not specified**

## What QCD teaches us about Quantum Gravity, and vice versa

*Friday, 28 June 2019 11:15 (30 minutes)***Abstract:**

For long time, gravity is used for learning dynamical aspects of QCD, because holography connects gravity and QFT. In this talk, I will review the opposite direction: learning about gravity from QFT. In particular, I will focus on the quantum nature of black hole. Techniques developed among QCD-practitioners turned out to be useful for quantum gravity. At the same time, quantum gravity leads to new understanding about QCD and QFT. As an example, I introduce a new symmetry breaking mechanism motivated by evaporating black hole a la Hawking.

**Additional comments****Primary author:** Dr HANADA, Masanori**Presenter:** Dr HANADA, Masanori**Session Classification:** Session 8**Track Classification:** Recent theoretical developments

Contribution ID: 48

Type: **not specified**

## **Odderon, proton structure and hollowness from the model-independent Levy imaging of elastic hadron-hadron collisions**

*Tuesday, 25 June 2019 15:00 (30 minutes)*

### **Additional comments**

**Presenter:** PASECHNIK, Roman (Lund university)

**Session Classification:** Session 3

Contribution ID: 49

Type: **not specified**

## **Astrophysics in Vietnam**

*Wednesday, 26 June 2019 10:55 (45 minutes)*

### **Additional comments**

**Presenter:** PHAM, Tuan-Anh (Vietnam National Space Center)

**Session Classification:** Session 5

Contribution ID: 50

Type: **not specified**

## **Proton spin in 3D momentum space**

*Thursday, 27 June 2019 08:30 (25 minutes)*

### **Additional comments**

**Presenter:** SIGNORI, Andrea (Argonne National Laboratory)

**Session Classification:** Session 6

Contribution ID: 51

Type: **not specified**

## Generalized Parton Distributions and the Center for Nuclear Femtography

*Thursday, 27 June 2019 11:30 (25 minutes)*

I will review the theory and recent phenomenology of Generalized Parton Distributions (GPDs). What sets apart GPDs from their forward kinematic counterparts, the Parton Distribution Functions (PDFs) is the insight they provide on the 3D structure of the nucleon. I will highlight developments of a recent initiative that will boost current investigations within the research program of the future Electron Ion Collider.

### Additional comments

**Primary author:** Prof. SIMONETTA, liuti

**Presenter:** Prof. SIMONETTA, liuti

**Session Classification:** Session 6

Contribution ID: 52

Type: **not specified**

## **Application of Conformal Field Theory to High Energy Scattering and Principal Series**

**Additional comments**

**Presenter:** TAN, Chung-I

**Session Classification:** Session 8

Contribution ID: 53

Type: **not specified**

## Conference Summary

*Friday, 28 June 2019 12:45 (30 minutes)*

**Presenter:** HIROSKY, Bob (University of Virginia (US))

**Session Classification:** Session 9

Contribution ID: 54

Type: **not specified**

## **Presentation of guests**

*Monday, 24 June 2019 08:30 (10 minutes)*

**Session Classification:** Opening

Contribution ID: 55

Type: **not specified**

## **J. Tran Thanh Van: Welcome**

*Monday, 24 June 2019 08:40 (10 minutes)*

**Session Classification:** Opening

Contribution ID: 56

Type: **not specified**

## **Nguyen Phi Long, Vice President of the province**

*Monday, 24 June 2019 08:50 (15 minutes)*

**Session Classification:** Opening

Contribution ID: 57

Type: **not specified**

## **Presentation of the EDS Blois series**

*Monday, 24 June 2019 09:05 (10 minutes)*

**Presenter:** MESROPIAN, Christina (Rockefeller University (US))

**Session Classification:** Opening

Contribution ID: 58

Type: **not specified**

## Conference photograph

*Monday, 24 June 2019 09:15 (15 minutes)*

**Session Classification:** Opening

Contribution ID: 59

Type: **not specified**

## Panel Discussion

*Friday, 28 June 2019 13:15 (1h 15m)*

**Session Classification:** Session 9