GHP Newsletter November 2019

American Physical Society Topical Group on Hadronic Physics

http://www.aps.org/units/ghp/

Executive Officers

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1 Elections

Elections will open soon for two posts in the GHP Executive (Vice-Chair and Member-at-Large) in 2019. Tanja Horn (Past Chair) and Anne Sickles (Member-at-Large) will have completed their terms.

Our rules state that: *the Committee shall nominate at least two candidates for the offices of Vice-Chair and for the open position of Member-at-Large; the slate of candidates will be balanced as much as possible to ensure wide representation amongst the various fields of physics included in the GHP's membership; the Nominating Committee shall be chaired by the immediate Past Chair and shall include four members in addition to its Chair, one of whom shall be appointed by the APS.*

Nominating Committee

Tanja Horn (*Chair*)
hornt@jlab.org

Ken Barish	Martha Constantinou	Jorge Morfin	Misak Sargsian
kenneth.barish@ucr.edu	marthac@temple.edu	morfin@fnal.gov	sargsian@fiu.edu

Attracting and serving a diverse and inclusive membership worldwide is a primary goal for APS. In calling for nominations, we wish to remind you how important it is to give full consideration to qualified women, members of underrepresented minority groups, and scientists from outside the United States. There is strength in diversity and so the Executive would like to see nominations from across the entire spectrum of GHP's membership.

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2 Membership

As made clear by Fig. 1, the membership of the GHP has been declining since around 2014, falling from 496 members on 1 January 2014 to 440 members on 1 January 2019. During this same period the APS as a whole has grown, with 55,158 members at the start of 2019. This decline in GHP membership relative to the total number of APS members has started to have a serious impact on the ability of the GHP to advocate for hadron physics within the APS and more broadly. Most significantly, in 2019 the GHP could only nominate one GHP member for an APS Fellowship, which is a drop from two in previous years. This is despite having a large number of outstanding nominees in 2019.

If this decline in membership does not start to turn around it will also impact the number of invited parallel talks allocated to the GHP at the APS April Meeting, and put at risk our own sorting categories. Therefore, for the health and vibrancy of hadron physics it is an imperative

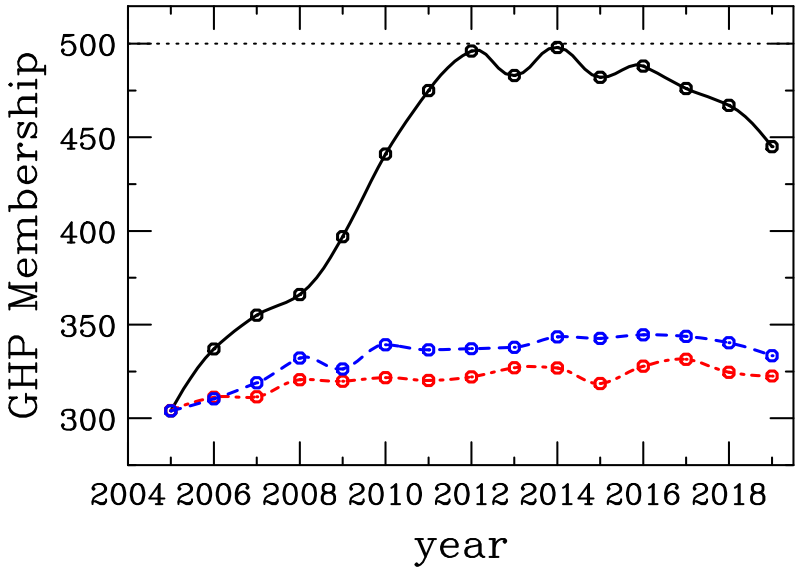


Figure 1: Solid line GHP membership, absolute value, with 2019 representing the APS Official Count at the beginning of 2019; dashed DNP membership normal ized to GHPs value in 2005 (2401 $\longrightarrow$ 304); and dot-dashed DPF m embership normalized to GHPs 2005 value (3291 $\longrightarrow$ 304).

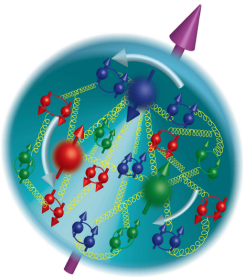
that the number of GHP members start to increase significantly. Given the size of the User Groups associated with RHIC, Jefferson Lab, Fermilab, EIC, etc, GHP membership well over 500 should be easily attainable. Therefore, please circulate this newsletter to your colleagues and students working in hadron physics and explain the benefits of becoming a member of the GHP. Current APS members can add units online by following a link on the lower-right of the GHP web page http://www.aps.org/units/ghp/index.cfm.

The GHP is also the only Topical Group that currently has a Dissertation Award for outstanding students in hadron physics. We are one of the few Topical Groups that holds a biennial meeting, which is very well attended by the broad hadronic physics community. To ensure the significant impact of the GHP continues, it is therefore crucial that GHP membership increase significantly.

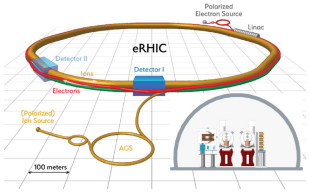
Unit membership is now \$10, of which the GHP receives \$5 from the APS. The remainder stays with the APS and covers the many services they provide. The APS has also provided additional support to the GHP, *e.g.*, the last five GHP meetings have been co-located with the APS April meeting which results in substantial savings. With this support we can be an active force for hadron physics. GHP membership fees are used to assist with expenses such as travel for the winner of the GHP Dissertation Award see Sec. 4; the organization of meetings such as GHP 2019, see Sec. 6 and the forthcoming GHP 2021; the preparation and publication of manuscripts that support and promote the GHPs activities; and participation in those fora that affect and decide the direction of basic research.

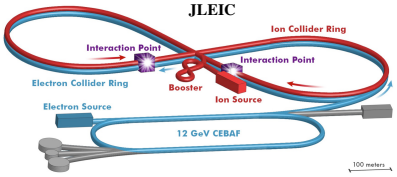
We have prepared a slide that GHP members can show in talks or post at conferences to promote the GHP and encourage colleagues to join. The slide, shown here, can be obtained from any member of the GHP Executive Committee.

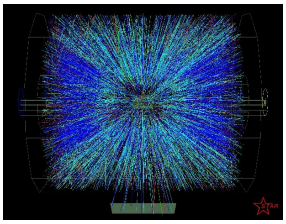
Benefits of GHP Membership



- The *Topical Group on Hadronic Physics (GHP)* is the dedicated organization that advocates for the science of QCD within the APS; and therefore to the broader physics community, funding agencies, and general public [www.aps.org/units/ghp/]
- Effectiveness of this advocacy and its impact is strongly coupled to the number of GHP members. Importantly, membership determines:
  - Number of APS Fellows the GHP can nominate — *250 members ≃ 1 APS Fellow per-year*
  - Number of invited parallel talks and our own sorting categories at the APS April Meeting
- Hadron Physics is a vibrant field, with upgrades at Jefferson Lab and RHIC, and the proposed $1.5 billion EIC — this growth should also be apparent in the GHP
  - GHP helps reward and highlight the world-class research in our field through, e.g., the GHP Dissertation award and APS Fellows — very important for hires, grants, and promotions
- Please consider joining the GHP — $10/yr with APS membership







If a Topical Group has a membership of 3% or more of the APS members, it can apply to become a Division. The Soft Matter Topical Group formed in 2015 and is currently at 3.5% of APS membership, which means it could soon transition to Division status, joining the 16 existing Divisions. The Nuclear Physics and Particles & Fields Divisions have most overlap with the GHP membership. There are currently thirteen Topical Groups, and of these the GHP is now one of the smallest, ranked 10th in terms of membership. Only Few Body Systems, Plasma Astrophysics, and Shock Compression are smaller. In terms of gender diversity, the GHP ranks 9th among the Topical Groups with 11.7% of members indicating "female" as their gender. About 4% of members declined to state a gender. For comparison, 20% of the Forum on Graduate Student Affairs (FGSA) are female, and the Groups on Medical Physics and Physics Education Research are both around 30% female.

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3 Fellowship

The GHP Fellowship Committee handling the nominations was:

	Fellowship Committee	
	Ian Cloët (*Chair*) icloet@anl.gov	
Cynthia Keppel keppel@jlab.org	Richad Milner milner@mit.edu	Jen-Chieh Peng jcpeng@illinois.edu

Each year the APS allocates a number of Fellowship Nominations to its units. The number of APS Fellows a Topical Group can nominate is determined by the APS based on the number of members of the group relative to the total APS membership. This meant that the GHP could nominate one Fellow this year www.aps.org/programs/honors/fellowships/allocations.cfm, which is down from two nominees in previous years. Note that the number of Fellows allotted by the APS for a given unit excludes student members and current Fellows from the member

count. This is a change in the method used in previous years. This new method of allotment, combined with the drop in GHP membership over recent years while APS membership has grown, led to the reduction of Fellows for GHP.

In 2019, Daniël Boer (University of Groningen) become an APS Fellow through the GHP, with the citation:

For contributions towards the understanding of the spin and momentum structure of quarks and gluons in nucleons, in particular those relevant in single spin asymmetries, and the studies of the color glass condensate phase in Quantum Chromodynamics.

Please join us in congratulating Daniël for this well deserved APS Fellowship.

The instructions for nomination may be found at
http://www.aps.org/programs/honors/fellowships/nominations.cfm
The entire process is now online.

The Executive urges members of GHP to nominate colleagues who have made advances in knowledge through original research and publication or made significant and innovative contributions in the application of physics to science and technology. They may also have made significant contributions to the teaching of physics or service and participation in the activities of the Society. We also note that maintaining a diversity in our Fellows can broaden the impact of the GHP.

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4 Dissertation Award Appeal

The GHP Dissertation Award was established in 2011 and is the only dissertation award from an APS Topical Group. The award is presented biennially "to recognize outstanding young scientists who have performed original research in the area of hadronic physics". The current endowment allows for a $1,000 stipend, a certificate, up to $1,500 in travel reimbursement, and a registration waiver to attend and give an invited talk at the biennial GHP meeting where the award is presented.

However, to meet the minimum requirement for a dissertation award stipend, set forth by the 2016 APS Prizes & Awards Committee Task Force Report, we need to raise the stipend to $1,500. Therefore, to maintain the current biennial award the GHP must raise $7,500 otherwise the GHP Dissertation Award is at risk.

To support the GHP Dissertation Award please consider making a donation to the award fund, either online by selecting "Dissertation Award in Hadronic Physics" at the APS donation page:

https://www.aps.org/memb-sec/donation/DonationFunds.cfm

or by a check payable to American Physical Society, which can be mailed to: APS Development Office, One Physics Ellipse, College Park, MD 20740. Please note "GHP Dissertation Award" in the memo field. For more information on making a donation please

reach out to Mariam Y. Mehter, APS Campaign and Donor Relations Manager at (301) 209-3639 or mehter@aps.org.

APS recognition for graduate research has many benefits to the recipients and our field, e.g., it significantly helping recipients to obtain positions at universities and in industry. As such, there is also a strong case to make the award annual, rather than biennial. To create an annual GHP Dissertation Award with a $1,500 stipend the GHP needs an award fund with an endowment of $45,000. With the current endowment this means raising an additional $30,000 which would then allow the GHP to give a dissertation award annually, in perpetuity.

Since its inception there have been many outstanding candidates, however we have only been able to grant three GHP Dissertation Awards. Our previous winners are all pursuing outstanding careers in physics: Jin Huang (2013) did his thesis work at MIT on E06-010 at Jefferson Lab, was a postdoc at Los Alamos National Laboratory, and is now an Associate Physicist at BNL; Daniel Pitonyak (2015) did his thesis work at Temple University, and held postdoc positions at BNL and Penn State Berks before becoming an Assistant Professor at Lebanon Valley College; and Phiala Shanahan (2017) did her thesis work at The University of Adelaide, then did a postdoc at MIT before accepting a joint position at the College of William & Mary and Jefferson Lab, and in 2018 became an Assistant Professor of Physics at MIT.

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5 GHP Program at the APS April Meeting, 2020

Washington D.C.
18-21 April 2020
http://www.aps.org/meetings/april/

GHP participates in the annual APS April Meeting, which is also the primary meeting of the unit in even years. Roughly 100 of our members attend the APS April meeting each year.

GHP is allocated two invited sessions at the April meetings. We often organize joint sessions with other units, in order to raise our profile by increasing the number of sessions sponsored by the GHP. (The maximum currently possible is four.)

The program committee for the 2020 APS April meeting is

GHP Program Committee

Garth Huber (*Chair*)
huberg@uregina.ca

Jake Bennet	Timothy Hobbs	Anne Sickles
gvbennet@olemiss.edu	tjhobbs@mail.smu.edu	sickles@illinois.edu

If you are planning to attend the April 2020 meeting, we ask that you consider using one of the Hadronic Physics (GHP) Sorting Categories:

E01 Hadronic Physics: General

E02 Light Mesons and Baryons

E03 Heavy Flavor Hadrons

E04 Exotic Hadrons

E05 Nucleon structure and nucleon spin

E06 QCD Effects in Medium

E07 Mini-symposium: Science Opportunities enabled by the Electron-Ion Collider

Using these categories increases the share of April 2020 registration income coming to GHP, which we can use for the benefit of the GHP Biennial meeting in Sacramento, CA in April 2021.

Program: There will be one GHP invited session, and two jointly co-organized invited sessions with DNP. The invited session topics are:

- Exotic Hadrons (GHP)
  Ths session covers the recent announcements on tetraquarks and pentaquarks from both theoretical and experimental perspectives.
- Electron-Ion Collider Science Program (GHP-DNP)
  This session will highlight the major pillars of the EIC nuclear physics case and cover instrumentation challenges and opportunities to make the associated measurements.
- Hadron Formation in Nuclear Media (GHP-DNP)
  This session will review our current understanding of the hadronic spectrum in vacuum and in hot QCD media.

Mini-Symposium:
The invited session on the EIC Science Program complements a GHP Mini-Symposium that we are also organizing. The EIC Mini-Symposium consists of an invited overview talk, followed by contributed talks. You are invited to submit a talk for this Mini-Symposium. Please be sure to use the GHP sorting category "E07. Mini-symposium: Science Opportunities enabled by the Electron-Ion Collider" so that we can be sure your talk is assigned the correct session.

The meeting will be held at the Washington Marriott Wardman Park Hotel, the same location as the 2017 April meeting as well as the 2017 GHP Workshop. We hope to see you in Washington, DC in April.

The Abstract Submission Deadline is:

10 January 2020, 17:00 EST

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6 GHP 2019 Summary

The biennial workshop of the GHP took place at the Sheraton Hotel in Denver, Colorado on April 10-12, immediately preceding the APS April Meeting. The workshop attendance was excellent, with 116 speakers giving presentations over the three days. We are grateful for the strong support for the workshop shown by GHP members. The program comprised a series of eighteen plenary talks highlighting the progress made in hadronic physics over the preceding two years, together with invited and contributed parallel talks expounding in greater detail the key developments. Whilst the workshop is primarily the coming together of the US hadronic physics community, three of the plenary speakers were from non-US institutions, with more contributing to the parallel sessions.

An important aim of the workshop was to emphasize the excitement and relevance of hadronic physics across a broad portfolio of physics activities. Several of the plenary talks focused on the phase structure of QCD, and the evolution to hadronic degrees of freedom. James Nagle discussed the interpretation of the quark-gluon plasma as a perfect fluid, and the detailed evolution of its properties in heavy-ion collisions. Abhijit Majumder studied the role of jets in probing the structure of the plasma, and the progress at constructing picture of fragmentation from that of an isolated jet to in-medium evolution. The beam-energy scan is a flagship part of the RHIC program, and the progress at developing a theoretical framework to describe it was provided by Bjoern Schenke. Finally, the role of ultra-peripheral collisions in nuclear scattering both at the LHC and at RHIC was presented by Peter Steinberg.

The study of the structure of the nucleon was the topic of several talks. Carl Carlson reviewed the status of our understanding of the charge radius of the proton, prefacing a talk about the PRAD experiment later in the workshop. The first determination of the pressure distribution inside the nucleon was presented by Volker Burkert, expanding on the work in his recent Nature article. Huey-Wen Lin showed the theoretical and computational advances in understanding the structure of hadrons through in lattice QCD where the Bjorken-x dependent distributions can now be obtained through ab initio calculation. Finally, in anticipation of a future Electron-Ion Collider, Yoshitaka Hatta described the exciting physics opportunities it would facilitate in revealing the "glue that binds us all".

Spectroscopy plays a key role in illuminating the degrees of freedom of QCD in the strong-coupling regime. Sean Dobbs describe the search for light exotics, a key component of the 12 GeV upgrade of Jefferson Lab. Johan Messchendorp showed the progress at understanding the spectrum of charmonium and of the heavier quarks, a topic that reignited the worldwide interest in the excited spectrum of QCD. A theoretical description of the spectrum was provided in the talk of Richard Williams, who reviewed the Schwinger-Dyson approach to the study of QCD, and its wide range of application from the phase structure of QCD, through the spectrum, to the structure of nucleon and pion, thereby providing insights on the emergence of mass.

The importance of the hadronic-physics program to our understanding of the Standard Model of high-energy and nuclear physics was demonstrated in two facets. Firstly, Igal Jaeglé described the search for dark matter particles in world-wide intensity-frontier experiments. Secondly, Jorge Morfin presented the challenges in neutrino-nuclear scattering, a quantitative understanding of which is essential for the interpretation of upcoming neutrino-oscillation experiments such as DUNE, but which can also provide a further window on the internal structure of the nucleon.

The organizational meeting of the GHP was held the first evening. After a welcome, Tim Hallman and Bogdan Mihaila presented reports from the DOE and NSF, respectively, including science highlights across their respective portfolios. The view from the labs was represented by Berndt Muller of BNL, and Bob Mckeown of Jefferson Lab, who presented the physics highlights, including the latest results from the 12 GeV upgrade of JLab and of the Beam-Energy Scan at RHIC. Both speakers emphasized the opportunities presented by the future Electron-Ion Collider. The meeting then moved to discuss the status of the GHP, emphasizing in particular the need to increase membership, with the consequent implications for APS Fellowships. Finally, the business meeting adjourned with presentations to recipients of awards, previewing the Prize Session.

The Prize Session concluded the workshop. The 2017 and 2019 Bonner Prize winners, Charles Perdrisat and Barbara Jacak, presented talks on the electromagnetic form factors of the

nucleon, and on our understanding of the phase structure of QCD, respectively. Two of the three recent APS fellows sponsored by GHP, Moskov Amaryan and Oscar Rondon-Aramayo, presented talks on the opportunities for strange-hadron spectroscopy and on our understanding of quark-gluon correlations in nucleons; Kawtar Hafidi, the remaining recipient, was unable to attend owing to a prior commitment. Finally, Jacob Ethier, the GHP Dissertation Prize winner, described his work on colinear distributions from a global analysis of world data, illustrating the vibrant work of the rising generation of hadronic physicists.

The parallel program comprised invited and contributed talks arranged into topical sessions. Due to the excellent attendance, it was necessary to have four streams of parallel talks.

Two parallel sessions were devoted to parton distribution functions (PDFs). The first session was focused on pseudoscalar mesons, including how their properties are crucial to the origin of mass through Dynamical Chiral Symmetry Breaking (DCSB), and the recent calculations of pion structure from Lattice QCD. The second session was very heavily attended, and included discussions of quantum entanglement effects at small x_B, how global analyses of HEP data and Lattice QCD are enabling hadronic physics to quickly become a precision field, with the prospect of detailed tomographic images of hadron structure, as well as new models of PDFs from a light-front parton gas model, and using Minkowski-space 4D dynamics.

The work of the Joint Physics Analysis Center (JPAC), dedicated to phenomenology and to the development of data-analysis tools for experimental data from JLab and worldwide facilities, was highlighted in two sessions The first session dealt with JPAC's role in spectroscopy analysis to find the signatures of new, unusual light resonances, through such channels as single and double meson photo production, and inclusive/exclusive meson electroproduction. The second session covered the analysis of three-body decays of mesons with higher mass or spin, and the determination of the lightest hybrid meson candidate.

There were two sessions devoted to the proposed Electron Ion Collider (EIC). One session was dedicated to the future science program, including GPD and TMD studies, light and heavy quark spectroscopy, and low x_B gluon saturation. The other concentrated on the eRHIC and JLEIC planned accelerator characteristics, and to considerations for the interaction-region design to enable the planned physics studies.

Relativistic Heavy Ions were covered in four sessions: RHIC Beam Energy Scans, Ultra-Peripheral Collisions, Small Systems, and Jet Physics. Ultra-Peripheral Collisions can be used to probe nuclear parton distributions, and both STAR and CMS have active programs. These were covered from both the experimental and theoretical viewpoint. The aim of the RHIC Beam Energy Scan program is to identify the QCD critical point. In addition to an experimental overview, theoretical predictions from Lattice QCD and hydrodynamics were presented. The session on small systems dealt with the smallest droplets of QCD fluids, the theoretical progress in describing small collision systems (both dilute and dense) and the role of flow. The session on Jet Physics included the Landau-Pomeranchuk-Migdal effect, where the energy spectrum of photons caused by the propagation of relativistic charges in the nuclear medium is suppressed due to coherence effects, jet and dijet production in heavy-ion collisions, and recent measurements and theoretical studies of jets from nuclear matter.

The parallel session on Nuclear and Heavy Ion gave an overview of recent results from both Jefferson Lab and RHIC. These included the recent color transparency studies from the $A(e, e'p)$ reaction in Hall C and Λ-Hyperon fragmentation results from CLAS, π^0-hadron correlation studies with PHENIX, and the collective excitations in the QGP. Finally, to round out the session, ongoing X-ray spectroscopy experiments at DAFNE (SIDDHARTA2) and J-PARC(E57) studying kaonic atoms to probe the strong interaction with strangeness in

kaonic atoms was discussed.

The session on Nuclear PDFs attacked the issue from a variety of angles, including: the use of LHC nuclear scattering data to constrain nCTEQ PDF determinations, inelasticity data from high-energy neutrino reactions measured with IceCube, theoretical studies of nuclear PDFs using neural networks, and the role of Pomeron exchange and other QCD effects in diffractive deep inelastic scattering from nuclei.

Two sessions were dedicated to GPDs and TMDs, and one to the burgeoning field of 3D Imaging (tomography) of nucleons. In the first GPD session, DVCS was discussed from both an experimental and theoretical perspective, including the role of lepton azimuthal angular distribution data from the Drell-Yan process to provide data complementary from deep inelastic scattering. and the role of pseudoscalar meson electroproduction to constrain chiral-odd GPDs. The second session dealt with gluon TMDs from quarkonium production in proton collisions, a survey of the GPD program at COMPASS, and unique backward-angle meson electroproduction data from JLab that enable access to Transition Distribution Amplitudes. In the session on 3D Imaging, the results of a novel analysis to extract the pressure and force distribution within hadrons via DVCS beam-spin asymmetry data at JLab was presented, as well as how deeply virtual exclusive measurements can constrain the equation of state of neutron stars. Theoretical progress on the modeling of Wigner functions, and plans towards developing a full 3D picture of nucleons using theory, computation and experimental data from JLab, a future EIC, and facilities worldwide, were also presented.

A single session was devoted to Quark-Gluon Correlations, whose motivation is to gain a better understanding of transverse degrees of freedom in nucleon spin. New dihadron channel results from CLAS, and single spin asymmetry results from Hall C of JLab were presented, along with theoretical studies of transverse force tomography and Twist-3 GPDs.

Production and Decays of hadrons was a very active topic, with four dedicated parallel sessions. The first session profiled results on hexaquarks, dibaryons and other developments from the Mainz-A2 Collaboration. Constraints on the poorly-known $\Lambda - n$ interaction via studies of Λnn resonances at Jefferson Lab were also presented. The second session focused on recent partial-wave-analysis (PWA) fits with the aims of constraining the strange and non-strange baryon spectrum, resolving the missing resonances problems in the N^* spectrum via η production data, and describing the hidden charm sector via e^+e^- and proton-antiproton annhilation data. The third session was more wide ranging, including recent results in hadron spectroscopy from B decays at Belle-I, II and BES-III, fracture functions from Λ leptoproduction at JLab, and a new global analysis of exclusive meson photo- and electroproduction data from JLab, ELSA (Bonn), and MAMI (Mainz). Finally, the fourth session was more theoretical, including studies of transition form factors in light-front dynamics, doubly radiative η and η' decays, and the role of 3-body dynamics in Lattice QCD.

Two sessions were devoted to Nucleon Structure and Hadron Form Factors. The nucleon structure session was particularly well attended, with new proton-radius results from the PRad experiment at JLab, as well as preliminary deep inelastic scattering results on ^{1}H and ^{12}C from Hall C and a summary of the tritium experiments in Hall A of JLab. In the session on form factors, new results on the proton magnetic form factor G_M^p from JLab were presented, along with ongoing work to model the pion electroproduction reaction, needed for the extraction of the pion form factor from these data at intermediate Q^2.

The topical sessions were arranged to emphasize the role of theory, experiment and computation together in constructing a faithful picture of hadronic physics. In particular, the parallel sessions included the important developments in lattice descriptions of the

excited-state spectrum, hadron structure, and the phase structure of QCD, and in the importance of factorization in constructing a self-consistent picture. QCD-based pictures of hadrons and of the quark-gluon plasma were emphasized in talks on Schwinger-Dyson approaches. One session was devoted purely to theoretical approaches. A description of a possible mechanism of confinement was presented, and applied to a SU(2) theory. The power of light-front holography in describing hadronic properties was reviewed, and a new interpretation of hadron structure in terms of quantum entanglement was presented. Finally, an n-particle effective field theory approach to QCD was described.

Many participants stayed on for the APS April Meeting, where there were three sponsored or jointly sponsored invited sessions with the DCOMP and DNP, as well as numerous contributed sessions.

The GHP program committee members were:

- Abhay Deshpande (Stony Brook University)
- Tanja Horn (Catholic University of America)
- Garth Huber (University of Regina) - co-Chair
- Spencer Klein (Lawrence Berkeley National Lab)
- Swagato Mukherjee (Brookhaven National Lab)
- Paul Reimer (Argonne National Lab)
- David Richards (Jefferson Lab) - co-Chair
- Susan Schadmand (Forschungszentrum Juelich)
- Anne Sickles (University of Illinois at Urbana-Champaign)
- Ramona Vogt (Lawrence Livermore National Lab and UC Davis)

We thank all the committee members for putting together a wonderful program, and we hope for a similarly successful program at the next GHP workshop in 2021 in Sacramento. Copies of the slides from all presentations are available from https://www.jlab.org/indico/event/282/other-view?view=nicecompact.

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7 Other News from APS

7.1 APS Joins Phase III of SCOAP^3 from 2020

(Condensed from APS News)

APS has committed to joining Phase III of the Sponsoring Consortium for Open Access Publishing in Particle Physics (SCOAP^3), facilitating large-scale open access publishing of high energy physics (HEP) research. SCOAP^3 is managed CERN and pools journal subscription fees for high-energy physics papers, compensating publishers to make articles open access at no cost to authors. In order to qualify for publication under SCOAP^3, articles appearing in one of the three participating APS journals (Physical Review C, Physical Review D and Physical Review Letters) have to posted on arXiv under one of the four HEP categories (theory - TH, lattice - LAT, phenomenology - PH, and experiment EX) at the time of publication.

SCOAP^3 was first launched in 2014 and APS joined in January 2018. So far, more than 4,400 HEP articles have been published in APS journals through the initiative. The new agreement extends the APS commitment to SCOAP^3 for another three years, 2020-2022. Thus all HEP papers published in the participating APS journals will continue to be made available open access with a CC-BY license immediately on publication without no cost to the authors. To find out more about SCOAP^3, see scoap3.org.

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8 Meeting Summaries

NB. We would be pleased to receive summaries from GHP membership of meetings that they have organized or attended. Please send the summaries to the GHP Secretary-Treasurer.

8.1 INT Program 19-1b "Origins of Correlations in High Energy Collisions"

(Communicated by Adrian Dumitru (Adrian.Dumitru@baruch.cuny.edu), Constantin Loizides (constantin.loizides@cern.ch), Bjoern Schenke (bschenke@bnl.gov) and Soeren Schlichting (sschlichting@physik.uni-bielefelde))

The 4-week INT program "Origins of Correlations in High Energy Collisions" focused on the physical origins of multi-particle correlations in high energy collisions of hadrons and nuclei, as well as in electron-nucleus collisions. The focus was on the understanding of 2- and 4- particle correlations in collisions of protons with heavy nuclei (and other protons) at the Relativistic Heavy Ion Collider (RHIC) and the Large Hadron Collider (LHC), as well as on collisions of other very light nuclei with heavy nuclei at RHIC. The main question is whether the observed momentum anisotropies in multi-particle correlation observables are driven by final state interactions that are affected by the system's initial geometry, by intrinsic initial momentum correlations, or both. Furthermore, one week was dedicated primarily to the physics relevant to multi-particle correlations in electron-ion collisions, relevant for a future US Electron Ion Collider (EIC), and its relation to $p+p/A$ collisions.

The meeting brought together experimentalists and theorists from across the globe and got started with a three day workshop, which set the stage for a productive meeting. The environment at the INT, with a lot of free time for discussions, allowed for excellent communication between experimentalists and theorists. Theories and models for the initial and final state description of the small system collisions were presented and critically assessed, clarifying a lot of the details and revealing caveats.

In particular, details of the Color Glass Condensate calculations of elliptic anisotropies were discussed, including current and future developments to go beyond the eikonal approximation and to next-to-leading order. These calculations for p+p and p+A collisions also have strong overlap with those for electron-ion collisions, of which dijet production in DIS and its relation to the gluon Wigner distribution, and azimuthal correlations in inclusive dijet production and their relation to transverse momentum dependent parton distribution functions were discussed.

The final state picture, that usually involves hydrodynamic calculations to interpret the observed anisotropies as generated by the systems dynamic response to initial state geometry fluctuations, was also discussed in great detail. One central physics question is why hydrodynamics appears to work so well to describe azimuthal correlations in small systems.

Progress in characterizing universal features of the evolution towards hydrodynamics in terms of non-equilibrium attractors was presented as one way to explain the success of hydrodynamics. Furthermore, multiple talks and discussions addressed the early time non-equilibrium dynamics based on different implementations of kinetic transport. Since the final state interpretation requires a detailed understanding of the nuclear geometry, the role to nuclear structure physics in describing the initial state of small (and large) system collisions was also discussed.

Future possibilities were discussed intensively, especially those of experimental nature. Some discussions addressed lighter symmetric collision systems, such as O+O collisions at both RHIC and LHC, as well as ultra-peripheral $p + A$ and $A + A$ collisions, and how $e - A$ scattering will help to improve our understanding of small system nuclear collisions.

8.2 QCD Evolution 2019

(Communicated by Ian Cloët (icloet@anl.gov))

The ninth QCD Evolution workshop was held in the Physics Division at Argonne National Laboratory on 13–17 May 2019 www.phy.anl.gov/qcd2019. The QCD Evolution workshop series started in 2011 with a two-day workshop held at Jefferson Lab. This workshop addressed the theoretical underpinnings of generalized parton distributions (GPDs) and transverse momentum distributions (TMDs), with a particular focus on the QCD evolution of the non-collinear TMDs. Since this initial meeting the workshop has broadened its scope considerably and grown significantly, and is now widely recognized as a leading hadron physics meeting in the field of hadron tomography. This workshop plays a key role in continuing to develop the theoretical basis for the quark and gluon tomography of hadrons, which is critical to the success of the nucleon tomography program at Jefferson Lab in the 12 GeV era. The QCD Evolution workshop series also plays an important role in the continual development of the science case for an electron-ion collider (EIC), and is also of relevance to key experiments at the Relativistic Heavy Ion Collider, Fermilab, and the Large Hadron Collider.

The QCD Evolution 2019 workshop continued this tradition. The workshop had 56 participants almost all of whom gave a 30 min presentation. There were no parallel sessions. In addition to the talks there were lively discussion sessions at the end of each day, which were chaired by: Tue – Cédric Lorcé, Piet Mulders; Wed – Yuri Kovchegov, Andrea Signori; Thu – Simonetta Liuti, Asmita Mukherjee; and Fri – Ian Cloët. Further details of the agenda and copies of the talks can be found on the workshop web page given above.

On behalf of all the organizers we gratefully acknowledge significant support from JSA and Jefferson Lab, which was critical to be able to support early-career scientists and thereby help make this workshop a great success. This workshop contributed positively to the Jefferson Lab 12 GeV program and the science case for a U.S.-based EIC. There continues to be a strong need for workshops like this that can help refine and develop the science case associated with quark/gluon tomography, and articulate how the Jefferson Lab community can help deliver this science, both in the 12 GeV era and beyond with an EIC. The next QCD Evolution workshop will be held at UCLA on 27 April − 1 May 2020 https://conferences.pa.ucla.edu/qcd-evolution-2020/ and the 2021 QCD Evolution workshop will be held in May of that year at the University of Virginia.

8.3 Lattice 2019

(Communicated by David Richards (dgr@jlab.org))

The 37$^{\text{th}}$ annual symposium on lattice field theory, Lattice 2019, took place in Wuhan, China from June 16 to June 22, 2019, bringing together 350 lattice gauge theorists from across the globe working on problems in both nuclear and high-energy physics, together with participants from the fields of experimental physics and high-performance computing. The program comprised a series of invited plenary talks, together with contributed parallel sessions.

The tremendous advances in applying first-principles lattice calculations of QCD to our understanding of hadronic physics were important highlights of the meeting. The opening talk, by Robert Edwards of Jefferson Lab, presented the latest results for the hadron spectrum, where direct calculation of the properties of resonances are now attainable, with realistic calculations now being made and are having a direct impact on the experimental programs. A revolution in our ability to understand the structure of hadrons from QCD has taken place through the introduction of methods that provide information on the Bjorken-x dependent parton distribution functions and other measures of hadron structure from lattice calculations performed in Euclidean space. The theoretical idea that stimulated these advances, namely the Large Momentum Effective Theory (LaMET) introduced by Xiangdong Ji, were described by Yong Zhao, followed by review of calculations of parton distribution functions by Nikhil Karthik of BNL. Tanmoy Bhattacharya of LANL reviewed the status of calculations of nucleon charges and form factors, where precision lattice data are crucial across a range of questions in nuclear and high-energy physics, including the proton charge radius, the neutrino program, and searches for new physics beyond the standard model. Finally, as series of talks reviewed progress at understanding multi-hadron systems through first principles lattice calculation, where calculations have advanced from the study of the spectrum and binding of such states to the first attempts at calculating the structure of such states. In particular, Michael Wagman of MIT showed how phenomena such as the EMC effect, and the quark and gluon structure are now accessible to exploratory lattice calculations. Indeed, precision multi-hadron matrix elements lie at the core of searches for neutrinoless double-beta decay.

Lattice QCD calculations play a key role in understanding the phase structure of QCD, and of interpreting the experimental programs at RHIC and the LHC. The study of the QCD at finite density in particular is the subject of intense activity due to the presence of the sign problem. Owe Philipsen of Frankfurt reviewed the progress over the past year, including efforts to address the sign problem through calculations at imaginary chemical potential and at small baryon number, whilst Hiroshi Ohno outlined the study of the in-medium properties of heavy quarks, an important tool in understanding properties of the quark-gluon plasma.

An area of high-energy and nuclear physics where lattice QCD is having a particular impact on the corresponding experimental programs is that of the hadronic contributions to the muon $g-2$. The status of the $g-2$ experiment at FNAL was provided by Dikai Li, whilst the status of lattice calculations of both the light-by-light and hadronic-vacuum-polarization contributions was reviewed by Vera Guelpers of Edinburgh.

Following the tradition of the annual lattice meetings, there were several presentations focused on the high-profile activities of the local community, beginning with the Chinas efforts on supercomputing. Perhaps particularly pertinent to the GHP, there was a talk on the physics program and design for the Electron-Ion Collider in China (EicC), accompanied by Star-Wars-Inspired animations! Finally, the emerging areas of machine learning and quantum computing that will be crucial to the future evolution of the field were represented in both the plenary and parallel sessions.

The organization of the meeting was truly outstanding, with the plenary presentations on a large-screen display worthy of the Superbowl, and live streamed for those unable to attend. Recognizing the importance of training the emerging generation of lattice gauge theorists, the symposium was followed by a three-week summer school "Frontiers in Lattice QCD at Peking University in Beijing. For further information about Lattice 2019, the invited and contributed talks are available online at https://indico.cern.ch/event/764552/overview, and proceedings will be published through Proceedings of Science.

Lattice 2020 will take place in Bonn, Germany, from August 3 to August 8, 2020.

8.4 Initial Stages

(Communicated by Peter Steinberg (peter.steinberg@bnl.gov) and Raju Venugopalan (rajuv@bnl.gov))

The Initial Stages conferences arose out of the urgent need to understand the exciting new data emerging from both the LHC and RHIC in the early years of this decade that showed promise of revealing fundamental information on how quark-gluon matter thermalizes in ion-ion collision, and how this matter relates to the quark-gluon structure of hadron wave functions. Initial Stages has now become one of the major conference in heavy ion physics, addressing a constellation of topics not addressed by the other major meetings in the field. The 2019 edition took place at Columbia University from June 24-28, 2019, and was the 5th in series, after previous meetings in Spain, Napa, Portugal and Poland. Over 150 participants gathered just as the summer began, for four and a half days of talks and discussions.

After a first session with theoretical and experimental status reports on progress since the 2017 Initial Stages workshop, the conference proceeded essentially chronologically. We heard about several facets of our current knowledge of parton distribution functions (PDFs). This ranged from recent techniques for resummation at low-x in nucleon PDFs to the current understanding of how those PDFs are modified in nuclei, a major experimental focus of the upcoming electron-ion collider, and a review of saturation physics which proposes a general framework for the universal physics underlying parton distributions in both nuclei and hadrons. The use of lattice quantum chromodynamics was also presented in detail, in particular how lattice can be used to calculate the nucleons radial pressure distribution, following its experimental measurement at JLab. A following session on nucleon and nuclear imaging described theoretical approaches to understanding spatial aspects of hadron and nuclear structure such as transverse momentum dependent distributions (TMDs) and generalized parton distributions (GPDs). An outcome of these talks was a better appreciation of the strong emergent synergies between these topics which are a major focus of the DIS community and that of the initial stages of ion-ion collisions. We also heard an overview of JLab data on high-x parton structure, which too may be of importance in a deeper understanding large x physics (at high transverse momenta) in heavy-ion collisions.

While the parton distribution functions are an essential tool for calculating scattering rates of specific processes, they are only the first step toward understanding how these initial processes lead to the formation of the hot, dense matter formed in heavy ion collisions. We dedicated a full session covering aspects of the thermalization process. This started with our understanding using pure field theory, followed by how initial pre-equilibrium processes can be matched to usable initial conditions for hydrodynamic calculations, and finally on how many different kinds of non-equilibrium behavior tend toward attractors that appear to be intrinsic to hydrodynamics. The attractor concept appears to be an important generic feature, one

which might help explain the apparent ubiquity of hydrodynamics in so many different systems of such different size and time scales.

The important debate about the relevance of initial and final state correlations was the centerpiece of the conference, with talks covering the full range of experimental results flow phenomena in large and small systems, followed by theoretical discussions on the successes, and limitations, of both hydro and saturation approaches. Most critical to the discussion was how to push each physical picture to the limits of its applicability, and to propose experimental tests in upcoming runs of RHIC and the LHC, as well as at the EIC.

There is no question that hydrodynamics provides a good description of a wide range of experimental data in relatively large (nucleus-sized) regions, with relatively straightforward assumptions about the initial geometry and energy density. This means it captures the dominant low-frequency degrees of freedom, and the impact of local energy conservation, and some degree of hydrodynamization, if not thermalization. However, hydrodynamic calculations also allow the estimation of transport coefficients that characterize the shorter-wavelength, microscopic degrees of freedom that ideally should connect back to the fundamental quarks and gluons of Quantum Chromodynamics. There is substantial debate on exactly how to approach understanding the transport properties of the QGP, since there are theoretical tools which utilize very different limits. So called weakly-coupled approaches, which calculate the properties of the plasma using kinetic theory, have very wide use, but it is still an open question exactly how they connect to hydrodynamics. By contrast, strongly-coupled approaches, such as using the AdS/CFT correspondence to map the system onto a higher-dimensional gravity theory, has led to some very important predictions in a limit difficult to access using kinetic theory, but at the cost of using theories which only resemble QCD, and include unrealistic degrees of freedom.

While most discussions on the initial stages concentrate on the contributions from the interactions of quarks and gluons, more and more attention in recent days is considering the impact of the strong electromagnetic fields generated by the nuclei themselves, and the interactions of those fields with the developing system. The best-known example of this, the Chiral Magnetic Effect, postulates that a chiral imbalance in the quark-gluon plasma can lead to a force on the produced charges that is aligned with the circulating magnetic field generated by the ultra-relativistic nuclei. The initial excitement over the observation of charge-dependent azimuthal modulations, relative to the event plane, has been tempered by the realizations that it is a small effect in the presence of substantial background from collective hydrodynamic effects as well as mundane, if ubiquitous, effects such as local charge conservation. Despite this, some new effects have been observed, such as a net polarization of produced hyperons (e.g. the lambda baryon or anti-baryon with one each of up, down and strange quarks or anti quarks) related to the initial angular momentum of the system, which manifests as an overall net vorticity.

The electromagnetic fields of the nuclei can also induce strong interactions, if a slightly-off-shell photon fluctuates into a quark-anti quark pair. This is just one example of a broad class of ultraperipheral collisions which can occur when the nuclei pass by each other far enough that the strong interactions do not dominate. New results shown at the meeting found that these photonuclear events showed collective effects similar (but smaller) in magnitude to that seen in proton-proton and proton-lead collisions. This is perhaps the most exotic small system to be found to evince collective flow. Results from other small systems, such as high energy electron-positron annihilation from CERNs large electron-positron (LEP) collider and deep inelastic (highly virtual) photon-proton collisions from the HERA collider at DESY, were found to show no similar effects. These results were also produced using archival data from

both machines, demonstrating the lasting importance of ongoing data archival projects. Other HERA data, on diffractive J/psi production, was also shown at the conference and interpreted theoretically in terms of density fluctuations in the proton wave function. The same density fluctuations have been found to lead to a good description of experimental data when coupled to a hydrodynamic calculations.

Finally, a group of talks discussed how to use hard processes to probe the initial state. While in principle, jets are highly modified by the hot and dense matter and so are thought to be mainly sensitive to final-state effects. However, it was pointed out that the magnitude of the correlation of the jet direction with the event plane is quite sensitive to the amount of time required to establish the hydrodynamic evolution, i.e. the thermalization or hydrodyanmization time. Furthermore, jets from boosted objects like W bosons from top quark decays can be used to "delay" the production of the jets and thus to probe the medium at different times, giving access to the full time history.

Due to the importance of geometry for nearly every result in heavy ion physics, the work of Nobel Laureate Roy Glauber (1925-2018) has been of paramount importance to the heavy ion community since its inception. A tribute from Bill Zajc, of Columbia University, covered many aspects of his illustrious scientific career, as well as reminiscences of his encounters with our science.

The conference concluded with sessions pointing toward the future of understanding the initial stages of heavy ion collisions. Compelling physics opportunities exist at present-day scientific facilities, as well as ones planned for the near and far futures. In the near future, opportunities for forward physics are important parts of the planned programs for an upgraded STAR detector as well as a planned forward upgrade to the sPHENIX detector planned for the next phase of high-luminosity RHIC running. The upgraded sPHENIX detector, as well as a dedicated system, could be important for the EIC physics program. The EIC will in future be a critical tool to explore many aspects of the physics covered in this conference, from the spatial structure and imaging of nucleons and nuclei, to novel phenomena at low-x, and even to a more thorough understanding of the nucleon's mass and spin. All these issues will bear directly on the present and future heavy ion physics program. Finally, interest has been building for two possible future machines at CERN (LHeC and FCC-eh) colliding electrons with hadrons and ions to push the study of nucleon and nuclear structure well into the saturation regime. These future machines are sure to complement the EIC and carry the physics of the initial stages into the decades ahead.

Initial Stages 2019 turned out to be very enjoyable for the speakers as well as the participants, with a large and diverse group of young scientists (undergrad to postdoc). This was no accident, as the IS2019 organization was planned with diversity and inclusion as guiding principles every step of the way. As an example, the simplest principle for speaker selection had the clearest positive effect: if we had several candidates of equal reputation, we always invited women. This led to having more women in both theory and experiment than is typical of large international science meetings. Because of this, everyone attending felt that this made a more dynamic scientific environment that encouraged more discussion and questions, especially from younger people. Nevertheless we felt we could have done better and would be glad to communicate our experience and suggestions for further progress on what we feel should be an essential component of future conferences and workshops.

The presentations may be found at the website https://indico.bnl.gov/event/5391/. The next meeting in the series will be held in January 2021 in Rehovot, Israel (organzed by the Weizmann Institute), see https://www.instagram.com/p/BzQiEiaHWkn/.

8.5 LIGHT CONE 2019 – QCD on the light cone: from hadrons to heavy ions

(Communicated by Cèdric Lorcè (cedric.lorce@polytechnique.edu) and Chueng Ji (crji@ncsu.edu))

The LIGHT CONE 2019 conference belongs to the series of Light Cone meetings established under the auspices of the International Light Cone Advisory Committee (ILCAC), Inc. (http://www.ilcacinc.org). Like the previous editions, the 2019 meeting followed the objectives of ILCAC, Inc.: "to advance research in quantum field theory, particularly light-cone quantization methods to the solution of physical problems, and "to assist in the development of crucial experimental tests at hadron facilities.

The 2019 edition of the Light Cone conference took place on the campus of Ecole Polytechnique, Palaiseau, France, from 16-20 September. A detailed description of all aspects of the conference can be found on the webpage https://indico.cern.ch/event/734913. In particular, the scientific program, timetable and talks can be found at https://indico.cern.ch/event/734913/timetable/#20190916, and the names of all members of the international advisory committee and the local organizing committee can be found at https://indico.cern.ch/event/734913/page/17550-poster.

The conference was supported in part by generous funding from the Jefferson Science Associates (JSA) and Jefferson Laboratory, Institut Polytechnique de Paris, Université Paris-Saclay, CEA-IRFU, Institut de Physique Nucléaire dOrsay, CNRS, P2IO, and GDR QCD. The financial support by JSA and Jefferson Lab contributed to the McCartor Award granted to three young physicists: Dr. Fatma Aslan, who just graduated from New Mexico State University (USA); Meijian Li, a Ph.D. student at Iowa State University (USA); and Dr. Tianbo Liu, a young post-doctoral fellow at Jefferson Lab (USA). The award allowed them to attend the conference and to present the results of their research. It has been granted based on their Curriculum Vitae and also their more recent works on "Singularities in Twist-3 Quark Distributions", "Form factors and generalized parton distributions of heavy quarkonia in basis light front quantization", and "Nonperturbative strange-quark sea from lattice QCD, light-front holography, and meson-baryon fluctuation models", respectively. The funding from Université Paris-Saclay consisted in Light Cone Paris-Saclay Awards granted to seven Ph.D. students: Nisha Dhiman, Dr. B. R. Ambedkar National Institute of Technology Jalandhar (India); Daniel Guttierez-Reyes, Universidad Complutense de Madrid (Spain); Raj Kishore, Indian Institute of Technology Bombay (India); Christopher Leon, Florida International University (USA); Padval Siddhesh, University of Mumbai (India); Frank Vera, Florida International University (USA); and Andrea Vioque-Rodrguez, Universidad Complutense de Madrid (Spain). These awards covered the registration fees and accommodation, and were granted by the local organizing committee. The rest of the contributions from the various funding agencies was used to reduce as much as possible the registration fees of the other students and postdocs.

The LIGHT CONE 2019 conference gathered 111 registered participants, including 48 students and young scientists, and 13 women scientists. The program included 15 plenary sessions (for a total of 20 invited talks + 14 contributed talks) and 17 parallel sessions (for a total of 60 contributed talks). Young scientists delivered 20.5% of the plenary talks and 50% of the parallel talks. The conference was also attended by researchers from Ecole Polytechnique, Universit Clermont-Auvergne, CEA-IRFU, IPN Orsay, The George Washington University, Kyungpook National University, University of Groningen, VN Karazin National University, Universidad de Valparaiso, Universit degli Studi di Pavia, and Universit degli Studi di Trento.

The topics of the scientific program were organized in the following categories:

- Hadronic structure
- Small-x physics and heavy ions
- QCD at finite temperature
- Few- and many-body physics
- Chiral symmetry
- Quarkonia
- Field theories in the front form
- Lattice field theory
- Effective field theories
- Phenomenological models
- Present and future facilities

The conference addressed new frontiers and challenges in QCD, both in experiment and in theory, with emphasis on the small-x and heavy ions aspects. Most recent methods in light-front physics were presented, for example in the talks of James Vary (Iowa State University, USA, Hadronic Properties from Basis Light Front Quantization), Matthew Walters (CERN, Matching between equal-time and light-front quantization in non-perturbative calculations) and Wayne Polyzou (University of Iowa, USA, Light front quantum mechanics and quantum field theory).

Hadron structure was discussed in the talks by Pawel Sznajder (National Centre for Nuclear Research, Poland, Overview of GPDs), Oleg Teryaev (Joint Institute for Nuclear Research, Russia, Energy-Momentum Tensor and Light Cone), and Miguel Echevarria (INFN Pavia, Italy, Overview of TMDs).

Lattice field theory and lattice QCD results were discussed by Fernanda Steffens (DESY, Germany, PDFs on the Lattice) and Savvas Zafeiropoulos (Universität Heidelberg, Germany, Parton-pseudo distribution functions from Lattice QCD).

Relativistic Heavy-Ion Collisions were discussed in the talks by Franois Gelis (CEA, France, Early stages of heavy-ion collisions) and Maxime Guilbaud (CERN, Can we create quark-gluon plasma in small colliding systems?).

QCD at finite temperature and chiral symmetry were discussed in the talks by Urko Reinosa (Ecole Polytechnique, France, QCD at finite temperature and density from the Curci-Ferrari model) and Julien Serreau (Universit Paris-Diderot, France, The massive gluon and the massless pion).

Small-x and jet physics were discussed in the talks by Tolga Altinoluk (National Centre for Nuclear Research, Poland, Overview of small-x physics and TMDs) and Gregory Soyez (CEA, France, Overview of jet physics).

A number of talks were presented on the light-front holography, for example by Ruben Sandapen (Acadia University, Canada, An overview of light-front holography) and Stan Brodsky (SLAC, USA, Color Confinement and Supersymmetric Properties of Hadron Physics from Light-Front Holography).

The present experimental status and future plans were highlighted in the talks by Barbara Trzeciak (Utrecht University, The Netherlands, Review on heavy-ions@LHC and RHIC), Michael Winn (Universit Paris-Saclay, France, Small system physics and EIC), Radek Zlebcik (DESY, Germany, Overview of low-x experiments), and Umberto Tamponi (INFN Torino, Italy, Exotic and Conventional Quarkonium Physics Prospects at Belle II).

In the closing session, the McCartor awardees presented their work: Fatma Aslan (New Mexico State University, USA, Singularities in Twist-3 Quark Distributions), Meijian Li (Iowa State University, USA, Frame dependence of transition form factors in light-front dynamics), and Tianbio Liu (Jefferson Lab, USA, Parton distributions from light-front holographic QCD).

A special session dedicated to the issue of zero modes in light-front field theories was held on Friday afternoon and included the contributions of Matthias Burkardt (New Mexico State University, USA, Much ado about nothing - an introduction to the LF vacuum), Philip Mannheim (University of Connecticut, USA, Structure of light front vacuum sector), Peter Lowdon (Ecole Polytechnique, France, Non-perturbative aspects of light-front quantisation), and Daya Kulsheshtha (University of Delhi, USA, Role of Light-Front Zero Modes in String Theory).

A half-day was left free for discovering some of the beauties of Paris followed by the conference dinner in the iconic French restaurant "Le Train Bleu" inside the train station "Paris Gare de Lyon", where the Gary McCartor award ceremony was held. Chueng Ji, ILCAC Chair, together with Cédric Lorc´, LIGHT CONE 2019 chair, presented the awards to this years three McCartor Award recipients. James Vary, member of the ILCAC Board of Directors, gave a short address about the history and objectives of the McCartor Fellowships awards.

The proceedings of the conference will be refereed and published in Proceedings of Science.

8.6 POETIC 9

(Communicated by Feng Yuan (fyuan@lbl.gov) and Ernst Sichtermann (epsichtermann@lbl.gov))

The ninth edition of the "Physics Opportunities at an Electron Ion Collider" conference (POETIC 9) was hold at Lawrence Berkeley National Laboratory from September 19 to 21, 2019. It was preceded by a meeting of the "Topical Collaboration for the Coordinated Theoretical Approach to Transverse Momentum Dependent Hadron Structure in QCD" (TMD Collaboration).

The POETIC 9 workshop attracted 80 participants from all over the world. The opening session featured presentations by Gordon Baym of UIUC, who recently co-chaired the National Academies consensus assessment of US-based Electron-Ion Collider (EIC) science, Xiangdong Ji of the University of Maryland and Shanghai JiaoTong University, who discussed highlights of EIC physics, and Martha Constantinou of Temple University, who discussed recent lattice QCD advances and their relationship to EIC. The summary talk was give by Werner Vogelsang of Tübingen University.

The POETIC conference series has traditionally emphasized theoretical and phenomenological developments related to Electron-Ion Collider physics worldwide. POETIC 9 was no exception. It also included presentations making connections to future Drell-Yan and neutrino scattering opportunities and new pioneering work including presentations on the application of quantum computation to QCD parton physics and a quantum entanglement interpretation of high energy experiments.

All talks generated strong interest from and lively discussion among the participants. While it is impossible to give a complete summary here, the central themes involved: (1) nucleon/nucleus tomography; (2) lattice QCD progress; (3) small-x physics; and (4) jet physics.

Nucleon/nucleus tomography has been a central pillar of the EIC science case. It has gained tremendous momentum in the last few years. Andreas Metz gave a detailed overview of recent progress towards accessing the quark/gluon Wigner distributions in hard processes at the EIC, whereas Bjorn Schenke emphasized the small-x perspective for the EIC. Other presentations discussed recent developments and future directions with Transverse Momentum Dependent distributions and Generalized Parton Distributions.

Lattice QCD was one of the highlights during POETIC 9. Sergey Syritsyn gave a broad summary of recent developments to compute fundamental properties of the nucleon from first principles. These developments have been made possible thanks to computational advances and theoretical breakthroughs, including proposals to compute parton distributions directly from lattice QCD. These developments have gained traction in the wider community and were discussed extensively during the workshop. At the same time, it was recognized that enormous challenges remain for future applications.

Several presentations focused on recent theoretical developments in small-x physics and, in particular, nucleon spin structure. Yuri Kovchegov and Yoshitaka Hatta reported their recent results based on different versions of small-x resummation techniques and stimulated scientific debate among the participants on the small-x evolution of parton helicity and orbital angular momentum.

Jet probes have recently attracted renewed attention in the context of EIC. A number of presentations focused on jet related observables and discussed their potential impact on EIC physics objectives. This included interest from the high-energy collider community and from the heavy-ion physics community, and was one of the highlights of POETIC 9.

The POETIC 9 organizing committee was co-chaired by Feng Yuan and Ernst Sichtermann. The conference received generous support from Brookhaven National Laboratory, the Center for Frontiers in Nuclear Science at Stony Brook University, Jefferson Lab, and Lawrence Berkeley National Laboratory.

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9 Forthcoming Hadron Physics Meetings

Meetings of interest to GHP's membership are listed at Mark Manley's page: http://cnr2.kent.edu/ manley/BRAGmeetings.html. In this connection, if there is a meeting you feel should be included, please send the appropriate information to Mark Manley (manley@kent.edu).

The following list is based on Mark's page:

- IOP Workshop on Exotic Hadron Spectroscopy (York, UK, 12-13 December 2019) https://events.iop.org/exotic-hardon-spectroscopy-2019
- QEIC: International Workshop on QCD with Electron-Ion Collider (Bombay, India, 4-7 January 2020) https://indico.cern.ch/event/797767/
- FNHP2020: International School on Frontiers in Nuclear and Hadronic Physics (Florence, Italy, 24 February - 6 March 2020) http://www.ggi.infn.it/showevent.pl?id=341

- WWND: Winter Workshop on Nuclear Dynamics (Puerto Vallarta, Mexico, 1-7 March 2020) https://indico.cern.ch/event/841247/
- DIS2020: XXVIII International Workshop on Deep Inelastic Scattering and Related Subjects (Brooklyn, NY, USA, 23-27 March 2020) https://www.stonybrook.edu/cfns/dis2020/
- QCD Evolution Workshop 2020 (Los Angeles, CA, USA, 27 April - 1 May 2020) https://conferences.pa.ucla.edu/qcd-evolution-2020/
- Origin of the Visible Universe: Unraveling the Proton Mass (INT Workshop INT-20-77W, Seattle, WA, USA, 4-8 May 2020) http://www.int.washington.edu/PROGRAMS/20-77W/
- Chirality and Criticality: Novel Phenomena in Heavy-Ion Collisions (INT Program INT-20-1c, Seattle, WA, USA, 11 May - 5 June 2020) http://www.int.washington.edu/PROGRAMS/20-1c/
- CHARM 2020: 10^{th} International Workshop on Charm Physics (Mexico City, Mexico, 18-22 May 2020) https://indico.nucleares.unam.mx/event/1488/
- Transversity 2020: 6^{th} International Conference on Transverse Polarization Phenomena in Hard Processes (Pavia, Italy, 25-29 May 2020) https://agenda.infn.it/event/19219/
- Hard Probes 2020: 10^{th} International Conference on Hard and Electromagnetic Probes of High-Energy Nuclear Collisions (Austin, TX, USA, 31 May - 5 June 2020) https://indico.cern.ch/event/751767/
- Tomography of light nuclei at an EIC (ECT*, Trento, Italy, 15-19 June 2020)
- Hadronic Parity Nonconservation II (INT Workshop INT-19-76W, Seattle, WA, USA, 8-10 July 2020) http://www.int.washington.edu/PROGRAMS/19-76W/
- Bad Honnef Physics School: Methods of effective field theory and lattice field theory (Bad Honnef, Germany, 24 July - 2 August 2020)https://www.dpg-physik.de/veranstaltungen/2020/methods-of-effective-field-theory-and-lattice-field-theory
- Conf XIV: The XIVth Quark confinement and the Hadron spectrum conference (Stavanger, Norway, 27 July - 1 August 2020) https://ux.uis.no/confxiv/
- ICHEP 2020: 40^{th} International Conference on High Energy Physics (Prague, Czech Republic, 30 July - 5 August 2020) http://ichep2020.org/
- Lattice 2020: The 38^{th} International Symposium on Lattice Field Theory (Bonn, Germany, 3-8 August 2020) https://indico.hiskp.uni-bonn.de/event/1/
- PANIC2020: 22^{nd} International Conference on Particles and Nuclei (Lisbon, Portugal, 31 August - 4 September 2020) https://indico.lip.pt/event/592/
- QWG 2020: 14^{th} International Workshop on Heavy Quarkonium (Davis, CA, USA, 14-18 September 2020) https://indico.cern.ch/event/838970/overview
- Spin 2020: 24th Int. Spin Symposium (Matsue, Japan, 21-25 September 2020) http://spin2020.riken.jp/
- Baryons 2020: International Conference on the Structure of Baryons (Seville, Spain, 22-25 September, 2020) https://www.upo.es/baryons2020/

- Gordon Research Conference on Photonuclear Reactions: Frontiers in Nuclear and Hadronic Physics (Holderness, NH, USA, 9-14 August 2020) https://www.grc.org/photonuclea r-reactions-conference/2020/
- Lepton-Photon 2021: XXX International Symposium on Lepton-Photon Interactions at High Energies (Manchester, UK, 9-14 August 2021) https://www.leptonphoton2021.org/
- QNP 2021: Quarks and Nucleon Physics (Bonn, Germany, 20-24 September 2021)

GHP members might also be interested in other conferences and workshops listed at the following sites:

- ECT* ... www.ectstar.eu
- INT ... www.int.washington.edu/PROGRAMS/programs_all.html
- JLab ... www.jlab.org/conferences
- NuPECC ... http://www.nupecc.org/index.php?display=events

This GHP Newsletter was edited by Ramona Vogt for the Executive Committee.