

Executive Officers

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NB. EMail addressed to ghpexec@anl.gov will reach all members of the Executive.

Join GHP by following a link on the lower-right of our web page; namely, from:
<http://www.aps.org/units/ghp/>.

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1 Elections

Elections for two posts in the GHP Executive (Vice-Chair, Secretary/Treasurer, Member-at-Large) closed on 10 December 2016. Of the 489 eligible voters, 38.9% of GHP members voted. The new Executive Committee is listed at the top of this newsletter: we are pleased to welcome David Richard (Vice-Chair) and Xiaochao Zheng (Member-at-Large).

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,*

Raju Venugopalan (raju@bnl.gov)

this year; and shall include four members in addition to its Chair, one of whom shall be appointed by the APS.

We urge GHP members now to begin considering whom they would like to see filling the two open positions in 2017 and encourage members with ideas to contact the *Chair of the Nominating Committee* and pass on their suggestions. There is strength in diversity and so the Executive would like to see nominations from across the entire spectrum of GHP’s membership.

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.

2 Membership

At the beginning of 2017, the APS Unit Membership Statistics list GHP with 476 members, which represents 0.88% of APS membership. This represents a loss of 12 members since January 2016. If a Topical Group has a membership of 3% or more of the APS members, it can apply to become a Division. The “Gravitation” and “Quantum Information” Topical Groups transitioned to Division status within the last year, joining the 14 existing Divisions.

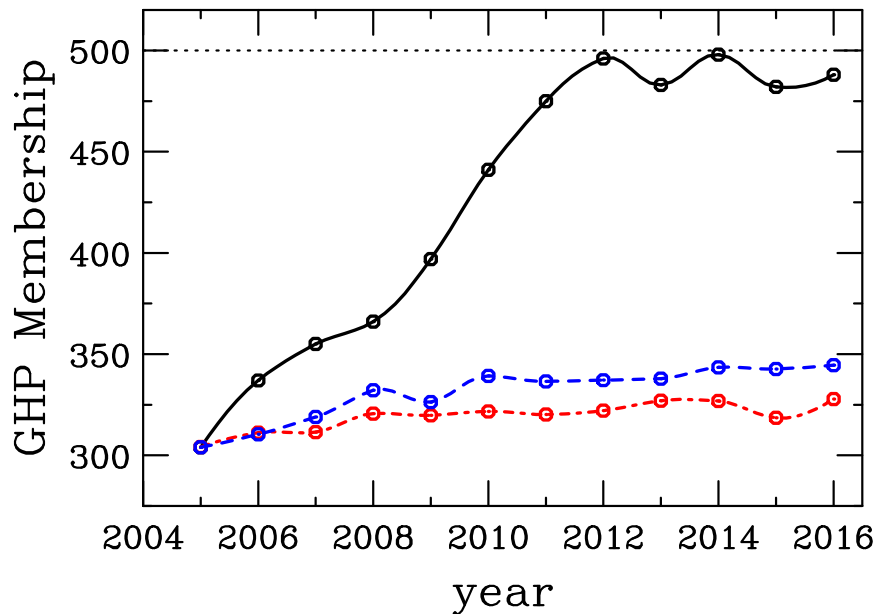


Figure 1: Solid line GHP membership, absolute value, with 2016 representing the APS Official Count at the beginning of 2016; dashed DNP membership normalized to GHPs value in 2005 (2401 \rightarrow 304); and dot-dashed DPF membership normalized to GHPs 2005 value (3291 \rightarrow 304).

Interestingly, three of the existing Divisions, “Polymer Physics”, “Physics of Beams”, and “Laser Science” are now below the 3% criteria.

While the GHP has been holding rather steady since 2012 with $\sim 489 \pm 8$ members over this time period, the APS as a whole has been gaining members, starting off 2016 with 53,096 members, a 6% increase overall.

There are currently thirteen Topical Groups, down one from those listed in the January 2017 Unit Membership Statistics since GQI’s recent transition to DQI. Of these Groups, GHP is now one of the smallest, ranked 9th in terms of membership. In 2016, most Topical Groups gained in membership except for “Energy Research and Applications”, “Physics of Climate” and “Shock Compression of Condensed Matter”, in addition to our decrease. While Gravitation and Quantum Information became Divisions, a new Topical Group, Medical Physics was added in 2017.

Some other statistics are of interest as well. The GHP has 128 student members and 25 early career members, 31.4%, compared to 285 regular members. While this is good, in some Groups the number of students is larger than the number of regular members. In terms of gender diversity, the GHP ranks 10th among the Topical Groups in members that stated ‘female’ as their gender, with 10.9%. (About 5% of members declined to state a gender.) Encouragingly, 20% of the Forum on Graduate Student Affairs (FGSA) are female. Other Units with $\sim 20\%$ female members are the Division of Biological Physics (DBIO) at 20%, Topical Group on Education Research (GPER) at 28%, and the Forum on Outreach and Engaging the Public (FOEP) at 26.5%. Across the geographically-distributed Sections, approximately 14% of all members are female.

So long as GHP membership remains at a level of approximately 500, we will be able to

nominate two regular Fellows in 2017, an excellent boost for Hadron Physics, see Sec. 3. Currently, 125 of GHP members are Fellows, 25.6% of our membership, a higher percentage than either the Division of Nuclear Physics (20%) or the Division of Particles and Fields (22.7%). Thus the GHP is doing well in this category.

Membership in a strong GHP brings many benefits. A vital GHP

- establishes and raises the profile of Hadron Physics in the broader physics community, e.g., by nominating members
 - to APS governance committees,
 - to APS prize and award selection committees,
 - for election to Fellowship in the APS
- has a greater role in planning the program for major APS meetings;
- and provides a vehicle for community action on topics that affect the way research is conducted and funded.

Whether one considers the APS alone, or takes a broader perspective, the impact GHP that can have is primarily determined by the number of members. (It is also influenced by the energy of the Executive.) The Executive urges existing members to encourage their colleagues to join us. We know there are absent-minded people who have overlooked the opportunity to join GHP but many will react positively to a little gentle prodding.

Unit membership is now \$10. Of this, GHP receives \$5 from the APS. The remainder stays with the APS and covers the many services they provide. They have been very helpful, *e.g.*, the last five GHP meetings have been co-located with the APS April meeting which results in substantial savings for us. With this support we can be an active force for Hadron Physics. The money can be used, for example, to assist with: the GHP Dissertation Award see Sec. 4; the organization of meetings such as GHP2017, see Sec. 6; 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.

Hence, if you are reading this newsletter but are not a member of GHP, please join. On the other hand, if you're already a member, please circulate this newsletter to your colleagues and encourage them to join. Current APS members can add units online through the APS secure server by following a link on the lower-right of our web page; namely, <http://www.aps.org/units/ghp/index.cfm>.

3 Fellowship

This is a good time to remind the GHP that each year the APS allocates a number of Fellowship Nominations to a Topical Group. That number is based primarily on membership. Since we are in the neighborhood of 500 members, we are allocated TWO Regular nominations.

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

A few things to know before proceeding, however. One must

- Ensure the nominee is a member of the Society in good standing as well as a member of GHP. The online site will do this for you but it's best to check beforehand, to save yourself time or get your nominee to join APS and GHP.
- A nomination requires a sponsor and a co-sponsor. During the online nomination process, you will be required to provide details for a co-sponsor. After you complete a nomination, the co-sponsor will be notified by EMail. It would be best to coordinate with the co-sponsor beforehand.
- In addition to the nomination letters, you will require supporting letters, that will need to be uploaded to the APS web site. Two letters of support are sufficient. Individuals providing letters of support do not have to be members of the APS, however the sponsor and co-sponsor should be APS members.
- The nomination process should be complete prior to GHP's deadline:

Monday 1st June 2017

The APS will subsequently forward the nominations to the GHP Fellowship Committee, chaired by GHP Vice-Chair David Richards.

	Fellowship Committee	
	David Richards (<i>Chair</i>) dgr@jlab.org	
Ian Cloët icloet@anl.gov	Curtis Meyer cmeyer@cmu.edu	Bernd Surrow surrow@temple.edu

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.

4 Thesis Prize

The GHP Dissertation Award was established in February 2012, thanks to significant contributions from Brookhaven Science Associates (the management contractor for the Brookhaven National Laboratory), Jefferson Science Associates, LLC (the management contractor for Jefferson Lab), Universities Research Association (the management contractor for Fermi National Accelerator Lab) and personal contributions from some of our members.

The Award is a prize of \$1000 and a travel allowance of up to \$1500; and the winner is invited to deliver a plenary presentation at the Biennial GHP Meeting, the next of which will take place in 2019.

At this time the GHP Executive would like to urge GHP's members to begin thinking about suitable candidates for the Third GHP Dissertation Award, nominations for which will close on

Monday 8 October, 2018

The nominations should be sent to Tanja Horn, who will be GHP Chair at that time. In the interim, Tanja will invite four other GHP members to join her five-member Dissertation Award Committee.

The submissions are judged according to the following criteria: quality of the written dissertation (40%), contribution of the student to the research (30%), impact of the work (15%), and broader involvement of the student in the community (15%).

The current endowment enables GHP to present the Dissertation Award biennially. In order to maintain that endowment and, perhaps, to expand the Award, the Executive encourages our members to

[Donate to the award fund.](#)

For information on how to proceed, please see:

<https://www.aps.org/memb-sec/profile/DonationFunds.cfm>

It would be ideal if we could increase the endowment so that sufficient funds were available to present this award in every year and thereby honor more of the bright young scientists entering Hadron Physics.

5 GHP Program at the APS April Meeting, 2018

Columbus, OH

<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 2018 APS April meeting is

2017 GHP Program Committee, preparing for April 2018

Kai-Thomas Brinkmann kai-thomas.brinkmann@exp2.physik.uni-giessen.de	Michael Engelhardt engel@physics.nmsu.edu
Renee Fatemi rfatemi@pa.uky.edu	Susan Gardner svg@pa.uky.edu

Tanja Horn hornt@jlab.org is Chair.

6 GHP 2017: 7th Workshop of the GHP

The Seventh Workshop of the APS Topical Group on Hadron Physics was held during the three days that immediately followed the April APS meeting in January 2017. The Program Committee was chaired by Paul Reimer and Tanja Horn.

The topics covered included:

- AdS/QFT, novel phenomena

- Continuum QCD and Phenomenology
- Exotic hadrons
- Future facilities
- Lattice QCD
- Light and heavy quark mesons and baryons
- Nucleon spin physics and hadronic structure
- Physics of the quark-gluon plasma
- Physics of gluon saturation

By the numbers, this was the largest GHP meeting to date with 125 registered participants. Of these, twenty were students, including two undergraduates, all of whom paid a reduced registration fee. Although not a separate registration category, APS recognizes junior members as being those up to five years past their PhD. Fifteen junior APS members attended GHP17. Eighty of the participants were GHP members while 45 were non-members. Nineteen of the participants were from institutions outside the US.

The plenary sessions included the GHP members awarded APS Fellowship the last two years: Richard Lebed, Xiaochao Zheng, Maarten Goltermann and Peter Bosted. Phalia Shanahan, our current Dissertation Award winner, also gave a plenary talk.

Due to the larger number of participants and abstracts, four sessions were held in parallel. This was an increase over our previous meetings.

Two parallel sessions were devoted to intrinsic charm. First proposed in the 1980s by Brodsky and collaborators, the topic is still the subject of lively debate. Two parallel sessions were devoted to the subject. Susan Gardner gave an overview of the topic. Ranjan Laha discussed how intrinsic charm could perhaps explain some of the neutrino excess observed by Ice Cube. Two current experimental efforts could measure charm in a kinematic region where intrinsic charm is more important: AFTER@LHC is a proposed fixed-target experiment while SMOG is an internal LHCb fixed-target program. Both efforts were represented by talks.

In addition the amount of charm intrinsic to the nucleon has been assessed by ever more inclusive global analyses which reach different conclusions as to the intrinsic charm content of the proton. The CTEQ-TEA Collaboration, which found a level of up to 1% was compatible with their analysis, was represented by Dawulaiti Shayifujiamali. The analysis of Jimenez-Delgado *et al.*, which included more data but with a more restrictive goodness of fit requirement, was discussed by Tim Hobbs. Unfortunately the NNPDF Collaboration, which made the most recent analysis, using neural networks to determine that the preferred shape of the charm structure function at large fractional parton momentum, was unable to send a representative. Nonetheless, a lively discussion of all three analyses took up much of the second session.

Several sessions at the workshop focused on three-dimensional imaging of hadrons, notably through the study of Transverse-Momentum-Dependent Distributions (TMDs). This focus is timely with the emergence of the TMD Topical Collaboration and many theoretical and experimental challenges have to be overcome. Amongst the topics discussed were our understanding of factorization and evolution involving TMDs, the connection between the twist-2 and twist-3 factorization frameworks in the description of the transverse spin

phenomena, orbital angular momentum from generalized TMDs (GTMDs), the relation of hadronization in Monte Carlo event generators to correlation functions of TMD factorization, transverse momentum dependent jets and their substructure from Soft Collinear Effective Theory, and the physical insights that can be obtained, notably on the origin of spin in the nucleon. All these questions are key to the current experimental programs at RHIC-spin and at JLab, and in developing an exciting physics program at a future EIC. The complementary three-dimensional imaging of the nucleon afforded by Generalized Parton Distributions was discussed. A theme common across both 3D and 1D imaging of the nucleon was the development of analysis tools and the need for global fits.

Determining the spectrum of QCD encapsulates our understanding of theory, The latest experimental results from Jefferson Lab were presented, including the first results from the new GlueX experiment, as well as analysis from BaBar. The search for the LHCb pentaquark in J/ψ production at Jefferson Laboratory was also described, reflecting a new opportunity for JLab to contribute to the broader spectroscopy program. The role of lattice QCD in providing an ab initio description of resonances in amplitudes was also described.

Two parallel sessions were devoted to the structure of hadrons using lattice QCD, focusing on the most recent and exciting developments. The first lattice session showcased a selection of the most exciting developments in hadron-structure calculations, from the full proton mass decomposition (including contributions from both quarks and gluons), the first gluonic transversity calculation, the recent breakthrough in the notoriously challenging light-by-light contribution to the muon $g - 2$ (showing significant progress, matching the experimental progress), and a new idea for improving the calculation of the proton charge radius through computing moments of correlation functions.

The second session focused on the recent breakthrough in the direct calculation of the Bjorken- x dependence of parton distribution functions. Following the proposal of Xiangdong Ji in 2013, for the first time one can directly calculate the full Bjorken- x dependence of any structure function, rather than just the first few moments. This opens the door to three-dimensional mappings of the proton directly from lattice QCD. It is also the first time lattice-QCD calculations can reveal the quark distribution in both the unpolarized and polarized sea. However, there remain important steps needed to renormalize and match the outcome of lattice calculations with continuum distributions in order to achieve full systematic control. This session aimed at giving the community a broad overview, with talks progressing from the introduction of Ji's original proposal, through the first lattice-QCD calculations, up to recent developments on renormalization and operator improvement. More developments in this direction can be expected in the near future.

There were three parallel sessions which explored broad themes in the structure of hadrons and nuclei. For example, the possible link between short-range correlations and the EMC effect was discussed, together with the forthcoming experiments at Jefferson Lab which will further explore this connection. The significant progress of lattice QCD in the study of light nuclei was presented, with an emphasis on magnetic and axial structure. The first Dyson-Schwinger equation results for nucleon PDFs were given and, in another talk, results for meson and baryon form factors using the same approach were discussed. The current status, together with planned experiments, for pion and nucleon elastic form factor measurements, were also presented. An overview of generalized parton distributions was given and a separate talk gave an introduction to the PARTON software project. This session finished with a review of the impact that Jefferson Lab data has had on global PDF analyses and, in a separate talk, preliminary results from the ongoing Drell-Yan measurements at SeaQuest were presented. A fourth parallel session was dedicated to the GlueX experiment, where some of the first results

were presented, together with important progress in lattice QCD and amplitude analysis.

A number of plenary talks as well as three parallel sessions of the workshop were dedicated to heavy-ion physics. The plenary talks featured developments in heavy-ion theory, the chiral magnetic effect and QCD thermodynamics on the lattice. New lattice results on the equation of state at non-zero baryon density based on the Taylor expansion up to sixth order have been presented for the first time at this meeting. Several of the parallel sessions featured topics that are of interest to both the hadron physics and heavy-ion physics communities. There were two dedicated sessions on quarkonium production in heavy-ion collisions that featured a review of the experimental results from RHIC and LHC as well as lattice QCD studies of color screening and high temperature and quarkonium spectral functions.

The study of collectivity, thermalization and early time dynamics in heavy-ion collisions was also addressed in two parallel sessions with highlights that included an ab-initio study of thermalization in the weak coupling approach and a first principles weak coupling calculation of the chiral magnetic effect. There was a session dedicated to the Beam Energy Scan (BES) experimental program at RHIC that will start in 2019. (There is also a Topical Collaboration on BES theory – the BEST Collaboration.) The BES session featured an experimental overview of the current results and future prospects and two lattice talks on QCD at non-zero chemical potential.

An evening business meeting was held the first night. The Secretary-Treasurer’s report was heard and Jim Sowinski made some informal remarks on behalf of the Department of Energy’s Office of Science. The workshop dinner, held at Lillie’s down the street from the meeting venue, was attended by 80 of the participants.

7 Leadership Convocation

The APS Leadership Convocation was held in Washington, DC 26-27 January 2017. Ramona Vogt (Secretary/Treasurer) represented GHP. The Convocation is a meeting of the unit officers and provides them with an opportunity to learn about the structure and procedures of the APS, as well as to learn from each other. This year the Convocation was held at the Marriott Wardman Park Hotel in Washington DC,, the same venue as the APS April meeting and GHP17.

Ahead of the convocation, some of the unit officers in attendance went on Capitol Hill visits. This year eighty Members of Congress were visited. It is clear that not every Congressperson gets a visit since there are not enough unit officers and there are some districts that are not represented, but it is important to visit as many as possible. It is also clear that we need to visit ‘enemies’ as well as ‘allies’.

The first day of the convocation was spent learning how APS works and some of the services available to the unit officers. There was also time for networking during the day and the evening dinner which was highlighted by the address to the members by outgoing APS President Homer Neal.

The second day opened with an address on the state of the APS by CEO Kate Kirby, followed by a talk from incoming APS President Laura Greene. She reminded members that APS is, at least in part, an advocacy group for physics and, regardless of their personal politics, APS members should vote. She spoke about visiting the Heritage Foundation where one stated goal

is to cut science funding back to 2008 levels because they feel that industry should take over research funding. Possible exceptions are computation and nuclear physics which they deem more strategic.

President Greene was followed by Francis Slakey from the office of public affairs. He reminded those in attendance that it was important to get scientific societies to speak with one voice rather than to try to place one branch above another since all science is valuable. He also noted that it was important to find Republicans in Congress who could be champions of science. (There are no Republicans in Congress who are trained as scientists.) While cultivating Members of Congress that are not necessarily supporters of science is crucial, he emphasized the need to not take supporters of science in Congress for granted and to thank them for their support so that they realize that their efforts on behalf of science are appreciated. Please see the contribution from Greg Mack of the Office of Public Affairs later in this newsletter for suggestions on how to make a difference in attitudes toward science, both in Congress and among members of the public. Expect to see regular contributions from OPA in future newsletters.

7.1 OSTP open data requirements

Mark Doyle talked about the APS response to the Office of Science and Technology Policy (OSTP) directive to ensure that data from federally-funded research be made available to the public, industry and scientific community. The directive includes peer-reviewed publications and digital data. Both DOE and NSF have plans in place to help them respond to the mandate. DOE has data management plans to make data accessible. These include: supplementary information including data from plots; extra discussion of analysis; and how to find the data. It includes a definition of sharing, preservation and validation of data in a “one size fits all” approach. NSF has a public access plan that targets communities of interest, acknowledging that different data sets might fit specific areas of science.

To help inform OSTP, APS recently conducted a survey of unit leadership to assess the impact of the OSTP requirement. The results of that survey were used to put together a more detailed survey sent to authors. The findings of both surveys are briefly summarized here.

There were six basic issues that arose from the unit leader survey. They are listed below with some comments.

1. *Lack of clarity in what and how much data are expected to be included under the mandate.* At a minimum, the data displayed in tables and figures in a publication would be made available. This option would be rather straightforward without placing undue burden on the PI. At a maximum, the directive could require all data used in the publication, including raw data sets, which could require substantially more resources than typically available.
2. *Placing additional significant requirements on researchers to store and prepare files for open data without a concomitant increase in resources.* In the case of a maximal open data requirement, a large resource burden could be placed on some groups and additional funding would have to be made available to implement such a plan, unlikely in the current political climate.
3. *The challenge of widely varying data intensity and disparate levels of effort in implementing open data, across a vast array of scientific fields and federal agencies.*

Some data sets are rather minimal and require the upload of relatively little data. However, some data sets can be more than a terabyte in size. For a one size fits all policy, certain fields would have a larger burden of storage than others. When researchers obtain funding from multiple agencies, they should be subject to the same requirements across all agencies. In addition, when international collaborations are involved, the international open data policies must also be considered.

4. *Potential for misunderstanding data sets without significant additional context and effort.* There was concern about data misuse, especially when accessed by non-experts and members of the public. In addition, some data sets require additional software to be made available, some of which may be proprietary.
5. *Potential difficulties in maintaining access to data as digital archiving methods change over time.* The data sets need to be maintained over time by adjusting to advances in storage and display technology. The question is who bears the responsibility for long term preservation.
6. *A lack of accurate estimates of all the costs involves with setting up and maintaining and open data system, including the time and effort of researchers and the administrative and technology burdens on research institutions.* The open data mandate does not currently address the cost of the mandate to researchers and institutions.

Three main conclusions could be drawn from the subsequent author survey:

1. *Considerable data sharing is already occurring* Nearly 80% of respondents report sharing data with their colleagues and a similar number said that their colleagues share with them. There is, however, a difference between this type of data sharing and making data publicly available.
2. *Staffing and funding* Respondents suggested that making the published data from figures and tables available would place a minimal burden on them but requiring raw data be made available would create a staffing and funding burden.
3. *Attitudes towards open data* Up to 30% of respondents reported that it would be too time consuming to prepare data for others, even if they wanted to. However, nearly 50% would be more willing to follow the directive if infrastructure improvements and additional funds were in place to assist in the effort.

The conclusion from the report was as follows: Based on the surveys, APS urges that before OSTP consider any broad application of the open data directive, the federal government should carry out a thorough examination of costs and impact. Further, APS supports the proposal in the NSF workshop report to implement pilot projects to evaluate and develop the infrastructure required for an open data system.

There are also political implications, especially when government may be hostile to scientific results. In addition, it appears unlikely that supplemental funding will not be made available in the current political climate.

7.2 Update on Open Access

Matthew Salter, the new APS Publisher, spoke about the APS journals. Salter is new to APS, having been hired as publisher last year. He noted that there are 2000 journal publishers

globally, publishing 28500 peer-reviewed journals. The published content increases 3-4% each year with about 2000000 articles per year. Given this large output, APS, with 18335 articles published in the twelve APS journals in 2016 is a boutique publisher compared to more commercial scientific publishing houses.

He noted that of the many articles published by all journals, China produces 18.7% of total papers, making it the country contributing the most papers overall to all journals. There are 110 countries submitting papers to APS journals. Indeed, 79.2% of papers submitted to APS journals are from outside the US. He also noted that, of the twelve journals in the APS portfolio, Physical Review B is the biggest with nearly 5000 papers published per year.

The revenue from journal subscriptions is a major source of funding for APS. Thus the important topic of Open Access (OA) and how it would affect APS funding was discussed again this year. Under OA, the publishing cost is paid by the authors, institutions, funders. This model assumes that authors of accepted papers can pay the Article Publication Charge but does not take into account the cost of rejected manuscripts. There is no pay wall for readers, instead there is free access for all.

Since in this model, there is a direct relationship between the publication of papers and income, the more papers published, the more income. Therefore, there could be a push towards quantity rather than quality for some publishers to keep journals alive. This raises the question of how to maintain quality standards for publications when OA charges drive income.

Salter pointed out that OA is here to stay and is growing. In the long held subscription model employed by APS, institutions and individuals pay for package subscriptions to journals, whether a single journal or a suite of journals from a single publisher. Articles are available only behind the subscription wall but the cost of publication is borne by the subscribers. An OA mandate could collapse the subscription model for journal publishers, whether commercial or society-based publishers.

The ramifications of OA is not necessarily understood or fully appreciated, even by its advocates, some of whom actually would like to collapse the subscription model and make papers directly available to the public without journals as an intermediary. This begs the question of whether the peer review process would survive without journals.

To go to a full OA model would move the publication cost to authors, institutions and funding agencies. This model assumes that someone associated with the authors of accepted papers can pay. The model does not take into account the fact that the journals spend almost as much or more time on rejected papers since many papers are not rejected outright but only after one or two rounds of refereeing. Therefore these papers require at least as much effort for the journal on the submission side, the costs of which have to be absorbed elsewhere.

There are several terms associated with OA that are worth defining:

Article Publication Charge (APC) Publication charge paid by author at some level.

(Cost could be covered through institutional or laboratory overhead or negotiated with funding agencies.)

Version of Record (VOR) Published version of manuscript.

Author Final Version (AFV) Author's submitted version, not the same format as the published version but with the same content.

Gold OA A type of OA that allows immediate access to publishers VOR paid by APC (PRX, PR Accelerators and Beams, PR Education Research are APS journals that are

already Gold OA.)

Green OA A type of OA less stringent than Gold OA that involves the deposition of AFV or VOR after an embargo period of 6-12 months. In this case, no payment is needed. However shorter and shorter embargo periods reduce interest in subscriptions, leading eventually to Gold OA.

“Big Flip” A move to all OA with a current target date of 2020.

In the “Big Flip”, the idea would be to convert subscription payments into OA. APCs intended to be cost neutral to the journals. The source of journal revenue, *i.e.* who pays, is different however. For authors to cover APCs, additional funding is likely to be required. The timing is critical on the journal side since early adopters of OA could lose out, at least temporarily, since authors could move to journals where papers are still free to publish. One way to cushion high-quality journals against the Big Flip could involve a funder mandate that would induce all journals to flip at the same time.

The point about moving to journals without page charges was brought home in the discussion by David Gross who recalled that, in 1970s, high energy theorists refused (could not afford) to pay page charges when they were mandatory and moved to publish in Elsevier. He suggested that they might move to a still newer model in response to OA. One could also note that some of these same physicists were behind the arXiv site some twenty years later. There was concern at the time that sites like arXiv would harm publishers but most papers posted on arXiv are also submitted to and published in journals after peer review.

There are various drivers of OA. These include advocacy groups (the Open Source Initiative (OSI), advocating sharing of data to return taxpayer investment back to society <https://opensource.org/>, Scholarly Publishing and Academic Resources Coalition (SPARC <https://sparcopen.org/who-we-are/>), a group led by academic and research libraries focusing on open access, open education and open data that claims that research is currently hidden behind technical, legal and financial barriers, locking out most of the world), funder mandates, government initiatives (the US-based office of Science and Technology Policy (OSTP) <https://www.whitehouse.gov/ostp> and the EU-led Horizon 2020 <https://ec.europa.eu/programmes/horizon2020/en/what-horizon-2020>), research organizations, and librarian groups. These diverse drivers have different levels of friendliness toward publishers.

Open access advocates want to reform publishing and reduce its cost. (Though how OA does this is not necessarily clear.) They think that publishers are not being cost effective. Some want to put caps on paying OA APCs without understanding that high quality peer review and publication has real costs. Caps proposed by advocates and funding agencies may not be realistic to maintain current levels of quality. Some also want to go beyond reforming publishing to changing the peer review process, academic assessment, and so on. Publishing in prestige journals is not seen as important to these particular OA advocates.

The general target date for all OA publication, although not set in stone, is 2020. This date is driven in part by international considerations. However, not all countries will react the same way to OA. Some countries publish little but can read articles for free. These countries may not be able to pay APCs. Countries and institutions that publish a lot may have to pay more for publishing than for subscriptions. While grants from some international funding agencies still include a budget line item for page charges, this is no longer the case for many US grants since page charges in many journals have been either absent or voluntary for a long period. Thus there is no longer any institutional memory for these costs.

Open access challenges publishers and researchers alike. In particular, there is an affordability problem. Gold OA mandates are not fully funded. There is concern about the impact on research budgets since not all research fields are well suited to OA. (Theory is one example because grants typically only fund people and travel. Another is high energy physics with large international collaborations involving hundreds or thousands of physicists where costs may be spread over many but it then hard to identify who (institution, country, etc.) should pay.)

The challenge to researchers is fairly clear: How can they pay APCs and still maintain the scientific effectiveness of their research programs? PIs may be forced to choose between publishing a paper and hiring a graduate student; publication and going to a conference or workshop; and even publication and upgrading equipment. There is no free money in the system.

Publishers will be forced to make choices based on the level of OA required. Gold OA only generates revenue when a paper is published so revenues become more volatile. As previously mentioned, rejected papers are not cost free, APCs would be driven higher to cover the cost of rejection. Some funding agencies mandate publication in OA-only journals but don't want to pay the fees, seeming to want it both ways. Green OA has no revenue stream. Even without an OA mandate, journals with high OA fraction can still endanger subscription revenues. Finally, highly selective and review journals are hard to convert to OA because there are not enough publications to cover the cost of these journals.

The existential threat is thus real, to APS and other journals. There are some specifics for APS that can be mentioned. Currently, there are some APS journals that are all OA as well as some journals allowing both OA and non-OA papers following the subscription model. These OA papers currently constitute only a few percent of APS revenue with a small percent of papers published OA. For example, the education research APS journal published 89 papers last year. There were a total of under 500 OA papers APS-wide. For journals allowing both only a small fraction of papers are published OA. APS currently has a fairly liberal OA policy that supports the principles of OA to the maximum extent that allows the society to maintain high quality journals.

APS has undertaken several initiatives to satisfy OA without forfeiting the subscription model thus far. It allows hybrid OA on all subscription journals and gives free access to journals through public libraries and high schools. In addition, authors are allowed to post the VOR on their personal and institutional websites.

Gold OA would represent significant challenges to APS journals. For example, if all articles in APS journals in 2015 were published OA, the profit realized by the journals would have been dramatically different. Thus an all OA market threatens size and stability of APS revenues. The current APCs would not generate equivalent revenue to replace the subscription model. Thus there is a need to increase APCs to maintain revenue without subscriptions. This has to be done year by year to raise the APCs to the level required for the Big Flip to protect the integrity of the journals.

APCs have currently not increased year-by-year in the OA APS journals or in the hybrid model employed by the other journals since increased costs of publication are absorbed by increased subscription fees. The APS is investigating how to structure APCs to replace the subscription model while maintaining the current high standard of quality.

A number of steps have been taken so far. These include, as previously mentioned, a phased program of APC increases in anticipation of the Big Flip, currently planned for 2020. Institutional OA deals are under discussion, as is the future publication relationship with

CERN for high energy physics. The APS is also talking with funding agencies and advocating with Congress regarding the effect of an author pays system on science budgets. They are also assessing the OA impact on sales and budgets. One point is that research should not be paid for a second time since funders pay for research and not for dissemination.

Clearly much work remains to be done and we will keep following the issue in our newsletter.

8 Congressional Report by Congressman Bill Foster

As the only physicist in the U.S. Congress, I am deeply concerned about the future of science and science funding in the United States. As any scientist knows, discoveries aren't made over night, and experiments need sustained attention and resources for us to learn from them. It's easy for politicians to become political heroes in the short term when they vote for budgets to eliminate funding for these important projects. Unfortunately, a lot of politicians like to become short-term heroes by cutting investment in areas that need long-term investment and research. Our scientific infrastructure requires long-term, sustained funding to ensure opportunities are not missed. I have heard from a number of my colleagues in the scientific community who are worried about what the incoming administration could mean for scientific progress in this country.

There's a lot at stake for future of scientific research in this country. In the "skinny" budget the Trump Administration proposed in March, science funding would be cut to historically low levels in the coming fiscal year. Nearly all departments would face cuts that would significantly alter their work. The budget includes a 15 percent reduction in the Department of Energy's Office of Science. It also proposes an 18 percent cut in the National Institutes of Health and a 31 percent cut in the Environmental Protection Agency.

The future of science funding means the difference between maintaining leadership or falling behind. Recently, I testified before the House Appropriations Subcommittee on Energy and Water, which oversees funding for the Department of Energy, where I advocated for robust funding for the Office of Science. I ended my testimony with a story of Robert Rathburn Wilson who was attempting to build what is now Fermilab testifying before a Congressional Committee. The story goes that he was asked by a Senator whether the accelerator laboratory he was hoping to build would involve the security of the country. He famously answered that "it has nothing to do directly with defending our country except to make it worth defending." When we value science in this country, everyone benefits. Innovation and technology have propelled this country to the forefront of economic and educational progress. Now, we must work together to make sure this legacy continues.

Congressman Bill Foster represents the 11th District in Illinois. For over twenty years, he worked as a high-energy physicist and particle accelerator designer at Fermi National Accelerator Laboratory and was a member of the team that discovered the top quark, the heaviest known form of matter.

For Congressman Foster's commentary on the March for Science, see <http://thehill.com/blogs/congress-blog/politics/329809-why-we-will-march-for-science>.

9 Building Champions For Science in Congress: An APS Strategy

(Communicated by Gregory Mack, APS Government Relations Specialist in the APS Office of Public Affairs – mack@aps.org.)

In the current political climate, it is more important than ever to voice the needs of the physics community and foster support for science among members of the U.S. Congress of both political parties. That is the best path for enabling science-friendly legislation that can be passed into law.

To achieve this, the APS Office of Public Affairs (OPA) under the leadership of Interim Director Francis Slakey is working with APS Units including GHP with the goal of developing more champions for science in Congress. OPA, the policy and advocacy arm of APS, developed a strategy to achieve this goal in partnership with APS Unit Leaders at the Leadership Convocation in January.

OPA has identified 29 key members of the U.S. House of Representatives who, based on voting records, could become science champions. Subsequently, OPA determined which APS members are in the Representatives districts as well as the Unit affiliation of those APS members. Working with the Units, the relevant APS members have been asked to volunteer for this advocacy effort.

Why is there a need for more champions for science in Congress? President Trump's proposed budget for Fiscal Year 2018 makes significant cuts to federal agencies. In particular, the President wants to increase defense and security spending by \$54 billion to \$603 billion and consequently other programs science agencies included suffer substantial cuts.

While the House and Senate will devise their own budget plans in response, both Chambers and the President would have to agree on the numbers in order to have the budget pass and be signed into law. Although the agencies could therefore end up receiving cuts, there may be an additional source of funding for science projects that could provide some relief: President Trump's proposed \$1 trillion initiative to rebuild the nations physical infrastructure.

APS and other scientific societies believe that science infrastructure should be part of the proposed infrastructure initiative. In order to make that happen, more Members of Congress need to be convinced that upgrades to research facilities at national labs and universities should be included. This is the focus of the first step of the APS champion-building strategy.

Americans rely on the countrys scientific infrastructure the national laboratories, research facilities at universities, state-of-the-art instrumentation and hardware spread across the country for the breakthroughs and discoveries that improve everyday lives. The U.S. scientific infrastructure is also essential scaffolding that directly supports more than 17 million jobs.

Under NSF, infrastructure opportunities include the Major Research Instrumentation (MRI), Major Research Equipment and Facilities Construction (MREFC), and Academic Research Infrastructure (ARI) programs. Under the DOE Office of Science, more than \$2 billion in projects include the Science Laboratories Infrastructure (SLI) Program and major facility upgrade projects, such as light sources and advanced computing systems. Other opportunities also exist.

As part of APSs strategic effort, OPA is working with other scientific organizations to draft a document explaining the benefits of including science in the infrastructure initiative. OPA will also help draft a "Dear Colleague Letter" (DCL) that members of Congress can sign to

express their support for the inclusion. A DCL serves as an on-the-record stance for the signers and can influence other members of Congress.

The first action of the APS member volunteers in the target districts will be to try to persuade the 29 Representatives to sign this DCL. These specific members of Congress have voted favorably on some science issues in the past, but not consistently. The goal is to have their constituents (the APS members) tell them why they should support science, specifically its inclusion in infrastructure plans Representatives can be convinced if they hear compelling stories from their constituents.

OPA will be assisting the APS members who participate in the effort by providing draft emails, phone call scripts, tweets, and op-eds for local newspapers. For those APS member volunteers who want to hold a meeting in their Representatives local offices, OPA would work with them in various ways to have the most productive meetings possible.

As the APS volunteer advocate network builds on the infrastructure initiative, the Society will broaden the push to include the federal science budget and other science issues, with the ultimate goal of developing science champions.

The APS values the work that APS members spend on these activities and recognizes their efforts through profiles in APS News and with an annual award for those who are exceptional in their advocacy: the title “Five Sigma (5σ) Physicist”.

It is crucial for members of the physics community to speak up for its needs and priorities. Who else knows those needs better?

If you have any questions about the APS strategy, please contact Greg Mack at mack@aps.org.

10 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.

10.1 Light-Cone 2016: Theory and Experiment for Hadrons on the Light Front

Communicated by Teresa Peña (teresa.pena@tecnico.ulisboa.pt), Alfred Stadler (stadler@uevora.pt) and Cheung Ji (crji@ncsu.edu).

The LIGHT-CONE 2016 workshop 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>. The 2016 meeting, as the ones before it, followed the objectives of ILCAC, Inc.: “to advance research in quantum field theory, in 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 2016 edition of the Light-Cone meeting took place at Instituto Superior Tcnico, University of Lisbon, Portugal, from 5-8 September. A detailed description of all aspects of the workshop, including the scientific program, can be found on the web page: <http://lc2016.net>. The talks are available at <http://www.lc2016.net/en/talks>.

The members of the local organizing committee were: Teresa Peña (co-chair), CFTP-IST, Lisboa; Alfred Stadler (co-chair), Évora; Orlando Oliveira, U. Coimbra; João Seixas, LIP U. Lisboa; Pedro Bicudo, CFTP-IST Lisboa; Elmar Biernat, CFTP-IST Lisboa; and Sofia Leitão, CFTP-IST Lisboa.

The workshop was supported in part by the generous contributions from the Jefferson Science Association (JSA) and Jefferson Laboratory. This financial support allowed ILCAC to award this years McCartor Fellowships to two young physicists, enabling them to attend the conference and to present the results of their research: Maria Gomez Rocha (currently ECT* Trento, PhD from Graz) and Luca Mantovani (PhD from Pavia). The prize was awarded for their Curriculum Vitae and also their more recent work “Toward heavy-quarkonium states within the renormalization-group procedure for effective particles” and “The gauge-field propagator in light-cone gauge: which is the correct one?”, respectively. The Portuguese Funding Agency, Fundação para a Ciência e Tecnologia (FCT), also sponsored the Lisbon LIGHT-CONE 2016 workshop.

The LIGHT-CONE 2016 workshop gathered 57 registered participants, 20 of whom were young scientists and 21% were women scientists. The program included 12 plenary sessions (33 invited talks) and 4 parallel sessions (17 contributed talks). Young scientists delivered 30% of the plenary talks and 60% of the contributed talks. The workshop was also attended by researchers in Portugal, working on hadronic physics at Lisboa and Coimbra.

The topics of the scientific program were organized into the following categories: present and future experimental advances in hadron physics, light-front field theory in QCD and QED, nonperturbative methods in quantum field theory, lattice gauge theories, relativistic models for hadrons and nuclei, and few-body problems on the light cone.

The workshop addressed new frontiers and challenges in hadron physics, both in experiment and in theory, and issues of the present precision era in both sectors. Examples were illustrated in the talks of J. Vary (Iowa State, on the connection between methods for nuclear and hadron physics calculations), C. Fanelli (MIT, on the first results from the GlueX program at JLab), P. Maris (Iowa State U, on High Performance Computing), J. Gomez (JLab, on nucleon structure functions and the mirror nuclei ^3H and ^3He program at JLab), and also G. Koutsou (Cyprus Institute) and C. Thomas (Cambridge) on spectroscopy and calculations of dynamical observables within lattice QCD. Other QCD lattice calculations were also reported, by N. Cardoso (IST-Lisboa) on the string tension as function of the temperature, by M. Marinkovic (CERN) on the muon anomalous magnetic moment and by O. Oliveira (Coimbra) on gluon dynamics.

A variety of other methods to solve QCD and QED problems were presented. For example, the Dyson-Schwinger approach (G. Eichmann, Giessen, and P. Tandy, Kent State), solutions of the Bethe-Salpeter equation in Minkowski and Euclidean space (T. Frederico, ITA-S. Paulo, and G. Salmé, INFN Rome), the Bethe-Salpeter-type Covariant Spectator Theory and its results, e.g. for the meson spectrum (F. Gross, JLab, and S. Leito, IST Lisboa), light-front quantization in QED and QCD calculations (C. Ji, North Carolina State; X. Zhao, CAS Lanzhou; and Y. Li, Iowa State), scattering states in Euclidean relativistic quantum theory (W. Polyzou, Iowa) and effective particles in quantum field theory (S. Glazek, Warsaw), as well as gluon dynamics (A. Misra, Mumbai and S. Cotogno, VU Amsterdam).

Hadron structure results (both experimental and theoretical) were covered by the talks of A. Kim (JLab), F. Steffens (DESY), M. Burkardt (New Mexico State) and J. Rodriguez-Quintero (Huelva), covering results on Parton Distribution Amplitudes (PDAs). Future perspectives and feasibility studies of PANDA-GSI were presented by L. Szymanowski (NCNR Warsaw)

and E. Atomssa (Orsay) presented results on transition distribution amplitudes (TDAs). In-medium effects, valence and parton distributions were presented by K. Tsushima (Cruzeiro do Sul), L. Poliniário (IST-Lisboa) and J. Cabral de Melo (Cruzeiro do Sul).

In the closing session, S. Brodsky gave a captivating overview of recent progress on properties of QCD from light-front holography.

A half-day excursion comprised a visit of the Jerónimos Monastery in Belém and a trip on the Tagus River in an amphibian bus, a visit to the XVIII century Palace of the Marquis of Pombal in Oeiras, followed by wine tasting and the conference dinner, which included a performance of Portuguese fado by local artists. During the dinner, Chueng Ji, ILCAC Chair, together with Teresa Peña and Alfred Stadler, LIGHT-CONE 2016 chairs, presented the awards to this years two McCartor Fellowship 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 workshop will be refereed and published as a special issue of Few-Body Systems.

10.2 Probing QCD in Photon-Nucleus Interactions at RHIC and LHC: the Path to EIC

Communicated by Daniel Tapia Takaki (jdtt@ku.edu)

The Institute for Nuclear Theory (INT) workshop “INT-17-65W: Probing QCD in Photon-Nucleus Interactions at RHIC and LHC: the Path to EIC” took place in Seattle, Washington 13-17 February 2017. The workshop was organized by Daniel Tapia Takaki (Kansas) acting as Chair, together with Carlos Bertulani (Texas A&M Commerce), Tuomas Lappi (Jyväskylä), Spencer Klein (Lawrence Berkeley National Lab) and Mark Strikman (Penn State).

During the five-day program, approximately 50 participants discussed the physics of high-energy photon-nucleon (nucleus) collisions and how they can be used to probe the hadron structure, QCD dynamics and small Bjorken- x gluon dynamics. These topics have been highlighted as key priorities in the 2015 Long Range Plan for Nuclear Science which also recommends the construction of an electron-proton (nucleus) collider in the United States. The proposed experimental facility aims at answering fundamental questions such as the nature of the initial state created in high-energy nucleus-nucleus collisions and the emergence of saturated QCD matter.

It has been realized that photon-nucleon (nucleus) collisions at RHIC/LHC provide a bridge to the physics of the EIC. The INT workshop was the first to address the connection between these two physics programs, a unique feature of this meeting.

The workshop aimed at discussing the main theoretical challenges in the physics of photon-induced process. The main themes of the workshop were the current status of nuclear PDFs, strategies for probing nuclear PDFs in γA collisions at RHIC and the LHC, strategies for observing nonlinear and gluon saturation effects in photon-nucleon (nucleus) scattering, as well as predictions of the leading-twist, dipole and Color Glass Condensate (CGC) models for exclusive photon-proton and photon-nucleus scattering.

Participants included scientists from universities and national laboratories both from the United States and abroad. The workshop also welcomed the participation of several postdocs

and some senior graduate students. The theoretical overview talk was given by Vadim Guzey (Petersburg Nuclear Physics Institute). Although most of the talks were given by theorists, many discussions were centered on how to exploit the current RHIC and LHC results as well as plans for new measurements. Thus the presence of experimental physicists was very important. One of the purposes of bringing the experimental and theoretical communities closer together was to discuss how to tackle some of the challenges, such as how to use ultraperipheral collision (UPC) data to constrain nuclear gluon PDFs and how to make measurements to search for nonlinear and gluon saturation effects.

UPCs are providing the first data on gluon nuclear PDFs at small x . This might be the best information the community will get for the next 10 years before the Electron-Ion Collider turns on. Ramona Vogt (Lawrence Livermore National Lab & UC Davis) gave an introduction to nuclear PDFs and connections to UPC physics, and described the latest results from EPPS16. Subsequently, Fred Olness (Southern Methodist) and Shunzo Kumano (High Energy Accelerator Research Organization, KEK) discussed the CTEQ and HKN nuclear PDFs.

Since this is one of the first dedicated workshops to connect the RHIC/LHC ultra-peripheral collisions community with the nascent EIC community, several presentations addressed the question of how to use the UPC knowledge at RHIC and LHC for physics studies at EIC? Elke Aschenauer (Brookhaven National Lab) and Christian Weiss (Jefferson Lab) discussed this question in detail in their talks, while Michael Lomnitz (Lawrence Berkeley National Lab) focused on recent progress on STARLIGHT and its upgrade to include an electron-ion mode.

The INT workshop took place one week after the Quark Matter conference held in Chicago 5-11 February 2017. The recent results at RHIC and the LHC presented at QM were discussed in detail at the INT workshop. In particular, the latest results on vector meson photoproduction were presented by the ALICE, CMS and STAR collaborations. First results on photonuclear jets were presented by ATLAS. The experimental presentations were followed by a panel discussion featuring the speakers and other experimentalists from RHIC and LHC participating at the workshop. ALICE and STAR showed a clear shadowing contribution observed in coherent ρ^0 production, and larger than that expected in the standard Glauber picture. STAR also presented first results on the t -distribution of ρ^0 photonuclear production. Also, the ALICE and CMS data on coherent J/ψ production were both found to be inconsistent with calculations that neglect nuclear gluon shadowing. ATLAS results on UPC jets will provide additional constraints on the nuclear PDFs in kinematic regions different from those explored by exclusive vector meson photoproduction and inclusive jet production at the LHC. The STAR talk was given by Jarda Adam (Creighton), the ATLAS talk by Aaron Angerami (Columbia), the ALICE talk by Evgeny Kryshen (Petersburg Nuclear Physics Institute), and the CMS talk by Michael Murray (Kansas).

Although most of the LHC and RHIC studies have been exploratory so far, it was clear from the workshop that forthcoming measurements are moving towards precision measurements for some observables, and that theoretical predictions are required to be of equal precision.

Talks related to the gluon saturation phenomena were given by Anna Stasto (Penn State), Piotr Kotko (Penn State), Amir Rezaeian (Universidad Tecnica Federico Santa Maria), and Heikki Mäntysaari (Brookhaven National Lab). New results on how to use photon-nucleons (nucleon) scattering to study jet photonuclear production and two-particle corrections were presented.

Studies on diffraction phenomena and color fluctuations were discussed by Mark Strikman (Penn State) and Leonid Frankfurt (Tel Aviv), and Misak Sargsian (Florida International) focused on large- x physics. Boris Blok (Israel Institute of Technology, Technion) presented his

studies on photonuclear data and multiparticle interactions. Heavy quark hadronization models were discussed by Guangyao Chen (Iowa State), Wolfgang Schaefer (Cracow Institute of Nuclear Physics), and Beatriz Gay Ducati (Instituto de Fisica UFRGS).

New observables related to quantum tomography and polarization were presented by John Ralston (Kansas) and Dennis Sivers (Portland Institute & Michigan University) discussed polarization and chiral effects. Maria Elena Tejada-Yeomans (Universidad de Sonora) discussed azimuthal angular correlations of three partons in inclusive DIS to explore the dynamics of saturated partonic matter and first steps to measure this process in UPCs.

The workshop proved to be beneficial for identifying and working on some of the challenging aspects of the theory for RHIC and LHC measurements, in anticipation of the EIC. The excellent talks and the ample time for discussion made the meeting very productive and enjoyable. Since this field is becoming more mature and moving into new searches for saturated QCD matter and precision observables, a White Paper will be prepared to describe the opportunities and challenges of this physics within nuclear science. This workshop promises a bright future for light-induced studies and searches for novel QCD phenomena in such theory-experiment networks.

11 State of the Laboratories

11.1 RHIC Run 17

(Communicated by Jamie Dunlop – dunlop@bnl.gov.)

The 17th run of RHIC began with collisions for physics measurements on 24 February 24 this year, and will continue until June. The main focus this year is to expand on the investigation of the spin structure of the proton, focusing on phenomena related to the components transverse to the direction the proton travels, in order to test, first, whether scaling of these processes with momentum transfer is understandable quantitatively, and, second, whether a fundamental prediction of a sign change between observables in proton-proton and electron-proton collisions can be seen.

A smaller amount of time will be dedicated to making cross section and spin asymmetry measurements at very forward angles, in order to improve hadronic interaction models for air showers and to further probe the origin of spin effects in forward neutrons. The run will end with the second year of dedicated time for a proof-of-principle experiment on Coherent Electron Cooling.

The run has begun with a high-statistics followup to the data set taken in 2011 with transversely polarized proton collisions at center of mass energies of 500 GeV. Recent advances in Quantum Chromodynamics have allowed for quantitative predictions on observables related to the Sivers function, one of the Transverse Momentum Distributions in the proton, both on their evolution with scale and sign. Due to the gauge invariance of the Sivers function, observables are expected to change sign between semi-inclusive deep inelastic collisions and proton-proton collisions, since the sensitivity to the Sivers function in one case is from final-state interactions while in the other case is from interactions in the initial state. This sign change is a fundamental prediction of perturbative QCD, so a test of this sign change is a test of the fundamental applicability of QCD to these processes.

STAR has made first measurements of the transverse single spin asymmetries in W production from a short portion of the 2011 run [Phys. Rev. Lett. **116** (2016) 132301], which favor a sign change, but a definitive answer calls for much more precise measurements. The 2017 run will provide more than an order of magnitude increase in statistical power in this measurement, and, also, thanks to improved instrumentation, allow for first measurements of the transverse single spin asymmetry of Drell-Yan pairs in the forward direction. The combination of the Drell-Yan and W measurements will allow an investigation of the evolution of the observables sensitive to the Sivers function over more than an order of magnitude scale difference in momentum transfer.

An instrument for precise measurement of the spectrum of forward neutrons has been moved from the LHC at CERN to RHIC for this year's run. This instrument will take data in concert with the STAR detector in specialized beam conditions, to measure the spectrum of forward neutrons, a key input into models of the development of air showers from high energy cosmic rays. Further, it will measure the detailed asymmetry of this spectrum with respect to the polarization direction of the proton beams, in order to constrain models of the origin of the large integrated asymmetry of these neutrons, which is critical for machine tuning. More importantly, the topic is not fully understood theoretically.

The run is expected to end with the planned second year of the proof-of-principle experiment on Coherent Electron Cooling, begun last year. This new collider technology, essentially an extremely high bandwidth approach to the successful stochastic cooling technology already implemented at RHIC, forms a key piece of the current thinking behind the possible implementation of the Electron-Ion Collider using the RHIC complex. In order to prove its use in a collider environment, a prototype system has been built and installed at one of the unused interaction points at RHIC. This system will run in a realistic environment in order to prove the principles of its operation and to use lessons learned in the experiment as input into the design of the full system envisioned for an Electron-Ion Collider.

11.2 The Year 2016 at Jefferson Lab

(Communicated by Bob McKeown – bmck@jlab.org)

The 12 GeV upgrade project is essentially complete, except for delivery and commissioning of the solenoid magnet in Hall B (delivery is now expected in May 2017). CEBAF beam was successfully delivered to Halls A, B, and D during 2016 and we expect to achieve full operation in 4 experimental halls by the end of 2017. Hugh Montgomery is stepping down as Laboratory Director and will be succeeded by Stuart Henderson who will arrive at the Laboratory in April 2017.

12 GeV Upgrade Status

Hall B: The newly-constructed torus magnet for CLAS12 reached the full design current of 3770 A on 4 November without any quenches of the magnet. After a period at this top field, the current was reduced to 3000 A and a field map made in all six sectors at four positions each as well as in the bore of the magnet. The latter helps identify any small misalignment of the six coils. Gap to gap variation of the field was less than 1%, remarkable for a magnet of this scale. The installation of the drift chambers was then completed and the Forward Carriage, which includes the Calorimeters, Forward Time-of-Flight and Low Threshold Cerenkov counter, was rolled into its operating position. In parallel, the Central Time of Flight

was installed, followed by installation of the High Threshold Cerenkov counter and Silicon Vertex Tracker, remaining elements of the beamline, a pair of carbon filament targets and a few items of shielding. A short period of beam commissioning with 6.4 GeV electrons followed and final approval to operate CLAS12 with beam was obtained. The beam commissioning run took place from 3-6 February (over a weekend, naturally), with the preparatory calibration work having been done so well that a first neutral pion mass spectrum was available within an hour. A full series of plots demonstrating all detectors timed in, particles tracked from the target through the spectrometer, and particle identification working well was submitted to DOE the day after the run ended. Approval was obtained from DOE on 7 February that the Key Performance Parameters for Hall B had been successfully demonstrated.

Hall C: The remaining three superconducting magnets for the Super High Momentum Spectrometer were all installed and commissioned between October and February. The two Quadrupoles arrived from the vendor fully assembled, needing connections to cryogenics services and their power supplies after they were placed in their steel yokes. The large Dipole arrived 31 October at JLab and required the addition of its cryogenic control reservoir and final vacuum cryostat closure before it could be commissioned. All three magnets reached full design current and a few percent more, with the Dipole reaching full current February 27. The detectors, including the Shower Counter, Pre-Shower Counter, Scintillator and Quartz-bar Hodoscopes, Heavy-Gas Cerenkov counter and Drift Chamber planes, had been installed and tested with cosmic rays in the spectrometer detector hut. Once the Dipole testing was complete, the Noble-Gas Cerenkov counter could be put back in its place just downstream of the Dipole exit window and the detector hut closed. The beamline and target were prepared, all SHMS magnets were set for 3 GeV/c central momentum, and permission was obtained to operate Hall C for beam. The beam commissioning run with 6.4 GeV electrons took place from 7-10 March, and first tracks were seen in the detectors quickly. A full series of plots demonstrating all detectors timed in, particles tracked through the entire detector package, and electrons identified in both Cerenkov counters was submitted to DOE once the run ended. Approval was obtained from DOE 14 March that the Key Performance Parameters (KPP) for Hall C had been successfully demonstrated. This brought to a successful conclusion the KPP demonstration for the 12 GeV Project.

Accelerator: The 750 MHz RF separators needed for simultaneous 4 hall operations were demonstrated to successfully achieve the required amount of beam separation. Following the test there was a vacuum leak due to a bellows failure, which has since been repaired. It is expected that CEBAF is now capable of simultaneous 4 hall operations.

Hall A

Two experiments were run during 2016 in Hall A at Jefferson Lab. One, Experiment E12-06-114, will measure the absolute helicity-dependent and helicity-independent cross sections for the Deeply Virtual Compton Scattering (DVCS) process as functions of four momentum transfer Q^2 for several values of the deep inelastic scaling variable Bjorken x , with 4% systematic uncertainty and similar statistical uncertainty. The 2016 run completed the first Phase of this experiment (50% of the data collected). These data will provide stringent scaling tests of the real and imaginary parts of the DVCS amplitude, over a much larger kinematic domain than has previously been achieved. The DVCS amplitude provides access to the Generalized Parton Distribution (GPD) functions, which in turn allow the exciting possibility of determining the spatial distribution of quarks and gluons in the nucleon as a function of their wavelength. In parallel, an experiment to precisely map the protons magnetic form factor up to the highest Q^2 reachable at JLab was run in 2016.

The brief Spring 2017 run provided data for a third experiment to be completed in Hall A. Experiment E12-14-012, “Measurement of the Spectral Function of ^{40}Ar through the $(e, e2p)$ Reaction” will provide the only available high statistics sample of electron scattering, single nucleon knockout data for Argon, experimental input indispensable to constructing the spectral function. Besides yielding previously unavailable information on nuclear structure and dynamics, this fundamental information is needed to achieve a quantitative description of neutrino-nucleus cross sections in the kinematic regimes relevant to upcoming and future neutrino experiments such as the Deep Underground Neutrino Experiment (DUNE). In addition, the analysis of these data will promote further theoretical developments, such as the description of final-state interactions, necessary for the correct interpretation of events collected by these neutrino experiments.

Hall B

The Heavy Photon Search experiment received 2.2 GeV beam at the end of the spring 2016 run, running on weekends only to enable CLAS12 construction activities during the week.

During the summer of 2016, an experiment to measure the proton radius in elastic electron-proton scattering (PRad) was installed. This experiment, which will provide data a lower momentum transfer than previous experiments, received beam for 4 weeks at 1.1 and 2.2 GeV energies.

Hall D

The GlueX engineering run was completed in spring 2016. In fall 2016, a week of beam delivery to Hall D/GlueX allowed check out of one of two new 50 micron thick diamonds, of massive changes made in the DAQ and electronics towards a robust and efficient DAQ system (now doubling our capacity of Level-1 trigger rates), and tests towards a basic software (level-3) L3 trigger up to rates of 70 kHz. The latter test was to better benchmark the computer requirements to fully implement the L3 trigger. This engineering week made it possible to expedite the start of the GlueX physics run in 2017.

2017 Schedule

In spring 2017 Hall A ran the Argon spectral function measurement and Hall D acquired additional GlueX data. The fall 2017 schedule is quite uncertain since we do not know the FY18 DOE budget. However, we hope to realize the start of the ^3H program in Hall A and an engineering run in Hall B followed by the commissioning experiment (part of run Group A). Hall C will calibrate the Super High Momentum Spectrometer (SHMS), recommission the High Momentum spectrometer (HMS) and follow with the set of commissioning experiments chosen by Hall C. Hall D will continue the GlueX run started in the spring.

Other Projects

The Super BigBite Spectrometer construction is essentially complete, with final reporting and transition to operations documentation in progress.

The SoLID (Solenoidal Large Intensity Device) collaboration had a Directors Review 23-24 February 2015. The collaboration continues to work to improve the science case and is

addressing the recommendations of the review panel. The CLEO solenoidal magnet has been delivered to Jefferson Lab in anticipation of its use for SoLID.

DIRC bars from the Babar experiment at SLAC will become available for GlueX. This will enable GlueX to enhance its particle identification capability.

Installation of the DarkLight experiment at the Low Energy Recirculator Facility (formerly FEL) was accomplished in summer 2016, followed by a short commissioning run.

A Directors Review of the MOLLER experiment was held on 15-16 December 2016 to assess the scientific, technical, cost and schedule status of this potential future project. The review committee contained 8 external reviewers and 5 internal reviewers and was chaired by Prof. Doug Beck from the University of Illinois. MOLLER has received CD-0 approval from DOE but is presently in a paused state due to budgetary uncertainty.

Program Advisory Committee

PAC45 will be held the week of 10 July 2017, and will review newly submitted proposals, letters of intent, and previously conditionally-approved proposals. Proposals are due 8:00 a.m. EDT (Eastern Daylight Time) on Monday, 22 May 2017. Additional information is available at <https://www.jlab.org/exp-prog/PACpage/PAC45/PAC45.html>.

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12 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 John Arrington (johna@anl.gov) or Mark Manley (manley@kent.edu).

The following list is based on Mark's page:

- <http://www.dis17.org> DIS'17: 25th International Workshop on Deep-Inelastic Scattering and Related Topics (Birmingham, UK, 3-7 April 2017)
- <https://www.bnl.gov/sdim17/> Saturation: Recent Developments, New Ideas and Measurements (Brookhaven National Laboratory, Upton, NY, USA, 26-28 April 2017)
- INT-17-1b: Precision Spectroscopy of QGP Properties with Jets and Heavy Quarks (INT, Seattle, WA, USA, 1 May - 6 June 2017)
- <https://www.jlab.org/conferences/trends2017/> Trends 2017: Future Trends in Nuclear Physics Computing (Newport News, VA, USA, 2-5 May 2017)
- <https://www.jlab.org/conferences/qcd-evolution2017/index.html> QCD Evolution Workshop 2017 (JLab, Newport News, VA, USA, 22-26 May 2017)
- <https://indico.mpp.mpg.de/event/5222/> Workshop on Prospects for a Very High Energy ep and eA Collider (Munich, Germany, 1-2 June 2017)

- <http://wdb.ugr.es/lattice2017> Lattice 2017: *35th International Symposium on Lattice Field Theory* (Grenada, Spain, 18-24 June 2017)
- <https://nuint2017.physics.utoronto.ca> NuInt 2017: *11th International Workshop on Neutrino-Nucleus Interactions in the Few-GeV Region* (Toronto, Canada, 25-30 June 2017)
- <https://www.bnl.gov/pppa17/> Synergies of *pp* and *pA* Collisions with an Electron-Ion Collider (Brookhaven National Laboratory, Upton, NY, USA, 26-28 June 2017)
- <https://indico.mitp.uni-mainz.de/event/86/> PhiPsi17: *International Workshop on e^+e^- collisions from Phi to Psi* (Mainz, Germany, 26-29 June 2017)
- <http://einrichtungen.ph.tum.de/T30f/tumqcd/school/index.html> JOINT FGZ-PH Summer School on Methods of Effective Field Theories & Lattice Field Theory (Munich, Germany, 26 June - 7 July 2017)
- <https://indico.cern.ch/event/576735/> SQM17: *17th International Conference on Strangeness in Quark Matter* (Utrecht, The Netherlands, 10-15 July 2017)
- <https://sites.google.com/site/nnpss2017/home> NNPSS 2017: National Nuclear Physics Summer School (Boulder, CO, USA, 9-22 July 2017)
- <https://www.physics.smu.edu/scalise/cteq/schools/summer17/> CTEQ School on QCD and Electroweak Phenomenology (Pittsburgh, PA, USA 18-28 July 2017)
- <http://consorzio-fisica-trieste.it/evento/electron-ion-collider-eic-user-group-meeting/> EIC Users Group Meeting (Trieste, Italy, 19-22 July 2017)
- <https://indico.cern.ch/event/588176/> CPOD 2017: *11th Critical Point and Onset of Deconfinement* (Stony Brook, NY, USA, 7-11 August 2017)
- <http://nstar2017.physics.sc.edu/> NSTAR 2017: *11th International Workshop on the Physics of Excited Nucleons* (Columbia, SC, USA, 20-23 August 2017)
- <http://indico.ihep.ac.cn/event/6581/> APFB-2017: *Seventh Asia-Pacific Few-Body Conference on Problems in Physics* (Guilin, China, 25-29 August 2017)
- INT-17-3: Spatial and Momentum Tomography of Hadrons and Nuclei (INT, Seattle, WA, USA, 28 August - 29 September 2017)
- <https://www.jlab.org/conferences/JPOS2017/> JPos'17: *International Workshop on Physics with Positrons at Jefferson Lab* (Newport News, VA, USA, 12-15 September 2017)
- <http://lcconference.mu.ac.in/> Light Cone 2017: *Frontiers in Light Front Hadron Physics: Theory and Experiment* (University of Mumbai, Mumbai, India, 18 - 22 September 2017)
- <http://hadron2017.usal.es/> HADRON 2017: *17th International Conference on Hadron Spectroscopy and Structure* (Salamanca, Spain, 25-29 September 2017)
- <http://itp.phy.pku.edu.cn/conference/qwg2017/> QWG12: *12th International Workshop on Heavy Quarkonium* (Beijing, China, 6-10 November 2017)
- <https://www.jlab.org/conferences/hyp2018> HYP 2018: *13th International Conference on Hypernuclear and Strange Particle Physics* (Norfolk, VA, USA, 24-29 June 2018)

- <http://www.pa.msu.edu/conf/Lattice2018/> Lattice 2018: *36th International Symposium on Lattice Field Theory* (East Lansing, MI, 22-28 July 2018)

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

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