GHP Newsletter March 2020

American Physical Society Topical Group on Hadronic Physics

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

Executive Officers

Chair	*Chair-Elect*	*Vice-Chair*
Garth Huber	Ian Cloët	Dave Gaskell
huberg@uregina.ca	icloet@anl.gov	gaskelld@jlab.org

Past-Chair	*Secretary/Treasurer*	*Members at Large*	
David Richards	Ramona Vogt	Tim Hobbs	Phiala Shanahan
dgr@jlab.org	rlvogt@lbl.gov	tjhobbs@mail.smu.edu	phiala@mit.edu

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/.

Contents

1 Elections **2**

2 Membership **3**

3 Fellowship **5**

4 Dissertation Award **6**

5 Covid-19 and APS **6**

6 GHP Program at the APS April Meeting, 2020 **7**

6.1 GHP invited: 8

6.2 Other invited sessions of interest for GHP members: 8

6.3 GHP contributed sessions: 9

6.4 Other sessions that may be of interest to GHP members: 9

7 GHP 2021: 9th Workshop of the GHP **10**

8 Bylaws Revision, Upcoming Special Election **10**

9 APS Annual Leadership Meeting **11**

10 Advocacy **16**

11 Highlights from DOE Topical Collaborations **17**

11.1 The Beam Energy Scan Theory (BEST) Collaboration 18

11.2 The TMD Collaboration 20

12 State of the Laboratories **22**

12.1 RHIC Run 20 22

12.2 The Year 2019 at Jefferson Lab 23

13 Meeting Summaries **25**

13.1 LPC Workshop on Physics Connections between the LHC and EIC 25

14 Forthcoming Hadron Physics Meetings **26**

---

1 Elections

There was an unexpected and regrettable delay in the nomination process for the 2019 election. The GHP Executive Committee worked with APS staff to get the election underway as soon as possible after the delay.

The election was completed on 27 March. The winners were Dave Gaskell, Jefferson Lab, as Vice Chair and Phiala Shanahan, MIT, as Member-at-Large. We welcome them to the Executive Committee and thank the other candidates for their willingness to run.

The 2019 Nominating Committee was:

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

Elections will be held for two posts in the GHP Executive (Vice Chair, and Member-at-Large) in 2020. David Richards (Past Chair) and Timothy Hobbs (Member-at-Large) will have completed their terms. In addition, the next election should include candidates for a new position on the Executive Committee, a student/early career member, see Sec. 8 for more details.

We urge GHP members now to begin considering whom they would like to see filling the two open positions in 2020 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.

Our rules state that: *the Committee shall recommend to the Executive Committee for approval at least two candidates for each open position; the slate of candidates will be balanced as much as possible to ensure demographic diversity and 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.*

In 2020, the Chair of the Nominating Committee will be

David Richards (dgr@jlab.org)

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

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

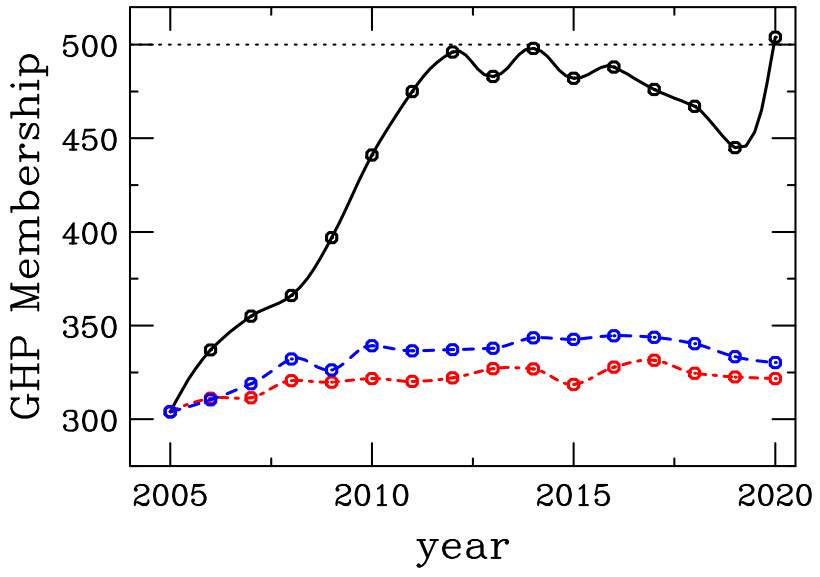

Figure 1: Solid line GHP membership, absolute value, with 2020 representing the APS Official Count at the beginning of 2020; dashed DNP membership normalized to GHPs value in 2005 (2401 $\longrightarrow$ 304); and dot-dashed DPF membership normalized to GHPs 2005 value (3291 $\longrightarrow$ 304).

GHP membership had been in decline since 2014, dropping to a decadal low of 445 members at the start of 2019. As a result, GHP was able to only propose ONE Fellow candidate in 2019. This was a frustration for the Fellowship Committee because there were a number of outstanding nominations in 2019 and is just one illustration of how a decline in membership hurts Topical Groups.

The Executive Committee worked very hard in 2019 to try and turn things around, not only

to be able to get back to two Fellowship nominations but also to prevent a decline in our impact on the April meeting. Letters from the Executive Committee were sent to the JLab User's Group, the RHIC-AGS User's Executive Committee, and the EIC User's Group for circulation among the membership explaining the benefits of joining GHP. We also had a membership drive at the 2019 April meeting and had APS reach out to lapsed members. With this concerted effort, the GHP membership at the beginning of 2020 was up to 504, the first time membership has risen above 500 at the start of a calendar year.

We thank members who have rejoined and also our new, first time members. We are glad you have joined and look forward to meeting many of you at the 2021 GHP meeting in Sacramento, CA.

Given the large User Groups associated with RHIC, Jefferson Lab, Fermilab, EIC, and more, we hope to sustain and further grow GHP membership. 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. We also encourage members to post copies of the promotional slide we have prepared at conferences or include it in talks. The slide, shown in the November 2019 newsletter, is available by request from ghpexec@anl.gov.

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 holding a biennial meeting, which is very well attended by the broad hadronic physics community. To ensure that the significant impact of GHP continues, it is crucial to sustain and grow our GHP membership.

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 the forthcoming GHP 2021; the preparation and publication of manuscripts that support and promote the GHP's activities; and participation in those fora that affect and decide the direction of basic research.

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 transitioned to Division status in 2019, after only 4 years. There are currently thirteen Topical Groups, with the Topical Group on Data Science established in 2019. With the new members joining last year, GHP is now eighth in size, with Few Body Systems, Medical Physics, Plasma Astrophysics, Physics of Climate and Shock Compression at lower membership levels. Of the Divisions, Nuclear Physics and Particles & Fields have most overlap with the GHP membership. We typically share invited session sponsorship with DNP at the April meeting but have also partnered with the Divisions of Astrophysics and Computational Physics in invited sessions.

Of our members, 65% are regular or senior members while 29% are in the student or early career category. In terms of gender diversity, 13.3% of members indicate "female" as their gender. About 3.2% of GHP members declined to state a gender.

---

3 Fellowship

The Executive Committee would like to remind the GHP membership that each year the APS allocates a number of Fellowship Nominations to a Topical Group. That number is based primarily on membership. The rubric excludes student members and current Fellows in the membership count to obtain eligible members. Since we are again in the neighborhood of 500 members, we are allocated TWO Regular nominations for 2020. Thanks to our new and returning members for making this possible.

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

Note that one does not have to be a Fellow to nominate a colleague for Fellowship.

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 3rd June 2019

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

The Vice-Chair will form the Fellowship Committee soon after the virtual April meeting. See the Committees tab on the GHP website,
https://www.aps.org/units/ghp/governance/committees/index.cfm, in early May 2020 to find out who is serving on the GHP Fellowship Committee.

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. The diversity of the Fellow candidates should reflect the GHP as a whole, both in terms of gender and in terms of physics interests.

---

4 Dissertation Award

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 currently a biennial prize of $ 1000 and a travel allowance of up to $ 1500. We are in the process of raising funds to increase the Award to $ 1500 to match current APS guidelines for Dissertation Awards. Concurrently, we are hoping to increase the frequency of the Award from biennial to annual, see the November 2018 newsletter for more details concerning our efforts.

To donate to the fund, please see the APS donation page, https://www.aps.org/memb-sec/donation/DonationFunds.cfm and select "Dissertation Award in Hadronic Physics". Once can also send a check payable to American Physical Society at:

APS Development Office
One Physics Ellipse
College Park, MD 20740

Please note, "GHP Dissertation Award" in the memo field. For more information on about making a gift, please reach out to Mariam Y. Mehter, APS Campaign and Donor Relations Manager at (301) 209-3639 or mehter@aps.org.

---

5 Covid-19 and APS

As this newsletter is in the process of production, the situation with the novel coronavirus has been evolving, with new cases and travel restrictions increasing. Indeed, the US is, as of this writing, becoming the latest pandemic hot spot with shelter in place orders common. Many universities are closed for classroom teaching, instead conducting classes online. National laboratories in many locations are encouraging teleworking with only minimal staff on site to carry on mission critical work.

In fact, very late on 29 February, the APS took the precautionary step of canceling the March meeting, set to begin in Denver on 2 March. Attendees were notified immediately of the decision as soon as it was made. On 1 March, APS leadership was informed of the decision and how it was reached. An email to all APS members explaining the decision was sent out on 2 March.

As that email explained, a number of participants from countries such as China where the virus had spread had already canceled. Travel to the US from these countries was already restricted. The APS was also concerned that some participants from countries where the situation was worsening would end up stuck in the US, unable to go home or placed under quarantine.

In addition, in a conference of 10,000 participants, it is likely that some participants will become ill, regardless of whether or not the illness is associated with Covid-19, perhaps leading to quarantine of a significant number of meeting participants. Social events would

have to be canceled to avoid potential contamination and spread of disease. (Think of shared serving utensils in a buffet line.)

APS will bear significant costs due to this unprecedented cancellation but, as reported in Sec. 9, the APS is in good financial shape. It was felt that the health and safety of members and other participants was of more importance.

We ask that our members exercise due caution to avoid becoming ill, as one would in a normal bad flu season. Wash your hands, cover your sneezes and coughs, avoid touching your face, and practice social distancing.

As the situation continues to evolve, the fate of other meetings and conferences, not just APS meeting, will be uncertain. Indeed the in-person April meeting was already canceled on 12 March. While we provide a list of upcoming conferences and workshops in this newsletter, not all of them will go on as scheduled. Some will be, or have already been, canceled while others may change from an in-person meeting to a virtual setting. Monitor the situation, as we intend to do also, and we will keep GHP members informed as much as possible.

---

6 GHP Program at the APS April Meeting, 2020

Washington DC
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.

Although an in-person meeting is canceled for this year, the APS is working toward holding the April meeting as a virtual meeting. Given the fact that, as of the cancellation date, there was still nearly a month before the meeting was due to start, this might be possible. A virtual meeting may allow others to attend the sessions and listen to the talks than at the meeting itself. We are posting the GHP-related program content here and will inform members when the arrangements for the talks are known. We also plan to hold the business meeting remotely. Watch for an email with the necessary information to follow the April meeting virtually.

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

The Program Committee has prepared an excellent program for the April 2020 meeting. There will be two invited sessions co-sponsored with DNP, one standalone GHP invited session, and one GHP Mini-Symposium associated with the invited session. In addition, there will be three GHP-sponsored contributed sessions.

We also point out some other invited and contributed sessions that may be of interest to GHP members at the April meeting.

6.1 GHP invited:

GHP: Exotic Hadrons
Session B07, Saturday 18 April 10:45-12:33, Chair: Jake Bennet (Mississippi)

- Eric Swanson (Pittsburgh) *What do Exotic Hadrons Require of Theory?*
- Ryan Mitchell (Indiana) *Exotic Mesons at Electron-Positron Colliders*
- Daniel Craik (MIT) *Exotics at Hadron Machines*

GHP: Mini-Symposium: Science Opportunities Enabled by the Electron-Ion Collider
Session C14, Saturday 18 April 13:30-15:18, Chair: Ernst Sichtermann (LBNL)

- Invited speaker: Rolf Ent (Jefferson Lab) *EIC Science Overview*
- Six contributed talks on EIC Science

GHP/DNP: The Hadronic Spectrum in Hot and Cold QCD
Session G07, Sunday 19 April 08:30-10:18, Chair: Anne Sickles (Illinois)

- Claudia Ratti (Houston) *The Hadronic Resonance Spectrum and QCD at Finite Temperature and Density*
- Jozef Dudek (William and Mary) *The Hadronic Resonance Spectrum at Zero Temperature*
- Anders Knospe (Houston) *Resonance formation in heavy-ion collisions*

DNP/GHP: Electron-Ion Collider Science
Session H04, Sunday 19 April 10:45-12:33, Chair: Rolf Ent (Jefferson Lab)

- Alexei Prokudin (Penn State Berks) *Spin physics at the Electron-Ion Collider*
- Anna Stasto (Penn State) *Gluon saturation at EIC*
- Thomas Ullrich (BNL) *EIC Detector Requirements and R&D*

6.2 Other invited sessions of interest for GHP members:

FIP: Nuclear Physics with Accelerators - Nuclear Physics
Session D07, Sunday 18 April 15:30-17:18, Chair: Elena Aprile (Columbia)

- Silvia Dalla Torre (CERN) *An Electron-Ion Collider: Physics Challenges and Opportunities*
- Marek Lewitowicz (GANIL and NuPECC) *The Roadmap of Nuclear Physics in Europe*
- Yasuhiro Okada (KEK) *Prospect of Accelerator-based Nuclear and High Energy Physics Programs in Asia*

DNP/DCOMP: From Quarks to the Cosmos
Session R04, Monday 20 April 13:30-15:18, Chair: Peter Petreczky (BNL)

- Huey-Wen Lin (Michigan State) *Overview of Lattice Calculations of Hadron Structure*
- Michael Wagman (Fermilab) *Nuclei from lattice QCD*
- Rasmus Larsen (BNL) *QCD at non-zero temperature and density*

DNP: Polarization and the QCD Nuclear Medium
Session Y04, Tuesday 21 April 13:30-15:18, Chair: Brad Sawatzky (Jefferson Lab)

- Phiala Shanahan (MIT) *Medium modification of nuclear currents*
- Douglas Higinbotham (Jefferson Lab) *Effective Neutron Polarization in Helium-3*
- Xiaochao Zheng (Jefferson Lab) *Nucleon spin structure results from Jefferson Lab*

6.3 GHP contributed sessions:

GHP: Heavy Flavor and Exotic Hadrons
Session D14, Saturday 18 April 15:30-17:18, Chair: Tim Hobbs (SMU)

GHP: Nucleon Structure and Nucleon Spin
Session J16, Sunday 19 April 13:30-14:54, Chair: Garth Huber (Regina)

GHP: Theoretical Approaches in Hadronic Physics
Session L16, Sunday 19 April 15:30-16:42, Chair: Ramona Vogt (LLNL and UC Davis)

6.4 Other sessions that may be of interest to GHP members:

DNP: Hadronic Physics
Session G14, Sunday 19 April 08:30-9:54, Chair: TBD

DNP: Mini-Symposium on Nuclear Femotgraphy
Session L12, Sunday 19 April 15:30-17:06, Chair: Latifa Elouadrhiri (Jefferson Lab)

- Invited speaker: Charles Hyde (Old Dominion) *Challenges and Opportunities in Nucleon and Nuclear Femtography*

DNP: Heavy Flavor and the Initial State in Heavy-Ion Collisions
Session Q18, Monday 20 April 10:45-11:57, Chair: Anders Knospe (Houston)

We also point out that the talk by Larry McLerran (Seattle) in the Tuesday morning plenary session, *20 Years of RHIC and Beyond*, was proposed by the GHP.

Finally, we will have a business meeting on Sunday evening, 19 April, at 18:30. The schedule is as follows:

- Welcome (Garth Huber): 5 min
- EIC status and outlook (Bernd Surrow, EIC User's Group): 20 min
- GHP Activities (Garth Huber): 10 min
- Secretary-Treasurer's Report (Ramona Vogt): 10 min
- Bylaws Changes (Ramona Vogt): 10 min

- Fellowships and Prizes (Ian Clöet): 10 min
- Encouraging participation in GHP Elections (David Richards): 5 min
- Discussion, Questions, Other business (all): 10 min

---

7 GHP 2021: 9th Workshop of the GHP

It is not too early to remind members of the Ninth Workshop of the APS Topical Group on Hadron Physics coming in 2021. It will be held the three days immediately prior to the April APS meeting in Sacramento, CA. Save the dates:

14-16 April 2021

for our next workshop. The meeting will be held at the newly-reopened Sacramento Convention Center, in downtown Sacramento. Further details, including members of the Program Committee, meeting topics, and the workshop website will be forthcoming in the November newsletter.

---

8 Bylaws Revision, Upcoming Special Election

The GHP will hold a special election soon after the April meeting to ratify proposed modifications to the GHP Bylaws. Although the GHP bylaws were amended as recently as May 2016, the APS Council mandated last year that all units include a student/early career member in their Executive Committee by October 2020. To make that mandate a reality requires an amendment specifying the addition of the new Executive Committee member, along with their term of service.

All proposed changes will be reviewed by the APS Governance Committee before being presented to the APS Council for approval.

While different units have set different terms for this new Executive Committee member, we have decided to add a student/early career Member-at-Large who will serve a one year term of office. The one year term is to place less of a burden on young members.

In addition, we have decided to codify in the bylaws, as a best practice, that appointed committee membership must be approved by the Executive Committee after a committee Chair has proposed members. The Executive Committee will also approve the slate of candidates selected by the Nominating Committee.

We have also made the bylaws more inclusive by using gender neutral language.

Finally, as per governance best practices, we will replace "CEO" with the appropriate APS staff contact throughout the document. Look for an announcement of the special election soon after the April meeting.

---

9 APS Annual Leadership Meeting

(Communicated by Ramona Vogt rlvogt@lbl.gov and Ian Clöet icloet@anl.gov.)

The 2020 APS Annual Leadership Meeting was hosted in downtown Washington, D.C. January 29th – February 1st. Ian (Chair Elect) and Ramona (Secretary-Treasurer) attended the 2020 APS Annual Leadership Meeting. The meeting is an expansion of the previous unit leadership meeting. In addition to unit officers, who have generally attended the convocation, committee chairs and student ambassadors were also invited and followed different tracks on Friday, after the APS Annual Business Meeting. The meeting was expanded to bring attention to forefront physics and science policy in Washington DC with access to policy makers and international leaders.

After the Congressional visits, which we were unable to attend, there was a welcome reception on Wednesday evening with Ernest J. Moniz as guest speaker. Thursday APS held an International Leadership Forum, focusing on both international collaboration and competition and how the two can reasonably coexist and still make scientific progress. Steven Chu was keynote speaker in the morning session. The APS medal and prize ceremony was held Thursday evening honoring Myriam Sarachik, winner of the APS Medal for Exceptional Achievement in Research; Joel Primack, winner of the Julius Edgar Lillenfeld Prize; and Norman Yao, winner of the George E. Valley Jr. Prize.

APS Business Meeting

Friday was devoted to the APS Annual Business meeting in the first part of the morning, followed by discussion of APS programs and procedures for the remainder of the day.

CEO's remarks

In Kate Kirby's CEO address, we learned that she is stepping down as CEO at the end of 2020. A search committee has been formed to find a replacement.

The membership of APS is strong, with 55K members and 49 units, including a new topical group on data science and the forum on diversity and inclusion. The APS March meeting had 12,000 attendees at the 2019 meetings.

The strategic plan was rolled out in 2019. In this first year, the organization developed policies according to the plan. For example, 2019 was the first year of the Innovation Fund designed to support initiatives in support of the strategic plan. The idea was to fund 3-4 grants of up to $100/year for two years. In the first year, the APS received more than 100 pre-proposals. Of those asked to submit full proposals, four were funded. These were: more humane APS meetings through machine learning (improved individualized scheduling at large meetings); formation of an APS inclusion, diversity and equity alliance; informing and activating the US physics community in nuclear threat reduction; and US-Africa initiative in electronic structure. There is already another call out for new pre-proposals for the 2020 Innovation Fund grants. The APS will continue to roll out other initiatives aligning with the Strategic Plan in 2020.

The APS has formed an ethics committee. The first meeting was in June 2019, followed by a second in October. The policy focus has developed through surveys of APS members and Physics Department Chairs. They are in the process of determining procedures and policies on reviewing and adjudicating ethics cases. One issue being discussed specifically at the leadership meeting was a policy concerning potential revocation of prizes and awards for ethics violations. These considerations would also extend to nominees for unit offices, board and council members, and potentially committee chairs. The policy and the language is still under

development. See the ethics policy at https://www.aps.org/policy/statements/19_1.cfm.

Treasurer's report

The treasurer's report indicated that the APS funds are in good shape. The investment performance was very strong in 2019. There were also fewer expenses than anticipated in 2019 in part due to delays in hiring. Those positions will be filled in 2020 but, because of this, the APS did not need to draw on its reserves as expected.

He indicated that staff costs make up 53% of the budget. Wage pressure is growing at APS so they are taking on a more competitive compensation policy. In addition, the threat of open access and "read and publish" looms larger every year. This is a very real threat to revenue and expenses. Thus the APS is looking for ways to increase philanthropic efforts.

Report from Speaker of the Council

Andrea Liu, current speaker for the council, made some remarks next. She noted that we live in times of increasing anxiety, especially for early career physicists wondering if a career path can be found. She asserts that women, underrepresented minorities, LGBTQ+ members, and international members on temporary visas are extra worried that the political culture will spill into the academic sphere.

As far as APS, she asserts that communication between members is not good, she says that Council is one way for members to communicate. It's not clear how many members would consider communicating with their Councilor rather than APS directly but it's good to know that. (By the way, the current GHP Councilor is Elizabeth Simmons, Executive Vice Chancellor at the University of San Diego, evc@ucsd.edu.)

During her year as speaker for the Council, she wants to focus on a few specific issues: science policy; diversity, equity and inclusion; and meetings. There is a task force examining the March meeting to try and decide how to make that meeting better. She also suggested the need for more virtual workshops to try and meet and communicate without traveling to help mitigate climate change.

Update on Publications

Liu's remarks were followed by talks from Matthew Salter and Michael Thoennessen, the APS journals publisher and editor-in-chief respectively. The APS journals include 14 peer-reviewed titles, four of which are fully open access. In addition, Physical Review D and parts of Physical Review C and Physical Review Letters are participating in SCOAP^3. There were a record number of submissions to Physical Review journals in 2019 and more than 20,000 papers were published in a single year for the first time. Of these papers, 19% were through open access.

The APS journals are working toward taking some leadership in open access, partly with the new open access journal Physical Review Research (PRR). Between August and December 2019, there were 1336 submissions to PRR and 342 articles published. The publication criteria are aligned with Physical Review A, B, C, D, Fluids, Applied and Materials. Although PRR has its own Editorial Board, it shares editorial staff with the other journals.

The journals are essential to the APS mission to advance scientific discovery and research dissemination while supporting the research community. They are also adaptive, growing and diversifying to fit the changing landscape of scientific publishing by adding new journals, particularly open access or hybrid open access journals.

The model of growth and diversification is a longstanding one, 2020 marks 50 years since Physical Review split into Physical Review A, B, C and D. As part of the anniversary year,

there will be special invited journal sessions at the March and April meetings as well as at appropriate divisional meetings. In addition, each journal will highlight influential papers from past issues on their websites. APS is also launching a 50 for 50 campaign for its open access and hybrid open access journals, reducing the article processing charges, APCs, by 50% for the year.

The journals are also working toward positioning themselves for the future. They plan to hold discussion group sessions for early career scientists at APS meetings and other major conferences to collect input and feedback so that they can continue to optimally serve the community. They will host a conference on the future of research dissemination 10-12 June this year, check https://journals.aps.org/physics-next/ for an announcement.

Office of Government Affairs

The last speaker of the business meeting was Francis Slakey, the head of the APS Office of Government Affairs. His focus was on three percentages: 75%, 32% and 15%. The 75% refers to the percentage of undergraduate women in physics who have been harassed. (For details about this result as well as a complete report on the study, see L. M. Aycock *et al.*, Sexual harassment reported by undergraduate female physicists, Phys. Rev. Phys. Educ. Res. **15**, 010121 (2019) https://journals.aps.org/prper/abstract/10.1103/PhysRevPhysEducRes.15.010121.) The 32% refers to the percentage of international students who choose not to come and study in the US because they think that the US is unwelcoming. The 15% is the percentage increase in the global climate impact caused by methane after reassessment. These percentages represent the 3 biggest challenges that APS and the OGA is trying to deal with: harassment, international issues and climate change. These target challenges align with the APS values of diversity, inclusion and respect; cooperation and open collaboration; and truth and integrity.

He noted that HR36, the Combatting Sexual Harassment in Science Act, whose introduction last year was timed with the Congressional Visits Day during the Leadership Convocation, was passed last year. He remarked that 10,000 bills are typically introduced in Congress every year and less than 5% are passed. HR36 passed the House of Representatives in 200 days. The Forum on Graduate Student Affairs, FGSA, did a lot of work to garner co-sponsors for the bill and get it passed. It has yet to be taken up by the Senate but they hope that will eventually come. For more on this issue as well as how to advocate for the bill to become law, see the OGA site on harassment https://www.aps.org/policy/issues/harassment.cfm.

Now OGA is working on passage of the Keep STEM Talent Act. The passage of this act would change the perception international students have of their welcome. APS has found that international students are more inclined to come to the US to study if they have a chance to work and to stay. Working with Senator Durbin, they are trying to include a provision in the bill to make it possible for international students to stay after graduation and get a Green Card. To learn more about this issue and find other APS statements on the topic, see https://www.aps.org/policy/issues/immigration.cfm.

Slakey also noted that members of the APS Topical Group on Climate were instrumental in understanding the methane contributions to climate change and revising them upward. The OGA website https://www.aps.org/policy/issues/methane.cfm has more information about methane and climate change.

He finally remarked that the OGA's targets for policy and legislation align with the values fostered and promoted by APS: diversity, inclusion and respect; cooperation and open collaboration; and truth and integrity. For an overview of all APS efforts toward policy and

advocacy and what you can do, see https://www.aps.org/policy/.

Breakout session reports

After the business meeting, there were breakout sessions for unit leaders, board and committee members, and student leaders to meet with APS staff to learn about services including discussions on diversity; education and outreach; meetings; communication; membership; finances and other topics.

In the diversity discussion, it was noted that 20% of all physics PhDs go to women and 6% to go underrepresented minorities. This worse than in almost all other fields. It turns out that the biggest loss of women in physics is between high school and college. Nearly 50% of students taking physics in high school are women but this drops to 20% for physics majors in college. Interestingly, there is little attrition after that so that once someone enters a major they stick it out. The big challenge is to convince more young women transitioning from high school to college to consider physics as a major. The APS Step Up program prepares material for high school teachers to discuss careers in physics and tell about women in physics. We were told that when high school teachers implemented the program, more women and underrepresented minorities choose physics as a major.

In the education discussion, the moderators mentioned that less than 50% of high school physics and chemistry classes are actually taught by a teacher with a degree in the subject. Indeed, many high school physics classes are taught by teachers with life science degrees. This is different from social sciences, English, biology and math, where 70-80% of all high school teachers in these areas have a degree in the topic. Thus another area of focus is PhysTEC (Physics Teacher Education Coalition) where the goal is to educate more high school physics teachers. The moderators also noted that teachers make more money than students tend to think: the gap between starting salaries for teachers and entry level industry jobs is not as large as one might think. They have also made an effort to add Wikipedia pages for physicists, particularly for female physicists. At the 2019 March meeting more than 50 participants created or edited biographies of female and minority physicists. (Ramona made the point that the Wikipedia editors who make these pages should notify the subjects that they are doing so in case they have a problem with the idea.)

The most notable part of the communications discussion, at least for Ramona, was that GHP was called out specifically. We sent 13 emails in 2019 and zero unsubscribes or opt outs, apparently the only unit with that record, so thanks for paying attention.

Saturday morning ethics discussion

Saturday morning was devoted to discussions of behavior at meetings and actions proposed by the Ethics Committee.

Behavior at meetings

Hunter Clemens, the new APS director of meetings, spoke about harassment at meetings and the code of conduct. The goal of APS is for everyone who attends meetings to feel comfortable and safe. In the survey of meeting experiences 60% of respondents reported being harassed at a meeting at some point in their career (both men and women). Of these, 84% said the harasser commented on their appearance; 79% said they were leered at or stared at; 49% said they were asked for sex and 39% said they were touched, groped or grabbed. These numbers, particularly for those asked for sex or suffered unwanted touching, are unacceptable. Participation in meetings is crucial for career advancement in science and fears of harassment are a distraction and can prevent people from going to social events to avoid mingling in crowds.

To help improve the situation at meetings, the DNP has instituted an Allies program at their fall meetings, in addition to posting the code of conduct. The program was started because it was reported at DNP CEU (Conference Experience for Undergraduates) students were harassed at meetings to the point that they did not want to continue in the field. The DNP's response was to appoint an ad-hoc committee chaired by Filomena Nunes of MSU. The first Allies were introduced at the 2017 DNP meeting and the program has grown over the subsequent two years and is being adapted for other divisional meetings. Roxanne Springer, the new head of the Allies program spoke about it Saturday morning. (Full disclosure, Ramona did the Allies training in 2019 and participated in the program in the DNP Fall 2019 meeting in Crystal City, VA.) Among the recommendations by the Allies was to consider how and when alcohol should be provided (which could exacerbate some aggressive tendencies), better space for poster sessions to avoid crowding, and carefully choosing session chairs and giving the guidance to avoid harassment during sessions.

Potential new ethical guidelines

The rest of the morning was taken up by the discussion of the activities of the Ethics Committee, led by Michael Marder, Chair. The charge of the Ethics Committee was to propose and oversee implementation of ethics policies for APS, including developing the role and responsibilities of an APS Ombudsperson (not yet hired) and potential revocation procedures (not yet put into place).

APS has been using the ethics policies of the American Geophysical Union (AGU) and American Association for the Advancement of Science (AAAS) as guidelines to develop their own. See https://www.agu.org/Learn-About-AGU/About-AGU/Ethics and http://www.aaas.org/programs/fellows/revocation-process to learn more.

The AGU and AAAS have policies in place to cover prize and award nominations as well as candidates for office that allow revocation of prize or fellowship status if the winners have been found to have violated ethics policies. Candidates for prizes, awards, and unit officers would have to sign a professional conduct disclosure form while the nominator would also have to certify that they are unaware of any ethics violations on the part of their nominee. It would seem to be sound policy that unit officers, Fellows, and prize winners should uphold APS ethics standards and known violators should be disqualified from these positions and prizes.

There are many considerations that need to be though through before any policy is implemented. Revoking an award or Fellowship or disqualifying a candidate from running for office are all serious steps and the standard of evidence to back up such actions should be high. Other, perhaps less stringent, evidence may be required to restrict attendance of violators at meetings. One should also consider a "statute of limitations" on offenses.

The discussion concerning what APS policy should be and how it should be implemented was lively and, at times, contentious. The small group discussions were summarized and the feedback will be used to determine what will ultimately be put in place and how the directives are structured.

---

10 APS Members Take to Capitol Hill to Make Case for Science Policy

(Communicated by Tawanda W. Johnson, APS Office of Government Affairs Press Secretary tjohnson@aps.org. To get involved in APSs grassroots advocacy initiatives, contact Callie Pruett, Senior Strategist for Grassroots Advocacy, at pruett@aps.org.)

Nearly 70 APS members recently advocated for the Societys policy priorities on Capitol Hill during APSs annual Congressional Visits Day (CVD), and based on their feedback, the experience was positive and productive. The event was held just before the start of the APS Annual Leadership Meeting at the end of January.

Representing 26 states across the country, groups of these volunteers participated in nearly 100 meetings to make the case for science policy priorities determined by APS members and leadership. During the meetings, APS volunteers requested that members of Congress: support the Combating Sexual Harassment in Science Act; cosponsor the Keep STEM Talent Act; preserve methane emissions regulations for the oil and gas industry; introduce legislation to keep the Federal Helium Reserve open and create a robust helium recycling program; and include funding increases of at least 4 percent real growth for key science agencies during the fiscal year 2021 appropriations process.

During the Capitol Hill meetings, leaders of APS membership units shared personal stories related to these science policy issues and explained to the staffers how those stories affected their congressional members districts and states. Thirteen sitting members of Congress participated in the meetingsa record-number for the APS CVD.

“APS is once again elated to have our members advocate on crucial science policy issues that are not only beneficial to the physics community but to society as a whole. We are committed to being the leading voice for physics in the US, and that means supporting member engagement in effective science advocacy to help shape federal science policy,” said APS President Phillip Bucksbaum.

Shannon Swilley Greco, a science education senior program leader at Princeton Plasma Physics Laboratory, said she appreciated the opportunity to be “civically engaged.” She added, “I think I am a good ambassador for these issues, and I’d like to think I’m effective. And the experience helped me hone my communication skills.”

Leslie Atkins Elliott, professor of curriculum, instruction, and foundation studies at Boise State University, said she was drawn to the APS CVD because she “knew very little about how groups like APS help shape policy decisions.” Elliott continued, “I enjoyed the insights into that process and thinking about how science isnt serendipity, but the outcome of deliberate actions by scientists and lawmakers.”

The APS CVD experience was “quite positive,” said Pushpa Bhat, senior scientist at Fermi National Accelerator Laboratory.

She noted that congressional staffers were “supportive of attracting the best and brightest” students to study and work in the US - a primary goal of the Keep STEM Talent Act.

“It doesn’t make sense to have these students trained here and then have them leave,” she explained.

Much to the delight of Jason Fry, assistant professor of physics and astronomy at Eastern Kentucky University, he received great news about the Keep STEM Talent Act during his

meetings.

"US Rep. Tim Burchett (TN-2nd) and US Rep. Andy Barr (KY-6th) both said they would like to co-sponsor it," he said, excitedly. "Everyone we talked to said it sounds like a good idea."

APS CVD continues to be a highlight event for APS members and the Societys advocacy efforts, said Callie Pruett, Senior Strategist for Grassroots Advocacy in the APS Office of Government Affairs (APS OGA).

"We equipped nearly 70 APS members to confidently go into meetings and speak on five key issues. And we strengthened our coalition of APS members who have already taken an active role in advocating for the future of science," she said.

APS members provided good feedback about their meetings on Capitol Hill, added Pruett.

"There are new avenues now open with congressional offices to help advance the Keep STEM Talent Act and the Combating Sexual Harassment in Science Act, address the helium crisis, counter the proposed rollback on methane emissions, and increase the federal research and development budget," she explained. "Our teams were well-prepared, organized, and on their A-game, and the feedback from the offices reflected that."

Following the CVD, Pruett said US Sen. Chris Van Hollen (MD) and US Sen. Dianne Feinstein (CA) signed on to co-sponsor the Combating Sexual Harassment in Science Act in the Senate. Additionally, US Rep. Himes (CT-4th) and Van Hollen have both added their co-sponsorships the Keep STEM Talent Act in the House and Senate, respectively.

"These legislative developments have a direct connection to APS's advocacy efforts. As follow-up and communication continues, we aim to see more results and co-sponsorships," said Pruett.

"CVD is a great example of APS staff across departments and locations working together to provide a unique opportunity for APS members," said Mark Elsesser, Associate Director APS OGA. "The day continues to be a success because of the strong coordination between several APS departments, including OGA, Communications, and Membership," he said.

Keeping members engaged on important science policy issues is a key goal of APS OGA, explained Francis Slakey, APS Chief Government Affairs Officer.

"We want to make sure our members are fully equipped to take advantage of as many opportunities as possible to make their voices heard on crucial science policy issues that impact the physics community and scientific enterprise," he said.

This story appears in the April 2020 issue of APS News.

---

11 Highlights from DOE Topical Collaborations

The DOE sponsors several Topical Collaborations in Nuclear Theory, generally over a five-year period. The first five-year period ended in 2015. New proposals were solicited and four new collaborations began work: Beam Energy Scan Theory (BEST); the Transverse Momentum Dependence (TMD) Collaboration; double beta decay; and Fission in r-Process Elements (FIRE), co-funded by the DOE Office of Nuclear Nonproliferation. The BEST and TMD Collaborations are directly related to the physics interests of the GHP. Brief reports of their

activities and status are covered here.

11.1 The Beam Energy Scan Theory (BEST) Collaboration

(Communicated by Volker Koch vkoch@lbl.gov and Swagato Mukherjee swagato@bnl.gov.)

One of the key topics of strong interaction research are the properties of strongly interacting matter, especially its phase structure. Phases of QCD matter can be studied experimentally in the particle colliders, such as the Relativistic Heavy-Ion Collider (RHIC) located at the Brookhaven National Laboratory (BNL), USA, by colliding heavy-ions moving closet to the speed-of-light. These collisions can answers various open questions: Does QCD matter exhibit a phase transition? If so, where is it located in a temperature-chemical potential phase diagram? Is this phase transition associated with the restoration of chiral symmetry, as expected from theoretical considerations?

For vanishing net baryon density, these questions have been answered by simulating QCD on supercomputers: The transition from nuclei dominated to quark-gluon dominated matter—the quark-gluon plasma (QGP)— takes place through a smooth crossover, with the thermodynamic properties and the chiral condensate changing rapidly around a pseudo-critical temperature of $T_c \simeq 150$ MeV. In addition, experiments at top RHIC and LHC energies have revealed several interesting and unexpected properties of QGP, most prominently its near perfect fluidity. Experiments at top RHIC energies also show indications that chiral symmetry is restored: The measurement of charge dependent correlations hint at the presence of an electric current induced by the strong magnetic field via the triangle anomaly. This so-called chiral magnetic effect (CME), if present, would indicate the presence of nearly massless fermions and, thus, the restoration of chiral symmetry.

The picture, however, may change considerably for QCD matter at non-vanishing net baryon density or chemical potential. Many model calculations predict that at non-zero baryon-number chemical potential QCD undergoes a first-order phase transition, which ends in a critical point (see left-hand side of Figure 2). Only experimental measurements can definitively answer the question about a possible QCD phase transition.

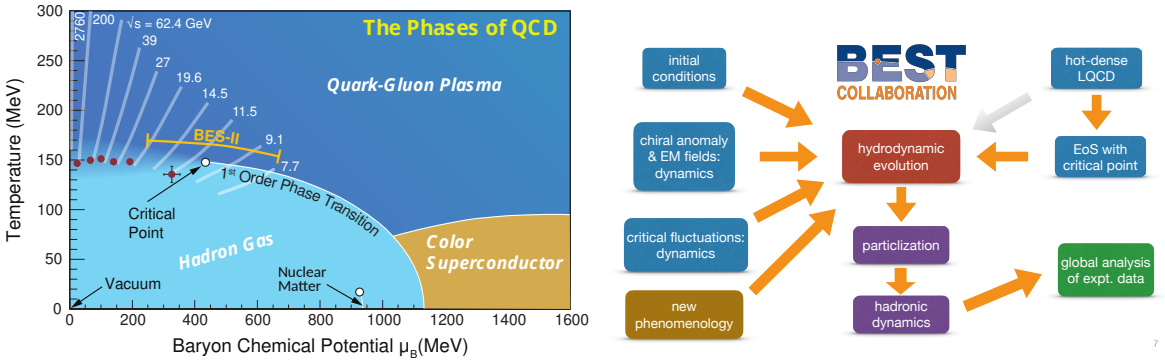

Figure 2: Left) Sketch of the QCD phase diagram and how it can be probed by the beam energy scan. (Right) The various components of the BEST framework.

Strongly interacting matter at non-vanishing net baryon density can be created by heavy-ion collisions at lower energies, where more of the incoming nuclei are stopped in the mid-rapidity region, and fewer matter-antimatter symmetric quark-antiquark pairs and gluons are produced.

A series of heavy-ion collision measurements scanning the collision energy can, therefore, explore the properties of a large region of the QCD phase diagram (see Figure 2, left). In the vicinity of the QCD critical point fluctuations, especially those of the net baryon-number, are expected to be strongly enhanced. Therefore, as the scan traverses the region around the critical point, one expects a peak in the fluctuations of the net baryon-number. At the same time, if the scan has passed the critical point so that the system is in the hadronic phase, chiral symmetry will be broken, and the anomalous CME current should disappear. These ideas are the key motivations for the Beam Energy Scan (BES) program at RHIC. The first, exploratory phase of this program has already provided intriguing results and its second phase, which is currently under way, will provide high statistics data sets with the aim to definitively find or set limits on the existence of a QCD critical point and the anomalous CME current.

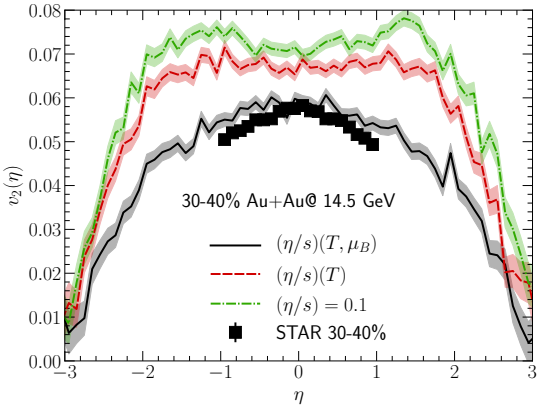

Figure 3: Pseudorapidity distributions of charged hadron elliptic flow coefficients in 30-40% Au+Au collisions at $\sqrt{s_{NN}} = 14.5$ GeV with different $(\eta/s)(T, \mu_B)$.

However, the success of the experimental BES program critically depends on the development of a comprehensive theoretical framework that can provide quantitative understanding of the entire evolution, from the initial collision to the final detection of the hadrons, of the system created in heavy-ion collisions at BES energies. While such a framework must be based on the progress achieved over the last decade in successful quantitative description of heavy-ion collisions at the highest RHIC and LHC energies, several important further developments are needed to address the relevant BES physics. This urgently required and highly complex task has been undertaken by the Beam Energy Scan Theory (BEST) collaboration, a Topical Collaboration in Nuclear Physics, funded by the Office of Nuclear Physics of US Department of Energy. The BEST is a multi-institutional collaboration of 12 universities and 2 national laboratories, centered around BNL. The components this comprehensive BEST framework and their inter-dependencies are illustrated on the right-hand side of Figure 2. Most of these elements have been developed. For example, work within the BEST collaboration has shown that the elliptic flow at lower energies requires the ratio of the shear viscosity (η) to the entropy (s) to depend not only on the temperature (T), but also on the baryon chemical potential (μ_B). This is illustrated in Figure 3, where the results of a viscous hydrodynamics calculation starting from improved initial conditions is compared with the data from the STAR collaboration. Clearly, neither a constant shear viscosity over entropy ratio, nor one that only depends on the temperature is able to reproduce the STAR data.

The remaining task of the collaboration is to integrate the various elements into an open-access framework. This open access framework then will be be used to carry out a

quantitative comparison with the upcoming data from the second phase of the BES using Bayesian methods to efficiently constrain the various model parameters, such as the location of the critical point *etc.* Details of the BEST collaboration's achievements, progress and open access code packages can be found at https://www.bnl.gov/physics/best/.

11.2 The TMD Collaboration

(Communicated by William Detmold (wdetmold@mit.edu) and Jian-Wei Qiu (jqiu@jlab.org.))

Understanding the structure of hadrons in terms of QCDs quarks and gluons (referred to collectively as partons) is one of the central goals of modern nuclear physics, as stated in 2015 NSAC Long-Range Plan. The structure and the landscape of hadrons, sketched in Fig. 4, depend on the scale at which we probe them. Their structure is an emergent phenomena of QCD at the Fermi scale (0.1-10 fm), which is the most interesting, rich, and complex, but

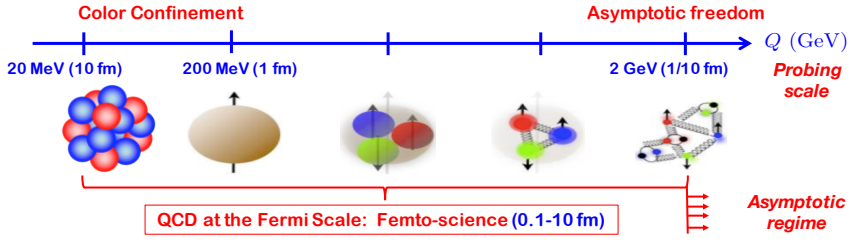

Figure 4: Schematic view of QCD landscape of hadrons.

mysterious regime of the theory. Owing to color confinement, a defining property of QCD, it has been an unprecedented intellectual challenge to explore and quantify the partonic structure of hadrons without being able to see quarks and gluons directly. However, with the help of asymptotic freedom, another defining properties of QCD by which the color interaction becomes weaker and calculable perturbatively at short distances, a reliable theoretical formalism, known as *QCD factorization*, has been developed to connect measurements of hadrons to information about the quarks and gluons inside them with controllable approximations. It is QCD factorization that enables us to "see" quarks and gluons indirectly and to define the structure of hadrons in terms of universal quantum probability distributions to find quarks and gluons inside them.

Fifty years of experimental investigations into hadrons' internal structure have provided remarkable insight into the dynamics of quarks and gluons. With the large momentum transfer $Q \gtrsim 2$ GeV $\sim (1/10 \text{ fm})^{-1}$, QCD factorization has been extremely successful in interpreting data from high energy scattering experiments and has provided us the confidence and the tools to discover the Higgs particle in proton-proton collisions. However, as indicated in Fig. 5 (Left), the probe with a large Q is so localized that it is less sensitive to the dynamics at the Fermi scale and the three-dimentional (3D) structure of hadrons, such as the transverse confined motion (k_T) and transverse spatial distribution (b_T) of quarks and gluons inside a hadron. Consequently, the generations of experiments have mainly provided one-dimensional (longitudinal momentum) snapshots of the internal structure of a fast moving hadron, encoded in the hadron's universal parton distribution functions (PDFs). Recently, new and more precise data are becoming available for *two-scale* observables, including from those processes shown in Fig. 5 (Right), which has the same hard scale Q to "see" the partons inside the colliding hadron and an additional soft scale $q_T \ll Q$ to be more sensitive to the partons'

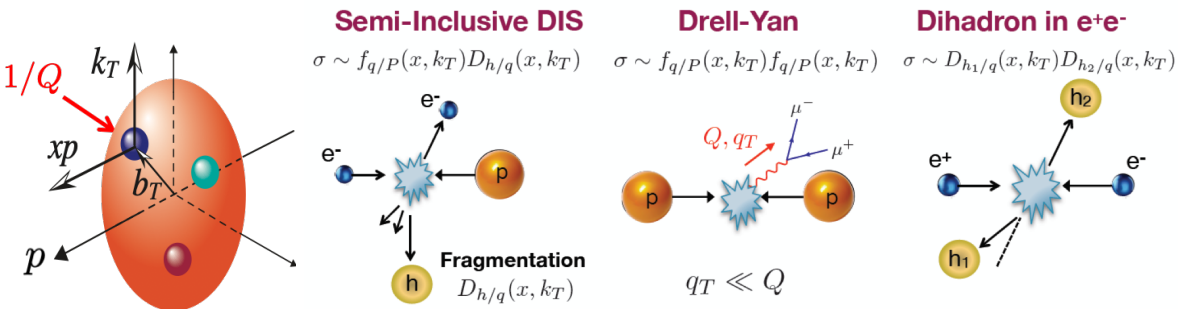

Figure 5: (Left) Schematic view of a probed parton inside a fast moving hadron. (Right) Sample TMD-factorizable two-scale observables.

confined motion (k_T). Equally importantly, theoretical advances over the past decade have resulted in the development of a new type of transverse momentum dependent (TMD) QCD factorization formalism, that provides quantitative links between the two-scale measurements and the 3D partonic structure of hadrons that is encoded in the transverse momentum dependent PDFs (or simply, TMDs). However, the probed transverse momentum (k_T) of the active parton in the hard collisions is *not* the same as the intrinsic transverse momentum of the same parton inside a bound hadron, as shown in Fig. 6. With the large momentum transfer, a parton shower develops during the collision making the k_T of the probed parton different from its intrinsic k_{T_0} due to its confined motion inside the bound hadron. The difference between the k_T and k_{T_0} is encoded in the QCD evolution of the TMDs, and is often non-perturbative, depending on the hard scale Q and the phase space available for the shower. With additional data from the dedicated experimental programs at Jefferson Lab and a future Electron-Ion Collider planed for construction at Brookhaven National Lab, it is a real challenge to control the link between the measured cross sections and the intrinsic partonic structure of hadrons.

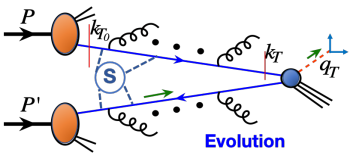

Figure 6: Sketch of two-scale Drell-Yan process in which a parton shower is produced.

The TMD Topical Collaboration, funded by the DOE Office of Nuclear Physics, was formed by pulling together expertise in QCD theory, phenomenology and lattice QCD from 10 universities and 4 national labs to address the challenge to develop new theoretical and phenomenological tools that are urgently needed for precision *extraction of 3D tomography* of parton motion inside hadrons from current and future data. Firstly, it has expertise in theory of QCD factorization to further develop the TMD factorization formalism to achieve higher precision and to extend it to more two-scale observables; secondly, it has leaders in phenomenological analysis that connects this rigorous formalism with global analysis of data to extract the 3D momentum-space landscape of the nucleon; and finally, it has experts in lattice QCD computations to provide the non-perturbative input, such as QCD evolution, that will enable a first principles matching of theory to data.

As a collaboration, with DOE and leveraged support, it helps to strengthen the effort on TMD physics in the US by supporting two bridged faculty positions, 8 postdocs, 4 graduate and several undergraduate students to work on QCD and TMD physics; it is making a concerted effort to bring young people, as well as to train them, to work on the physics connected with TMDs; and it has done important service to the Nuclear Physics community by organizing the TMD summer school and producing a Handbook of TMD Physics. The TMD Collaboration has provided a very positive impact to the community of QCD and hadron structure.

The Collaboration's work has (and will continue to) cast light on some simple yet profound questions regarding the hadron's internal structure, for example, what are the TMDs of quarks and gluons of a colliding hadron? how do the TMDs vary with the kinematics of the collision? how do the TMDs correlate with emergent hadron properties, such as spin? can we extract novel information on the color electric and magnetic force responsible for generating the spin-dependence of TMDs? and how to separate the intrinsic TMDs of quarks and gluons inside a bound hadron from the measured TMDs in high energy collisions? More details of the TMD Collaboration's activities, achievements and highlights can be found under https://sites.google.com/a/lbl.gov/tmdwiki/.

---

12 State of the Laboratories

12.1 RHIC Run 20

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

18 March: I'm writing this from the control room of the STAR experiment, where we are now well into the 20th year of RHIC running. Watching the events come in is like watching fireworks on July 4: no matter how many I see, I never fail to gasp at their beauty.

This year is the second of a three-year campaign, the RHIC Beam Energy Scan Phase 2 (BES-II) to scan, in detail, the structure of the QCD phase diagram as one changes the doping of the Quark-Gluon Plasma with quarks. We expect, and have tantalizing hints, that as one dopes the plasma with more and more quarks the nature of the phase transition changes from a smooth crossover to a first-order phase transition. We are searching for the point at which this change happens – the critical point. We have designed BES-II to make measurements of sufficient precision and incisiveness to confirm or refute these hints.

This year, the success of the program has critically depended on a new accelerator system, Low Energy RHIC Electron Cooling (LEReC). The cooling increases the luminosity, and therefore the rate at which the STAR detector can record collisions, enabling STAR to make measurements with the precision needed in a reasonable time. This system, the first use of a bunched-beam electron accelerator to cool ion beams, has been built, successfully commissioned during last year and the first half of this run, and is currently operating smoothly and at the required performance. This is a great success, and another testament to the versatility of RHIC, a machine that has accomplished so much beyond the capabilities for which it was initially designed.

The STAR detector has had three major upgrades for BES-II, all targeted towards increasing the ability of the detector to track and identify a larger fraction of the particles created in the collisions. All three have worked beautifully this year. In particular, the new endcap Time of Flight (eTOF) detector was critical to an extension of the BES-II program towards much higher baryon doping than is possible with colliding beams. This detector was developed for the CBM detector at GSI/FAIR and installed into STAR under the FAIR Phase 0 program. A gold target has been installed inside the beam pipe on one end of STAR, onto which we can manipulate one of the gold beams. This enables a time-efficient scan into much lower center-of-mass energies than are available in the colliding mode: this year we scanned 6 energies, with each taking about 2 days to complete.

To conclude, RHIC is now well into the Beam Energy Scan Phase 2 program. We have

completed the fixed-target program and the 3 highest colliding energies of the scan, are currently well into successful datataking with the second-lowest energy, and are looking forward to completing the program in the coming year.

12.2 The Year 2019 at Jefferson Lab

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

2019 was the second full year of the 12 GeV era of CEBAF operations, following the completion of the upgrade construction in Fall 2017. Beam operations for all 4 experimental halls resumed on Feb. 8, 2019 and continued through March 17. Summer running at lower energies began in May and continued until early September. Beam was restored in late November at the nominal full energy of 11.6 GeV and the run continued until Dec. 19 for the holiday shutdown. Running continued in mid-January 2020 for a planned run until May, 6, 2020 followed by a long shutdown for the remainder of CY 2020 to install the replacement 2K coldbox for Central Helium Liquiefier #1.

Hall A

Hall A began the year running the APEX experiment, a search for a new gauge boson (A') with sub-GeV mass that couples to ordinary matter, followed by installation of PREX-II during the spring in preparation for a summer production run. PREX-II, measurement of the neutron skin radius in Pb through parity violating electron scattering, had a very successful run during the summer. This was followed by initiation of a production run of CREX, a similar measurement of the neutron skin in ^{48}Ca to test ab initio nuclear structure calculations for this nucleus, during the fall running period. Super Bigbite Spectrometer installation is planned to begin in summer 2020.

Hall B

In January 2019, Hall B made the changeover to Run Group B, which runs with CLAS12 and the unpolarized liquid deuterium target; production running began in February. Hall B then made a transition to the Run Group A experiments to run with the unpolarized hydrogen target during March and continued running during the June running period. Reinstallation of the Heavy Photon Search (HPS) experiment preceded HPS production running in July through early September. In November, Hall B switched back to Run Group B for the remainder of the 2019 with plans to continue in early 2020.

Hall C

In February, Hall C began production running of a search for the LHCb charmed "pentaquark" using photoproduction of J/ψ at threshold and continuing until March. Hall C then completed the last kinematic setting in a search for Charge Symmetry Violations at the parton level, and then the lower energy beam energy settings for Rosenbluth separations in kaon electroproduction. The latter will guide our understanding of the possibility of spatial imaging of strange quarks in the nucleon. In the Summer run, Hall C completed part of two experiments to perform a longitudinal-transverse cross section separation to enable a measurement of the pion form factor at low momentum transfer, and completed a Virtual Compton Scattering experiment. They then commissioned the Moller polarimeter operation in preparation for the polarized ^{3}He experiments later this year. The remainder of CY 2019 was utilized to install the polarized ^{3}He target in preparation for 2020 running of the measurement of neutron spin asymmetry A_1^n in the valence quark region.

Hall D

In the fall of 2018, GlueX-I data taking was completed. Two new detectors, CompCal and DIRC, have been under construction. CompCal was installed and tested in the beam in Fall 2018 after the completion of GlueX-I. The DIRC detector was installed before the Spring 2019 run and two weeks were allocated for the DIRC commissioning. After that, Hall D ran the PRIMEX-eta experiment till the end of the Spring run, continuing during the summer. GlueX-II with the DIRC upgrade commenced operation in late November and will continue into the 2020 spring run after the holiday break.

Science Highlights

The GlueX collaboration published "First Measurement of Near-Threshold J/ Exclusive Photoproduction off the Proton", Phys. Rev. Lett. **123**, 072001 (2019). They find that the total cross section falls toward the threshold less steeply than expected from two-gluon exchange models. In addition, they see no evidence for the LHCb pentaquark candidates.

The PRad collaboration published their final result for the proton charge radius (Nature **575**, 147150 (2019)), obtaining a smaller value than previous determinations by electron scattering, $0.831 \pm 0.007\,(\text{stat.}) \pm 0.012\,(\text{syst.})$ fm, in agreement with the precise determinations from muonic hydrogen spectroscopy.

A study of previous CLAS 6 GeV data on the ^{12}C $(e, e'p)$ reaction, "Probing the core of the strong nuclear interaction", was published in Nature **578**, 540-544 (2019). In this work, the authors demonstrated that the cross section at high missing momentum, up to 1 GeV/c, is well reproduced by the Argonne AV18 model of the $N - N$ interaction.

Other Projects

MOLLER had a Directors review in April 2019 and the project team is working towards CD-1 in 2020.

The Super BigBite Spectrometer (SBS) construction is complete, with further work in progress on the polarized ^{3}He target required for the neutron form factor measurements. Installation of SBS will begin in Hall A in summer 2020.

The SoLID (Solenoidal Large Intensity Device) collaboration had a Directors Review Sept. 9-11, 2019. The collaboration has updated its pre-CDR document to address all recommendations and is awaiting a decision on a science review by DOE Office of Nuclear Physics.

Construction of a second RICH sector for CLAS12 and the Neutral-Particle Spectrometer in Hall C are ongoing.

Electron-Ion Collider and Nuclear Femtography

Development of Jefferson Lab Electron Ion Collider (JLEIC) concept continued in 2019 with emphasis on high luminosity ($> 10^{34}$ cm^{-1} s^{-1}) and high polarization (including deuterons) and energy reach for electron proton collisions up to 100 GeV in the center of mass. This effort has contributed to improvements in designs for both JLEIC and eRHIC at BNL. With the site selection at BNL announced by DOE in January 2020, Jefferson Lab will work with BNL design and construction to successfully realize the EIC at BNL. We have consolidated the local physics, theory and computation effort by establishing a center for these activities: Electron Ion Collider Center or EIC2@JLab. This effort will continue to support the advancement of the science program at the future EIC, including detector R&D and active participation in the EICUG such as preparation of the Yellow Report.

We have established a Center for Nuclear Femtography using funds from the state of Virginia. This will involve a consortium of Virginia universities in a coordinated multidisciplinary effort to develop this subject to an advanced state and capitalize on the extensive new dataset that will be available from operation of CEBAF at 12 GeV, and also future facilities such as an Electron Ion Collider. A Symposium on Nuclear Femtography was held at SURA HQ in Washington, DC, August 12-13, 2019. Progress on initial pilot projects was reviewed and discussions focused on machine learning and visualization techniques were held.

Plans continue to enhance the Labs capabilities and expertise in advanced computation. These will include an integrated Start to End Experimental Computing Model for the 12 GeV Physics Program and future EIC, computational and data science methodology and infrastructure to realize the scientific goals of Nuclear Femtography, and Machine Learning for accelerator modeling/control.

Program Advisory Committee

PAC48 will be held the week of July 13, 2020, and will review newly submitted proposals, letters of intent, and previously conditionally approved proposals. Experiments approved more than 4 years ago for Halls B and D that have not been scheduled yet will be considered in Jeopardy at PAC48. The deadline for submission of proposals and updates is 8:00 a.m. EDT (Eastern Daylight Time) on Monday, June 1, 2020. Additional information is available at https://www.jlab.org/exp_prog/PACpage/.

Acknowledgment: I would like to thank Rolf Ent, Patrizia Rossi, and Jianwei Qiu for their assistance in preparing this report.

---

13 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.

13.1 LPC Workshop on Physics Connections between the LHC and EIC

(Communicated by Tim Hobbs tjhobbs@smu.edu)

The 1st LHC Physics Center (LPC) Workshop on Physics Connections between the LHC and EIC took place at Fermi National Accelerator Facility on 13-15 November 2019. Full details, including a complete set of talks presented, can be found at the dedicated Indico meeting page, https://indico.cern.ch/event/853569/.

This 3-day workshop aimed to bring together members of the LHC and EIC communities explore possible synergies between the EIC program and LHC phenomenology. The areas of overlap discussed fell broadly along the lines of precision QCD, Monte Carlo event generators, lattice QCD and advanced computation, as well as opportunities in the electroweak sector, including potential improvements to neutrino phenomenology and BSM searches. The goal of this workshop was to identify and develop common working areas for which EIC science objectives can both inform and benefit from energy-frontier efforts at the LHC. A number of crucial areas were highlighted in the course of energetic discussions throughout the meeting, including EIC constraints to Higgs production predictions, overlaps in the phenomenology of

jets and heavy quarks, and computational synergies in event generation and lattice, among many other issues. Sessions were chaired by Stefan Hoeche, Fred Olness, Abhay Deshpande, Olga Evdokimov, and John Campbell, with organizational contributions from Tim Hobbs, Rik Yoshida, Abhay Deshpande, and Jianwei Qiu, as well as Radja Boughezal and Frank Petriello.

The organizers express their gratitude to the Fermilab LPC for their hospitality and assistance with the meeting, including LPC Coordinators Cecilia Gerber and Sergo Jindariani. Special thanks are due to Gabriele Benelli, Marguerite Tonjes, and Kevin Pedro of the LPC for their extensive help. The organizers are currently preparing a community whitepaper summarizing the main conclusions from this effort, along with anticipated next steps.

---

14 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).

Please note that this list does not reflect any cancelations or changes of venue due to the Covid-19 outbreak. For information about a particular meeting, please check the websites to see the organizer's response to the pandemic.

The following list is based on Mark's page:

- 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) http://www.ectstar.eu/node/4557

- Hadronic Parity Nonconservation II (INT Workshop INT-19-76W, Seattle, WA, USA, 8-10 July 2020) http://www.int.washington.edu/PROGRAMS/19-76W/
- Saturation and Diffraction at the LHC and the EIC (ECT*, Trento, Italy, 6-10 July 2020) http://www.ectstar.eu/node/4559
- 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$^{\text{th}}$ International Conference on High Energy Physics (Prague, Czech Republic, 30 July - 5 August 2020) http://ichep2020.org/
- Lattice 2020: The 38$^{\text{th}}$ International Symposium on Lattice Field Theory (Bonn, Germany, 3-8 August 2020) https://indico.hiskp.uni-bonn.de/event/1/
- Gordon Research Conference on Photonuclear Reactions: Frontiers in Nuclear and Hadronic Physics (Holderness, NH, USA, 9-14 August 2020) https://www.grc.org/photonuclear-reactions-conference/2020/
- PANIC2020: 22$^{\text{nd}}$ International Conference on Particles and Nuclei (Lisbon, Portugal, 31 August - 4 September 2020) https://indico.lip.pt/event/592/
- Theoretical and Experimental Challenges in Flavour Hadrons, Heavy Quarkonia and Multiquark Physics (ECT*, Trento, Italy, 7-11 September 2020) http://www.ectstar.eu/node/4562
- QWG 2020: 14$^{\text{th}}$ International Workshop on Heavy Quarkonium (Davis, CA, USA, 14-18 September 2020) https://indico.cern.ch/event/838970/overview
- Exploring High μ_B Matter with Rare Probes (ECT*, Trento, Italy, 7-11 September 2020) http://www.ectstar.eu/node/4563
- 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/
- Spin and Hydrodynamics in Relativistic Nuclear Collisions (ECT*, Trento, Italy, 5-9 October 2020) http://www.ectstar.eu/node/4564
- LFC20: Strong Interactions from QCD to New Strong Dynamics at LHC and Future Colliders (ECT*, Trento, Italy, 12-16 October 2020) http://www.ectstar.eu/node/4565
- 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

∗ Disclaimer ∗

The comments and contributions in this newsletter are not peer reviewed. They represent the views of the authors but not necessarily those of the American Physical Society.

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