NASA Astrophysics

ASTROPHYSICS ADVISORY COMMITTEE

June 23-24, 2020
Teleconference

MEETING MINUTES

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Tuesday, June 23

Introduction and Announcements

Dr. Hashima Hasan, Executive Secretary of the Astrophysics Advisory Committee (APAC), opened the virtual meeting by welcoming the Committee members. Dr. Hasan then reviewed the Federal Advisory Committee Act (FACA) rules. As APAC is a FACA committee, this meeting was open to the public, and minutes were being taken for the public record. There would also be opportunities for public comment. Each APAC member has been appointed on the basis of his or her subject matter expertise and must comply with Federal ethics laws applying to Special Government Employees (SGEs).

Dr. Hasan noted that a number of APAC members had conflicts of interest (COIs) with specific topics on the agenda: Dr. Jessica Gaskin: Imaging X-ray Polarimetry Explorer (IXPE) and Advanced Telescope for High Energy Astrophysics (Athena); Dr. Margaret Meixner: James Webb Space Telescope (Webb), Stratospheric Observatory for Infrared Astronomy (SOFIA), and the Nancy Grace Roman Space Telescope (Roman, formerly the Wide Field InfraRed Space Telescope (WFIRST)); Dr. Michael Meyer: Athena and Roman; Dr. John Conklin: Large Interferometer Space Antenna (LISA) and Roman; Dr. Leonidas Moustakas: Roman; Dr. Asantha Cooray: Roman; and Dr. William Jones: Roman. These members were required to recuse themselves from discussion during the presentations for which they were conflicted. Any questions related to ethics should go to her.

Dr. Charles Woodward, APAC Chair, thanked Dr. Hasan and the members, then reviewed some of the ground rules for the meeting. The outcome of the meeting was to be a report to Dr. Paul Hertz, Director of NASA's Astrophysics Division (APD).

Astrophysics Division Update

Dr. Hertz thanked the Committee members for participating in the meeting, and gave a special thanks to Drs. Cooray and Jones, who were completing their 3-year term as members; this was their last meeting.

Science Highlights

The Transiting Exoplanet Survey Satellite (TESS), which is searching the whole sky, found that a large sample of Delta Scuti stars have more orderly patterns than previously thought. This shows the power of a time domain mission like TESS. The Hubble Space Telescope (Hubble) found evidence of a directional Black Hole (BH) event within the Milky Way that illuminated gas far outside the galaxy. In the week before the meeting, the European Space Agency's (ESA's) XMM-Newton observatory and NASA's Nuclear Spectroscopic Telescope Array (NuSTAR) followed up on a March observation by the Neil Gehrels Swift Observatory, which revealed a new magnetar, the youngest ever found at approximately 240 years old. NASA celebrated Hubble's 30th anniversary online with many activities. Among these was "what did Hubble see on your birthday?" providing an Hubble image taken on a given date. The Mars 2020 Perseverance Rover cache tubes were integrated; this is a first step in Mars sample return.

There was to be a presentation on Webb, which Dr. Hertz showed folded up into launch configuration. It is now being prepared for environmental testing of the complete observatory in this configuration. This is the last environmental test, at which point it will go into the final deployment test. WFIRST is now in Phase C and has been renamed in honor of Dr. Nancy Grace Roman, NASA's first Chief of Astronomy and the first woman to hold an executive position at NASA. She is known as the "mother of Hubble," and the Roman is a perfect mission to honor her as it is a flagship mission of the same size as Hubble.

APD will be hiring multiple program scientists; those who are interested should contact Dr. Eric Smith.

COVID-19 Impact; R&A

All of APD's operating missions and data archives are performing nominally, although SOFIA had to

suspend flight operations for a while due to COVID-19. The Research and Analysis (R&A) program is still soliciting, reviewing, selecting, and funding proposals, with all of the activities being done through telework. APD is cancelling the 2021 Astrophysics Data Analysis Program (ADAP) call but will select twice the number of proposals for 2020. The ADAP and Theoretical and Computational Astrophysics Networks (TCAN) proposal due dates have been postponed. The impact of COVID-19 on missions in development varies. The project teams are working virtually, and Webb continues to be a priority. The NASA centers are resuming mission work on a case-by-case basis.

The new NASA Science Plan has been released for 2020-24. Dr. Hertz showed the four pillars of the Plan; one priority is inspiration, and a strategy within that has to do with diversity. The Science Mission Directorate (SMD) has been taking a strategic approach to ensure diverse and inclusive teams, with an emphasis on students and early career (EC) scientists. An example of SMD's efforts is the PI Launchpad workshop for new PIs. Plans are to continue the Launchpad, though it was interrupted by the pandemic.

The next round of Nancy Grace Roman Technology Fellowships will be announced later in the summer. The 2020 NASA Hubble Postdoctoral Fellows have been selected. APAC had previously discussed the policy in the Hubble fellowship program to require host institutions to offer employee status to the fellows. The Space Telescope Science Institute (STScI) has approved this change, to go into effect in 2022-23. APAC had also advised doubling the funding in the NASA Earth and Space Science and Technology (FINESST) program, which has been done. APD is now doing Dual Anonymous (Dual Anon) peer reviews. Following a successful pilot program for Hubble, all astrophysics General Observer/Guest Investigator (GO/GI) proposals will be evaluated under the Dual Anon protocols.

R&A funding continues to grow as recommended by the 2010 Decadal Survey (DS). The core R&A funding has grown over 50 percent since the recommendation came out. However, R&A funding is only about half of APD's total funding to the community, which also includes GO programs and now exceeds over $200 million annually. This amount will increase substantially when Webb launches. Dr. Hertz listed recent elements in Research Opportunities for Space and Earth Sciences (ROSES), which had some one-time calls. The Strategic Astrophysics Technology (SAT) call is on hold until the release of the upcoming DS.

COVID-19 has affected some R&A grantees, and SMD is finalizing a process to provide limited adjustments. Because not all grants can be made whole, SMD has made a priority of mitigating impacts to students, postdocs, and EC scientists so that the cohort of future leaders is not massively derailed. The policy should be out at the end of June. SMD is also looking at helping those affected by hiring freezes. There is nothing to announce yet, but it is a topic of discussion and Dr. Hertz welcomed APAC input. The Office of Management and Budget (OMB) has issued guidance that removes some barriers, such as easing the burden on grant recipients receiving "soft money." However, grant recipients need to communicate with NASA in order to access these accommodations.

APD has not cancelled any solicitations due to COVID-19. The peer reviewers are comfortable with the virtual format and feel they are able to do a quality job. This could influence how APD conducts peer reviews in the future, as there are benefits to virtual peer reviews. While virtual meetings are somewhat less efficient due to issues with time zones, attention at a computer, etc., the expectation is that this will be the format for quite a while.

Returning to ADAP, APD had decided to not offer it in 2021 as a means of reducing the community workload. In order to keep the same number of funded investigations, there will be twice as many selections funded for 2020. The reviews will be Dual Anon, and the due date has been pushed back by 2 weeks. The Division has received feedback that this policy may have a disparate impact on certain community members, however, especially those with family obligations. The Cosmic Origins Program

Analysis Group (COPAG) surveyed its members on this topic, and the results would be presented at this meeting.

Astrophysics Research and Analysis (APRA) will be amended to support lab equipment upgrades through the Lab Astro element. At the previous APAC meeting, there was an extensive discussion of the Exoplanet Research Program (XRP), which is now fully consolidated across SMD, with substantially increased funding. Each Fiscal Year (FY) through FY2023 (FY23), funding will increase by about 15 percent, with a corresponding increase in selections.

The next cubesat is the Colorado Ultraviolet Transit Experiment (CUTE), which is being prepared for spacecraft Integration and Testing (I&T). It will launch with LandSat-9. APD conducted a Senior Review (SR) of the archives, which is done every 4 years or so, to examine all elements of the data ecosystem. All of the archives did well. There will need to be additional funds to address the upcoming big astrophysics data era, however.

Dr. Massimiliano Galeazzi asked if the ADAP delay is to be a single occurrence or a change in cadence. Dr. Hertz said that the intent was to do this only once, but APD will watch to see how it works. This is in response to the pandemic. Dr. Gaskin asked if there might be additional funding due to COVID-19. Dr. Hertz explained that Congress is discussing it as part of another stimulus bill, but he does not know the chances of that going forward. APD is granting research extensions, but SMD will produce a policy on priorities for additional funding. It is not possible to make everyone whole, and the emphasis will be on minimizing the impact on EC investigators. Dr. Kelly Holley-Bockelmann asked about NASA's response to the recent immigration status changes. Dr. Hertz replied that that is a policy across all of the Federal research community, not just NASA.

Operating Missions and Missions in Development
Operating missions are working nominall; they were already capable of remote operations which is a benefit of the emphasis on reduced operations costs in extended phase. SOFIA is grounded, but planned maintenance has resumed and preparations for resuming flights are moving forward. NASA has also looked at the space communications program in terms of uplinks and downlinks, and seeks to have backup plans in place in case local communications capabilities are lost. Missions in development are doing as much as they can. Webb remains a priority. In March, the NASA team members from Goddard Space Flight Center (GSFC) returned home and Northrup Grumman reduced shifts, but the project is now moving to resume increased work shifts. For operating missions, some work can be done remotely from team member homes, although some command teams have to be on-site. TESS is in the final orbit of its prime mission. The SR recommended TESS for an extended mission, which begins July 4. This mission has been fabulously successful.

Among missions in development, there is as yet no due date for Webb Cycle 1 proposals. Roman was confirmed and entered Phase C on February 28. The only change at confirmation review was to designate the coronagraph as a technology demonstration instrument. The critical path task work continues at GSFC and the Jet Propulsion Lab (JPL). Roman science will touch virtually every area of astrophysics. NASA is identifying how to optimize the science for the community. Observing time will be available through open processes and based on community input. There will be a GO/Archival Researchers program and a coronagraph community participation program. Among the community input areas will be the coronagraph and retirement of risk. A community team will supplement the instrument team.

For Explorers, the cadence continues for Announcements of Opportunity (AOs). APD recently made selections for Small Explorers (SMEXes) and Medium Class Explorers (MIDEX) for 2021. Dr. Hertz presented a policy update on Explorers that addressed the fact that PI-proposed partnerships have not been effective in establishing NASA contributions to partner-led missions. Of these "Partner Mission of

Opportunity" (PMO) proposals, there have been 17 received over the past 10 years, with only three selected for Phase A and one downselected for flight. All of the three selections could have been initiated strategically instead of PI-proposed, and most of the other 14 could have been declined without receiving a proposal. SMD has concluded that the PMO process is neither successful nor efficient in establishing partnerships, and therefore SMD will no longer solicit PMO proposals. SMD will still allow proposals for Explorers missions with a limited partner contribution and will continue to seek community input on potential partnerships. Ad hoc input is always welcome via phone or email.

IXPE, the next Explorer in the queue, is the most affected by COVID-19, with a 3-month delay. The mirror integration work had to stop. Without the delay, this work would have been completed and the staff would have rolled off, but the timing was the worst of all the small missions. The Galactic/Extragalactic ULDB Spectroscopic Terahertz Observatory (GUSTO) was less affected; APAC was to receive an update at this meeting. The Spectro-Photometer for the History of the Universe Epoch of Reionization and Ices Explorer (SPHEREx), the next MIDEX, just entered Phase B and was impacted by the fact that the designers could not get together. The Preliminary Design Review (PDR) is now planned for October. There were also subcontract issues on this mission. There was no obvious impact on the NASA work for the Atmospheric Remote-sensing Infrared Exoplanet Large-survey (ARIEL) mission, to which NASA is contributing the Contribution to ARIEL Spectroscopy of Exoplanets (CASE) fine guidance instrument. The 2019 SMEX AO led to the selection of the Extreme-ultraviolet Stellar Characterization for Atmospheric Physics and Evolution (ESCAPE) and Compton Spectrometer and Imager (COSI), which are in Phase A. The Mission of Opportunity (MO) selections were Dorado and LargE Area burst Polarimeter (LEAP).

Dr. Cooray asked about selection of the team to solicit community input. Dr. Hertz replied that that is always done on a case-by-case basis. If the Agency agrees to provide an instrument that only NASA can do, it will be directed. If others can do it, NASA will put out a competition. When selecting the NASA science team, as with Euclid, NASA puts out a call. The COVID-19 impact remains uncertain because the trajectories for countries, partners, industry, and academia are unknown. For Roman, for example, many activities must go on in parallel. For Explorers, NASA will be able to handle the impact with existing program resources. The Webb reserves are adequate to encompass the COVID-19 impact in all likelihood. Roman is doing fine today but some work is being deferred, and yet that work is funded. So it is still too early to tell if the deferral will have significant financial impact.

Budget and Priorities

There have been no changes to the budget since the last meeting. APD is fully funded for FY20. However, Dr. Hertz was now free to show the final operating plan, which has been approved. Roman and Webb take about half the budget between them. This is the general distribution of a balanced program. The FY21 President's Budget Request (PBR) has not changed. It proposes terminating SOFIA and zeroes out Roman. Both chambers of Congress plan to mark up the budget in the next several weeks, with full committee markups rather than subcommittee markups.

NASA's highest priority is the Artemis mission to put humans on the Moon in 2024. SMD's role is to sponsor robotic precursor missions through the Commercial Lunar Payload Services (CLPS) program and the Volatiles Investigating Polar Exploration Rover (VIPER). All science opportunities are open to astrophysics, and two such payloads have been selected. The most important criterion is science merit.

The DS is underway; NASA looks forward to recommendations across the breadth of the balanced mission portfolio. APD needs to demonstrate its ability to manage missions well. Since NASA started committing to the 70 percent Joint Cost and Schedule Confidence Level (JCL), the net underrun has been 3 percent, so APD is confident that it can manage the project within budget. The Division is looking at the best ways to initiate preformulation work for whatever flagship missions and probes the DS recommends.

APD Responses to APAC Recommendations

Dr. Hertz reviewed some of the recommendations and responses from the March APAC meeting:

1 and 2. APAC sought information on how Dual Anon will work in technology and hardware programs. APD is still working on the pilot program and has not yet thought about this.
3. Regarding XRP proposal funding, APD reports that SMD has about the same number of proposals this year, but with 15 percent more funding.
4. The recommended SMD data officer will come on board soon.
5. APAC sought longitudinal study information on FINESST and other recipients of programs targeting EC scientists. APD does not follow this, but a 2018 summer intern tracked NASA Earth and Space Science Fellowship (NESSF) recipients and found that 96 percent remain in the field.
6. APAC made several requests about the Pioneers program. Comments from the community are still being received and analyzed, so there are no additional details yet. A Pioneers PI will be expected to propose a launch readiness date (LRD) and describe funding related to any wait period for a ride share. This is the same policy the Earth Science Division (ESD) uses on the Earth Venture (EV) program. There will be a 5-year timeframe, and proposers wanting something longer must explain why. The cost cap is the same regardless of time. This is not a level-of-effort program, but rather one in which the PI identifies a full development cycle.
7. The PI diversity study has not been started.
8. There will be an Roman update at the next APAC meeting.
9. APAC sought results from the Webb acoustic and vibration testing, but COVID-19 affected the mission's testing schedule.
10. There were multiple questions about SOFIA. This meeting was to include a SOFIA presentation.

The Pioneer schedule is about the same as described previously.

Dr. Lucianne Walkowicz was concerned about immigration. Dr. Hertz explained that this was not something that NASA has an official position on; NASA must implement administration policies. He also addressed fundamental physics on ISS; he is unaware of anything that currently applies to astrophysics.

State of Profession Discussion

Dr. Woodward introduced the discussion on Black, Indigenous, People of Color (BIPOC) workforce issues. The question is whether NASA truly provides these communities with opportunities to study the cosmos. There is a systematic failure to engage BIPOC in STEM aggressively as a fundamental core philosophy of NASA SMD workforce development, which is critical to long-term institutional success. SMD has put forth diversity initiatives, but they primarily benefit white women rather than BIPOC communities. There remain systemic problems, as most of the emphasis has been on gender. There is a need to incorporate BIPOC voices into the conversation.

Dr. Woodward described some of the diversity mechanisms that have benefited white women but not BIPOC, and asked if these be revisited. He also asked what fundamental changes are needed to transform the racist structures with these mechanisms. NASA needs to have diversification of leadership, expand funding to programs to uplift BIPOC, transform communications, set accountability metrics for grantees, and acknowledge systemic and pervasive exclusion. APAC wants to have a dialogue about this to engage communities that have not been involved. Dr. Woodward pointed out that diversity and inclusion are missing from the science roadmap. The state of the profession hinges on the ability to engage a wide variety of communities in these science endeavors. Therefore, the Committee wanted to talk about this with NASA management present. This will not be the last such conversation.

Dr. Walkowicz said it was important that Dr. Hertz be present for this discussion. She wanted to hear about professional development efforts. She has been struck by the Hubble fellowship program, which

has no BIPOC astronomers and is overwhelmingly white. The same is true of the PI development workshops. She is concerned that these efforts reinforce inequities and wanted to know the avenues possible for righting this situation. Dr. Hertz stated that he lacks expertise in this area. SMD has made efforts to reach out to BIPOC elements of the community when advertising jobs and fellowships. He wants to make all opportunities available to all in the community.

Dr. Cooray described a direct experience he had with a student who came through the Minority University Research and Education Project (MUREP) and had gone to a community college in California before finishing a Bachelor's and Master's degree. The student was then working on a PhD. The student applied for Hubble Space Telescope time and eventually ended up becoming a PI. So there are good things to come out of the MUREP program. The student applied for a graduate research program, and the comments received back on the proposal were not helpful. He would like NASA to think more about the FINESST selection process because it could leave out some people. If the goal is to mentor and train these students to become PIs and future leaders, the process needs to begin early on. He was very disappointed at the way graduate funding processes, especially NSF and NASA graduate fellowship programs, have turned out for students that were previously funded from MIRO/MUREP programs. Dr. Hertz agreed that the process can be done better.

Dr. Moustakas welcomed the conversation, noting that there is a lot being learned about implicit bias and systemic inequities. There have been steps to help address gender via the PI Launchpad and the Dual Anon reviews. The profession needs to learn more so that the leaders become more knowledgeable about how to address these issues. Getting professional feedback would be important. Dr. Galeazzi said that these are long overdue conversations. It is important to address why people already in the community are struggling, and how to expand the community. The community should be involved at lower levels to get more students involved in the field and make them feel welcome.

Dr. Walkowicz wanted to challenge everyone present to think beyond the frameworks that have been used with little success across the profession. There are ample data, including concrete recommendations, regarding inclusion of BIPOC members. The holdup is not lack of data. They should also stop saying "implicit bias," because it allows white scientists to feel they are not at fault for their actions. It does not serve them. Similarly, a philosophy is not an action. They need to look at what the American Astronomical Society (AAS) has come up with regarding steps to take. She would like to see them move to these and quit focusing on white people think about racism. Dr. Hertz said that he was taking notes and would find the practical steps Dr. Walkowicz referred to.

Dr. Woodward noted that some time will be needed to identify what has and has not worked, and whether programs are working as intended. There is also a need to assess communications. The long-term objective of APAC would be to look at things that are actionable. Dr. Meixner said that NASA has an amazing opportunity here and needs to follow through. Her first PhD student was Black and felt isolated. It is important to provide support and mentoring throughout, with infrastructure to support the students and keep them from falling out along the way. This requires action. That is broad, but it would be interesting for the PAGs to think about the types of programs to suggest to NASA to pursue.

Dr. Gaskin said that she has found that some communities and institutions cannot provide the resources. NASA needs to ensure that BIPOC communities are made aware of the opportunities, and there should be early mentoring. She wondered about active partnering to enable students to be competitive and help their institutions compete for more missions. Dr. Holley-Bockelmann said that she often hears from students of color that they are leaving academia due to a toxic culture that pushes them out. PIs need to be held accountable for their culture. There is a great amount of talent at Historically Black Colleges and Universities (HBCUs). NASA supports HBCUs, but not enough, and the support needs to increase. There is a need to look at some of the things funding agencies can do to address systemic racism. Dr. Meyer

said that education and outreach is not enough. It is important to make the relationships bilateral. Revamping those relationships is important. There should be an evaluation component to ensure the climate is not affected by institutional racism, similar to what NASA has done regarding sexual harassment.

Dr. Woodward observed that this goes to the leadership, which needs to have diverse individuals to encourage those in underrepresented groups to move forward. He asked the APAC members to think about these comments for further discussion.

ExoPAG/PhysPAG/COPAG Updates

Dr. Hertz clarified that in regard to ADAP funding, APD can do mitigation for some people selected, but others will go a year with no funding.

ExoPAG

Dr. Meyer listed the Executive Committee for the Exoplanet PAG (ExoPAG), identifying new members and noting that there are now NASA representatives from the Planetary Science Division (PSD) and Earth Science Division (ESD). Among recent activities were a cross-PAG report ("finding") based on the recent "Exoplanets in our own Backyard" meeting that included many planetary science PAG representatives, participation in a COVID-19 survey led by COPAG, and the ExoPAG22 virtual meeting with more than 150 participants. Dr. Meyer then showed the status of the current Study Analysis Groups (SAGs) and Science Interest Groups (SIGs). SAG19, on exoplanet imaging signal detection, should close out soon but is still ongoing. ExoPAG is proposing to initiate two new SAGs, described below. SIG 2, on exoplanet demographics had a successful symposium at ExoPAG21. The members are still working on a report, which has slowed down a bit. SIG 3, on exoplanet solar system synergies, is just starting and still in the outreach phase.

The first new SAG will address the effects of stellar contamination on space-based transmission spectroscopy, and the second SAG will study exoplanet host properties. The latter will not make a list of targets, but will instead make a quick recommendation for what NASA could support. The science gap list will be reviewed by the ExoPAG EC in addition to soliciting input from the ExoPAG to support release of a new version early next year. ExoPAG will continue to collect community input via a fall forum. The PAG is reviewing what it can do to help dismantle institutional barriers to realizing a more diverse, equitable, and inclusive community. Future activities include new discussions of zodiacal dust and high-contrast imaging (HCI), continued monthly telecons, a website update, a presentation to the Planetary Advisory Committee (PAC) in August, and plans for ExoPAG23 at the winter AAS meeting.

In answer to a question on extreme precision radial velocity (EPRV), Dr. Meyer explained that there are compelling assessments that indicate instruments can get to the centimeter-per-second level. ExoPAG wants to determine the associated challenges and limitations and would like to see a number of groups funded to answer this question. Regarding the upcoming PSD Decadal Survey and exoplanets, Dr. Meyer observed that the interest groups have self-segregated, giving the example of Google Docs sites set up for the subcommunities. It was hard to connect initially, but it is happening and he hopes to report collaboration.

PhysPAG

Dr. Graca Rocha, chair of the Physics of the Cosmos PAG (PhysPAG), reviewed the PAG's science objectives, listed the Executive Committee membership, and provided updates on the six SIGs. The Cosmic Ray (CR) SIG will ask members for input to help plan future workshops. The Gramma Ray (GR) SIG has plans to organize workshops, hackathons, and similar activities on instrument design, data analysis and analysis tools, and statistical methods, among other topics. These will be organized to

coincide with major meetings and events. The Gravitational Wave (GW) SIG is partnering with the LISA consortium and the Gravitational Wave International Committee (GWIC) for an international symposium in September. The Inflation Probe (IP) SIG and the X-Ray SIG each had a mini-symposium in April; Dr. Rocha provided the agendas and links to PDFs of presentations. Development for the X-Ray Imaging and Spectroscopy Mission (XRISM) continues despite COVID-19, and the mission is still on schedule for launch in 2022. Dr. Rocha described PhysPAG Executive Committee activities, with links to the information from an April townhall. The Executive Committee has monthly telecons.

The Executive Committee is actively discussing strategies and goals to improve access for researchers at under-resourced institutions. This could be a cross-PAG activity. The Committee is identifying goals, determining how to do a study, and considering deliverables. Other goals under discussion include assessment of access to usable data analysis tools and data representation, and preparation for DS outcomes. PhysPAG was asked to consider reorganizing the SIGs to be science-driven rather than wavelength/spectrum-driven. However, the SIG members want to continue as they are, as they feel the SIGs function well and help advocate for science. Another suggestion was to coordinate sessions at the winter AAS meetings, which they would like to do.

In answer to a question about the accessibility of the data analysis tool, Dr. Rocha explained that it will be cross-compatible and publicly available. The framework is not well-known by the community, and the goal is to make the tools accessible and useful to the community. Dr. Woodward noted that APAC has previously discussed this topic.

COPAG
Dr. Meixner, the COPAG Chair, listed the Executive Committee members, a number of whom will be rotating off soon; applicants for Committee membership are welcome. Among the COPAG activities since the March meeting was a multi-PAG survey on the impact of COVID-19. SAG 11, on the Cosmic Dawn, had a delayed start due to COVID-19.

The survey on COVID-19 sought input on how the pandemic has affected NASA astrophysics research, especially regarding preparation and submission of proposals for ADAP. There were 202 responses from members of the three PAGs. The first question Dr. Meixner reported on addressed the impact the change in the ADAP solicitation cadence has on the respondents' research. Results indicate that women felt the impact to be negative to a significantly greater degree than the men (76 percent vs 56 percent). The EC/non-tenured respondents were in between, at 66 percent feeling the impact to be negative. In addition, the time period for answering the survey was extended, and those who responded during the extension were more likely to identify negative effects.

When asked to provide additional input about the impacts that COVID-19 and the changed ADAP cadence are having on their NASA-supported astrophysics research, 49 respondents provided the following answers:

- Worried about ability to fund students, postdocs, soft money researchers: 14/49 = 29%
- Extra caregiving duties causing decreased productivity: 12/49 = 24%
- Furloughs and/or increased teaching duties causing decreased productivity: 5/49 = 10%
- Costed extensions, grant amendments, or small emergency grants needed: 9/49 = 18%

Supplementary data indicate that most respondents have had their plans to propose for ADAP impacted due to the NASA change. The importance of feedback on failed proposals was noted as being more readily implemented on a 1-year cadence, which is vital for EC researchers and those seeking tenure and career advancement. Overall, the survey found that having more opportunities with half the success rate is preferable to having fewer opportunities at a higher success rate. The main thing that COPAG found

illuminating was that COVID-19 hit women and EC respondents harder, and there is concern that they will suffer in not getting feedback from ADAP. Dr. Hertz also observed that about two thirds of the respondents are not current grant holders, so for them the extension is not a mitigation. That is useful information.

SOFIA Update

Dr. Meixner recused herself as an APAC member in this discussion. She is now the SOFIA Director of Science Mission Operations. She and Project Scientist Dr. Naseem Rangwala gave the SOFIA update. Dr. Meixner described SOFIA science highlights from past 10 years, as well as some of the work done with the Echelon-Cross-Echelle Spectrograph (EXES) and German REceiver for Astronomy at Terahertz Frequencies (upGREAT) instruments, which point to SOFIA's uniqueness and versatility. PIs can ride on SOFIA if their studies are accepted.

Dr. Meixner said that the team is pushing the legacy programs and gave the example of the galactic center mapping. The Flagship Mission Review (FMR) provides clear guidance on where to make improvements, with emphasis on the science and building the community. The SOFIA team wants to have partnerships with other great observatories, and is working toward an automated database for SOFIA metrics. Regarding the number of refereed publications, APAC had asked whether the publications target is realistic. Pre-FMR, SOFIA had already been working to improve the publication rate. The FY20 goal is 45 papers, and the FY22 goal is 75 papers. The cumulative effect will help in that latter goal because completed work lends itself to archived data that can be used. This is a factor of better program selection and improved user and community report. The H-index, which measures productivity and citation impact, is slowly going up. There has also been growth in the number of unique PIs and co-Is.

Dr. Meixner showed Cycle 8 selection data. Of the three legacy programs, two are pilots. The data become public immediately. There are three categories of research priority, and some outstanding science can be done in very little time. Priority 1 research has an Excellent grade and will be started, then carried over if need be. Priority 2 is Very Good to Excellent, and will be completed if started. Priority 3 projects are Good to Very Good, and are used to fill in time. The timeline for Cycle 9 has calls and selections in the latter half of 2020, with a July 2021-March 2022 observing period. Changes from Cycle 8 include keeping accepted proposals active for 2 years and Dual Anon review. There is the possibility of synergies with Webb, a joint call for proposals with the Green Bank Observatory, and a longer proprietary period for students. Legacy proposals are important to build up the archives, and there was to be a virtual legacy workshop the following week. The SOFIA instruments were graphed according to resolving power and wavelength. There will be an instrument roadmap exercise this summer. NASA has cancelled the High Resolution Mid-InfrarEd Spectrometer (HIRMES) instrument project, though HIRMES detector development may continue under separate funding. The team is gathering community input on this.

Dr. Rangwalla thanked Dr. Meixner and began her portion of the presentation by showing some science results from the SOFIA feedback legacy program. The GREAT survey of star formation mapped a 3D data cube of the Westerlund 2 Complex. Another example shows a bubble created by a single star, along with shell expansion. COVID-19 has affected work. The team had to cancel the New Zealand deployment due to that country's 14-day quarantine and international travel constraints. SOFIA will instead operate out of Palmdale. SOFIA has been increasing its footprint in the southern sky, and Cycle 7 was the longest deployment to New Zealand, with three instruments. Cycle 8 was to have had a single instrument. Cycle 9 plans are to offer a combination of long and short deployments with three instruments. The team is still assessing the impact of the Cycle 8 cancellation. Dr. Meixner noted that the Cycle 8 rules are that Priority 1 observations are carried over. PIs with Priority 2 observations that are only for the southern hemisphere must repropose, but that is just for this particular year. Dr. Rangwalla explained that once the team has replanned all of Cycle 8 for Palmdale, they will see what else they can do. The highest priority is to return to flight.

Dr. Cooray was concerned about the lost targets, which will make it impossible to complete some Cycle 7 papers. Dr. Meixner agreed, explaining that Cycle 7s observations that have made progress or are Priority 1 will move forward. Dr. Cooray said it would be good to know which percentage have data partially completed by the observatory and whether such fraction data allow the PIs to write papers. Dr. Gaskin said it was great that they are trying to expand the science. She asked how proposal pressure for the southern and northern hemispheres affects their costs and decisions. Dr. Rangwalla said the goal is to optimize observations across the whole year. Dr. Gaskin noted that there was a question at the last meeting about the increased resources needed for the southern hemisphere, and it was unclear what the outcome of the trade will look like. Part of it is trying to expand the base, but operations costs can go up. Dr. Rangwalla replied that the first thing is to do the best science, and quality is paramount. They are trying to see which deployments meet that, and balance the cost of observation.

Dr. Suvrath Mahadevan asked for more information on the HIRMES cancellation. Dr. Hertz explained that the project was over budget and schedule, and had unsolved technical problems as well. The team could not develop a believable plan. NASA is continuing the technology development, but it no longer falls to SOFIA. Interested proposers can submit to the SAT program. Dr. Woodward asked if the SOFIA is seeking additional places from which to deploy. Dr. Rangwalla said that the team is looking at Argentina and French Polynesia. She believes Argentina will be a bit more difficult. The team has assessed the sites for data quality and efficiency of science targets.

Public Comment Period

The meeting was opened to the public for comment.

Dr. Kartik Sheth of NASA thanked APAC for the discussion on the state of the profession. There are things happening at NASA already, in which he has been active, and he hopes APAC will hold the Agency accountable. There was a lot of discussions on things that are actionable, but he was very disappointed to hear the comments about generating interest and enthusiasm for astronomy in the BIPOC community. Such statements are extremely common, and they put the burden on BIPOC as being not sufficiently interested. Another type of statement notes the presumed lack of qualified BIPOC to take positions of leadership. The problems are actually structural and cultural, and constantly going to consultants to confirm this does not move the field forward. As an example, “get the best person” is a commonly heard phrase, but it signals a process that has been shown repeatedly to reinforce bias. There needs to be BIPOC leadership at the table, and NASA needs their voices to find the solutions at the structural and institutional level. NASA it taking actions but the Agency needs to dig levels deeper to achieve outcomes that are measurable. While he is cautiously optimistic, he wants to encourage APAC to reflect, and to listen and engage with BIPOC communities to co-develop solutions.

Dr. Brittany Kamai, a postdoc at UC Santa Cruz and CalTech, said that the discussion was disheartening to hear. A lot of the suggestions do not address the foundational problem, but instead note the symptoms. Unless every member of the Committee is actively working to eradicate racism, they are perpetuating it. NASA chooses which science to fund, which means NASA chooses which research cultures serve as role models for how to treat people within the astrophysics community. NASA needs to evaluate which research environments are being perpetuated. The Agency needs to hear the voices of other individuals who are impacted by NASA funding, and go beyond PIs. Anonymous reporting must be made available, because there are research cultures in which retaliation is rampant toward those who speak up. It is not enough to bring students into a culture that perpetuates racism and sexism. Why does NASA continue to fund those with a history of abuse toward students and postdocs? Why does NASA continue to fund those with a history of abuse toward BIPOC? NASA has an ethical obligation to dive deep into its own review processes. She participated in a NASA review panel, for which she was selected based on her scientific expertise, and it was clear that the same level of scientific rigor is not applied to evaluating the inclusion

packages, diverse representation, and community engagement. This is where NASA's actions need to focus. How we do science is as important as what we do. There is an opportunity to do better, and she hopes that NASA starts putting in the work.

Dr. Rita Sambruna of NASA said that the Agency is working on this. She described the GSFC effort on equity and an inclusive workforce, and NASA is taking stock of the policies to ensure inclusivity. This includes looking at the role of white astronomers. Change will not be overnight but it will happen.

Dr. Jones agreed with the need to hold PIs accountable. He thought there was a mechanism at both NASA and the National Science Foundation (NSF) for reporting toxic environments and toxic PIs. He wondered if these programs need to be made more broadly advertised and used. Dr. Woodward said they would hold that for discussion.

Dr. David Lieberhardt asked about the FY21 budget for SOFIA. Dr. Hertz replied that the Congressional appropriation committees have not yet marked up the NASA budget, so this is unknown.

Dr. Michele Silverstein of NASA asked whether, in regard to PIs and resources for accountability, there is something that can be done now. His understanding is that the new grant terms require universities to report investigations into sexual harassment. He was not sure if it covers racism, however. Dr. Holley-Bockelmann said that there needs to be something else because people have to identify themselves to put these cases forward.

Dr. Chanda Prescod-Weinstein from the University of New Hampshire (UNH) pointed out that she sees a lot of emphasis on gender, and race and gender. She is concerned that they are in a loop in which suggestions are made again and again, and conversations happen repeatedly. She asked where the implementation is and what efforts are made to see if change is happening, and seeing people move from grad school to postdoc and PI positions. This has been discussed for decades and seems to not be happening. Dr. Woodward said that APAC's intent was to make actionable findings and recommendations, with outcomes and metrics that can be assessed.

He thanked the members of the public who spoke, and invited those with further thoughts to join the next day's public comment session.

Discussion

Dr. Woodward said that Dr. Hertz wanted input on the 2021 ADAP cancellation, how the Agency will address some of the research institutions' issues resulting from COVID-19, the COPAG recommendation, and the Terms of Reference to endorse from ExoPAG. APAC wanted more information on the funding profile and guidance for proposers to the Pioneers program. The letter to Dr. Hertz should also include APAC's reaction to the SOFIA presentation in response to the pointed requests at the last meeting. He asked the members to think about these things in the evening, then thanked the presenters.

Dr. Hasan read a public comment from the WebEx chat, from Dr. Stephan McCandliss at Johns Hopkins University (JHU), which advised that Dr. Hertz consider women and EC researchers as a way to prioritize "costed extensions." Dr. Hertz replied that SMD is working on explicitly prioritizing EC researchers. Dr. Walkowicz said that the presentation was good in that it addressed the fact that treating EC as a block specifically benefits white women. The profession has been discussing women and minorities as a single block, and that is not the case. Their thinking needs to expand to move away from these combinations.

Wrap up for Day 1

The meeting was adjourned for the day at 5:01 pm.

Wednesday, June 24

Opening Remarks
Dr. Hasan welcomed the meeting participants, reminded everyone that this was a FACA meeting, and reviewed the ground rules. She then took roll.

Dr. Woodward welcomed the meeting participants and reminded conflicted members that they should have their COIs noted, then recuse themselves from discussion. They would be allowed to listen silently.

Webb Telescope Update
Drs. Meixner and Meyer were conflicted on this topic and recused themselves from the discussion. Dr. Eric Smith, of the Webb program office, explained that in the face of COVID-19, NASA was given permission to continue work on Webb but with social distancing restrictions. As a result, progress is being made but not as efficiently as before the pandemic. Initially, the GSFC-based NASA people came back from California and only the Northrup Grumman people worked on Webb. However, the NASA team members are returning for integration and testing (I&T). Still, it is not possible for workers to get into and out of the clean room as efficiently as before, and this has an impact on the work.

The team is assessing the schedule and expects to announce a new launch readiness date (LRD) in July. They completed the final steps for the observatory before environmental tests (Comprehensive System Test (CST) #4 and Ground Segment Test (GSEG) #3), and the cryocooler had the final fill. The GSEG is like a software test. The mission has reset the clock for the proposals for Cycle 1, but investigators can submit now if they are ready.

Dr. Smith noted what had been accomplished through April. The remaining milestones will be changed. A graph of the funded schedule reserve showed the initial plan, the GSFC recommendation, and the actual. Prior to the COVID-19 impact, there were about 2 months of funded schedule reserve, which indicates the kind of margin the team will want. They will have to factor social distancing into the schedule margin. GST 3 will begin in early July, followed by actual environmental tests. The efficiency is lost moving to shipment.

Past issues include technical issues with traveling wave tunable amplifiers (TWTAs), which have been replaced; the CST is closing that issue. The command and telemetry processor had a transformer problem, and that issue will be closing as well. The fairing depressurization issue cannot be updated at this time. The membrane release devices (MRDs) have been rebuilt, and the non-explosive actuators (NEAs) are being remanufactured. There are two new issues. First is the deployable radiator shade assembly (DRSA). These protect the spacecraft from radiation and help keep it cool. Some of the joints have been redone. This is proceeding as planned; it was never part of environmental testing and is not on the critical path. There was also a swap between the backup and main batteries following a contingency analysis. This is a change, not a technical issue, and it has been reviewed and approved. Dr. Smith showed a photo from before the deployment test of Webb in launch configuration. Aside from the installation of an antenna, this is the CST configuration. Environmental testing starts in August. A pre-environmental-review review is going on now.

Dr. Woodward observed that there are different sorts of aspects of the observatory falling under scrutiny, like the DRSAs and batteries. The integrated spacecraft is getting full, and he wondered if there might be additional challenges coming out of that. Dr. Smith said that system engineering carefully tracks mechanism use and when they are close to limits. It has always been actively watched. Material lifetime is not an area of concern. The long-term issue is contamination, which Northrup has been aggressively watching while NASA watches Northrup. Dr. Woodward said that the fairing depressurization was noted

at the last meeting. He asked about the flight manifest in July to test this. Dr. Smith said that the Arianne team has a launch scheduled for the end of July from French Guiana, and it should go off. Right now, system engineering believes a single flight will provide sufficient information.

They are working to define a new launch date. The tasks have stayed the same, but the efficiency with which they can be completed has changed. The question is whether social distancing rules affect various tasks. Without COVID-19, there would have been 2-5 months of schedule reserve, but that is being reassessed. There are fiscal reserves and the team does not anticipate needing additional funding. While there is Congressional language concerning Webb, it is not tied to a specific launch date. If there is no need for additional funds, there will be no need for another replan and reauthorization. The new launch date should be determined in July, at which time there will be a public announcement. When asked how far the schedule can slip before there is a need to request more funds, Dr. Smith said that he could not commit, but his best guess is that they can go several months past the March date and still have reserves.

Dr. Woodward thanked Dr. Smith. APAC looks forward to the fall update and discussion of the financial impacts that might occur due to the rescheduled launch date.

ESCAPE Update

Dr. Kevin France explained that ESCAPE is in Phase A. This is a relatively simple mission to study the stellar context for habitability, characterize habitable zones, and further assess how the type of star affects the habitable zone. NASA has a large investment in studying atmospheres. All of these missions are looking for atmospheric molecules and biosignatures, assuming the planets can maintain the atmosphere. The type of star affects this. There is a lot of excitement about red dwarfs, which are easy to find, but it could be that M-dwarfs planets cannot maintain atmospheres for long. This sets up the question of which star/planet systems are conducive to maintenance of habitable conditions? This is expensive to determine, leading to the question of where NASA and its partners should commit their resources. To understand the strongest stellar drivers for atmospheric escape, we need to know the extreme ultraviolet (EUV) flux. Much of what is known about the EUV fluxes of nearby stars comes from the 1990s and the Extreme Ultraviolet Explorer (EUVE). This is an area of uncertainty, and the proxies for the wavelength band are in disagreement. Flares may dominate the EUV output of active stars. ESCAPE will observe EUV flux and its variability over time.

Dr. France reviewed the three science objectives: 1. To determine if the stellar radiation environments permit habitable conditions on rocky planets; 2. To characterize EUV evolution and flares, and their impact on planetary atmospheres; and, 3. To determine the impact that coronal mass ejections (CMEs) have on loss of atmospheric mass. ESCAPE is an EUV and far ultraviolet (FUV) spectroscopy mission to examine 200 nearby stars, with a planned launch in 2025. Phase A involves modeling to estimate which star/planet systems are most promising for retaining atmospheres. ESCAPE will have 100 times the sensitivity of EUVE, enabling the statistical study. It will also be able to probe different evolutionary timescales, mapping the evolutionary sequence by types of stars and monitoring short-term events like flares. Finally, ESCAPE has the sensitivity to detect CMEs on other stars, being based on sun-as-a-star observations from the Solar Dynamics Observatory (SDO).

The mission is cross-disciplinary, involving astrophysics, heliophysics, and planetary science. The instrument builds on other missions, with all pieces based on previous NASA investments. Dr. France described how ESCAPE will work, along with the various elements, including the fraction grating, which grew out of NASA projects tested on sounding rockets. The spacecraft has a long heritage of satellites built for NASA. Dr. Woodward thanked Dr. France for his presentation.

It was noted that Drs. Gaskin and Brenneman were conflicted and therefore did not participate in the discussion. Dr. Mahadevan was unsure as to whether he had a COI, but recused himself in the absence of a determination.

Dr. Meyer asked about the ESCAPE mission lifetime and the diversity of the sample within the cohort. Dr. France replied that there are at least 40 stars per spectral type, more heavily weighted to the M class. These are broken out into early and late, within which ESCAPE can measure young and old categories. It will be able to anchor several points for each spectral subclass. The likely resolution will be 1.5 angstroms in the EUV. Regarding atmosphere viability, there are compositional factors, which will remain unknown, but the team is interested in the plausibility of studying planets, identifying those worth studying. About one quarter of the sample stars have known planets, and there are assumptions about the percentage. Information from TESS and missions like Webb will help the ESCAPE team set priorities.

Dr. Meixner asked how this differs from what could be learned from Hubble. Dr. France said that the emission line temperature is missing in Hubble, which creates the wide disparity in EUV estimates. The ESCAPE team wants to make the measurement because there is no way to do it by proxy. Dr. Meixner said that COPAG is very interested in this. She asked about public access. Dr. France said that part of the initial proposal is a 2-year focused mission with a GO program in coordination with NASA. He anticipates a GO program that would start in the second year, and all data would be published 6 months after initial observation.

Athena Update

Drs. Gaskin, Brenneman, and Galeazzi were conflicted on this topic and therefore recused themselves from discussion. Dr. Rob Petre explained that Athena is ESA's second large Cosmic Visions mission. It is a simple concept with a single telescope and a 12-meter focal length. The launch is planned for the early 2030s to an L1 orbit, and the prime mission will last 4 years with a design assuming 10 years. The focus is on the hot and energetic universe. Athena will measure gas bulk motions and turbulence with precision, with more collecting area and better spectral resolution than Hitomi and XRISM. Another focus is on super-massive black holes (SMBH). Athena will go much more deeply into SMBH formation than Chandra and XMM. There is a wealth of observatory and discovery science. Dr. Petre gave some examples of what can be measured. Athena will fill an important niche and a major hole in multi-wavelength measurement and MMA, and will have synergy with LISA, as shown in a timeline.

Dr. Petre noted the science requirements. The mission will have a huge x-ray mirror, strong resolution, and low background. The net effect of stacking the mirror plates is a 1.4-meter x-ray telescope. NASA will be contributing to two instruments. On the X-ray Integral Field Unit (X-IFU), led by France, NASA is contributing the focal point array. On the Wide Field Imager (WFI), NASA will provide design and modeling. Total NASA hardware contributions will be in the $100-150 million range. Dr. Petre described NASA's contribution to the ground segment. The Agency hopes to participate in the software, calibration database, and will have a science team for simulation software. There are already opportunities for U.S. scientists, including Athena science working groups. The NASA Athena science team has about 20 members advising the Agency on how best to participate. Dr. Petre listed future opportunities. Athena in Europe has entered Phase B, and NASA has transitioned it from a study to a project as of May. The two agencies hope to sync up by June, 2022.

Dr. Woodward thanked him for the presentation. He asked about the flight heritage and handling of the mirrors with the architecture being used. Dr. Petre said that the mirrors are being developed specifically for this mission, and there is no plan to fly them in advance of Athena. Regarding response to multi-messenger events, ESA tends to be in constant contact with its observatories for steady stream data. The actual driver for quick response would be to receive a request for an observation, go through logistics for

approval, and get the command to Athena. There will be a requirement to do this within 4 hours for a limited number of events per year, such as gamma-ray bursts.

The mission is in the equivalent of NASA's early Phase B. The GO and Guaranteed Time Observers (GTOs) will be similar to XMM. U.S. PIs can request funding as part of the ESA calls. Dr. Woodward noted that XMM is not always clear. There is a movement in the community to have a one-stop shop on x-ray. He asked if there had been any thoughts on that. Dr. Petre said that the communities are strongly overlapping. The Athena plans are still rather vague. They will be flexible and develop what makes most sense for the community that is also cost effective.

GUSTO Update

Dr. Chris Walker provided an update on GUSTO. This mission explores the lifecycle of the interstellar medium (ISM) through large-scale surveys of the Milky Way and Large Magellanic Cloud (LMC) in terahertz transitions of CII, NII. and OI. It will do meandering scans of the galactic plane, towards over a half a million lines of sight (LOS. This comprehensive set of observations will provide insight into the inner workings of the Milky Way and how the ISM evolves over cosmic time.. The Stratospheric Terahertz Observatory (STO), flown in Antarctica as an APRA balloon payload, was the pathfinder for GUSTO, and much of the same team continues to be involved in GUSTO. STO served as a testbed for the technology, operational concept, and data analysis techniques that are being employed on GUSTO.

The mission is well into Phase C, though I&T was slowed down by COVID-19. However, GUSTO is still on track for a late 2021 launch. Dr. Walker showed the instrument work, describing an oscillator and the Band 1 LO Array. One part of this is due from MIT but was held up by COVID-19. The array assembly passed pre-ship review the day before. The team expects to have all arrays by late summer.

Dr. Walker showed the risk chart. The super pressure balloon (SPB) test flight was cancelled due to COVID-19, but the team hopes to have a test flight next spring. In comparing cost versus baseline, he noted that they are slightly above where they want to be. They are also adding staff to make up for time lost to the pandemic. The program office has been helpful in supporting the effort, everyone is working well, and things are coming together.

Dr. Meixner said that it sounds like a phenomenal data set, and asked about community access to results. Dr. Walker said that results will be available after 6 months. There is no proprietary period. Dr. Woodward asked how the availability of the zero SPB might affect the campaign's threshold mission. Dr. Walker said they could meet the criteria with a single zero SPB flight. This is very complementary to other work, like that done on SOFIA. There will be multiple levels of data products, including the basic level and more reduced spectra, so people can try their hands at it. They are trying to learn from Herschel to minimize baseline issues. Every 5-10 minutes they will look at starfields, so they can reset the gyroscopic drift. There will be 4 to 5 arcsecs pointing accuracy. Calibration scans will be made toward known sources.

COSI Update

Dr. John Tomsick explained that COSI is a SMEX mission selected in the 2019 opportunity, currently in Phase A with a launch date in 2025. It will cover the entire sky daily in the MeV bandpass and will have polarization capabilities to study gamma-ray bursts. This is an interesting range of the spectrum that has not had good measurements thus far and so it presents a discovery space. The science objectives are to identify sources of galactic positrons, reveal sites of element formation, probe the physics in extreme environments with polarimetry, and find counterparts to merging neutron stars and high-energy neutrino events. Dr. Tomsick presented a simulation of what COSI would do.

COSI is more compact than previous Compton telescopes (Comptel), and will provide vastly improved performance with a fraction of the mass and volume. A lot of the instrument development has been through the APRA program with balloons, going back to 2005. Dr. Tomsick noted the imaging, spectrum, polarization, and real-time transient measurements coming from some of that work. COSI will have 16 detectors, and will require cooling and shielding. The orbit will need to be near-equatorial, with north-south repointing every 12 hours to cover the whole sky in a day. The team plans to have a target-of-opportunity (TOO) capability, as well as rapid transient alerts.

Regarding the science on galactic positrons, the origins remain unknown. COSI will determine if there are point sources or a substructure, measure the disk scale-height, and determine the total galactic positron production rate. Dr. Tomsick discussed the goal of revealing element formation – Fe60, Al26, and Ti44 – and what is known of their presence thus far, and what their presence reveals. COSI will also provide insight into gamma-ray burst polarization and extreme environments. The mission will study pulsars, active galactic nuclei (AGN), and black hole binaries. COSI will contribute to MMA research by detecting and localizing counterparts. Compton telescopes will combine a large field of view with good localization capabilities. The BGO shields are interactive and will detect gamma-ray bursts possibly associated with gravitational wave signals. Dr. Tomsick gave examples of potential TOOs. COSI will have the capability to deal with things that are low probability but offer a large payoff. Options include a Guest Investigator (GI) program like Fermi's, solar studies, and faster localization of gamma-ray transients. Dr. Tomsick described how TOOs might be implemented. Some measurements will be triggered by COSI observations, after COSI has a detection. Dr. Woodward asked how critical it has been to have the APRA opportunity to develop the workforce and techniques. Dr. Tomsick said it was very critical. Every iteration was an improvement and a change, and it allowed the team time to improve their software and learn. It has been a long and helpful process. Dr. Brenneman asked about how quickly COSI would be able to react to TOOs and also about coordinating observations with other missions that will be operating in 2025.

CASE/ARIEL Update

Dr. Mark Swain described CASE, NASA's contribution to the ARIEL mission and a great opportunity for U.S. scientists interested in characterizing exoplanet atmospheres. ARIEL is ESA's M4 mission, with plans to launch in 2028 to L2 for a 3.5-year prime mission. The goal is to survey exoplanet atmospheres, with an impact similar to that of Kepler. The mission will observe about 1,000 planets and sample many molecular opacities. It will overlap with Hubble and Webb. The science is organized around key questions about planet formation and composition that can only be addressed with a statistical study of exoplanets. The survey will have four tiers, the first being a reconnaissance survey of about 1,000 planets, followed by the Tier 2 deep survey of about 100 planets. The Tier 3 benchmark planets will have good signal-to-noise and illustrate important aspects of exoplanets. The phase curve component is Tier 4. Targets will be defined by the payload consortium science team. ESA and NASA are currently negotiating data rights.

The CASE hardware consists of a pair of detectors, cables, and electronics to digitize the signal. These are contributions are to the fine guidance system (FGS), which produces data that can create science data products. NASA will process FGS data. CASE enables U.S. participation in ARIEL survey design. CASE and ARIEL are highly synergistic with Webb. Dr. Swain showed some of the areas that CASE can measure. The science objectives are closely related to the covered wavelengths. CASE will determine the occurrence rate of aerosols – clouds and hazes. Forecasts on performance indicate a good margin to meet the requirements for a range of outcomes.

Dr. Swain described a simulation the CASE science team did for the ARIEL Tier 1 survey, demonstrating high science value. Work on aerosols will be of great value, and another opportunity will be a study of the

envelope loss and impact on composition. Community engagement will focus on three major areas: 1. Input into defining the observing priorities, factoring in Webb results; 2. Precursor observations; and 3. Access to CASE/ARIEL data products, to be made available through partnership with the NASA Exoplanet Science Institute (NExScI), which will mirror ARIEL science archive data products. The CASE science team's community engagement practices will follow the model of TESS, so that the community can provide input on observing priorities.

Dr. Cooray asked why this was an MO rather than a strategic mission. Dr. Swain said that the goal was always a competed mission path. The CASE science team discussed two paths with NASA. There was no discussion of a non-competed mission approach. There was a lot of consideration of lessons learned from Euclid. One lesson was that there was a need to be clear about not accepting technology development, which was considered risky. This model has been based on Euclid heritage parts operating as they were meant to operate on Euclid. Dr. Meyer noted that the ESA model is different from NASA's, and he wanted to know more about the risk of getting quality data to the U.S. community. Dr. Swain explained that this was the subject of much discussion. ESA creates L1 and L2 data products, which go to the consortium for validation. L3 products go to the mission archive. If there were to be a concern, there is a way to pull the L1 or L2 data products from mission archives and re-analyze them. That offers protection. Dr. Woodward said it might be helpful to get more detail in the future.

Public Comment Period
The meeting was opened to the public for comment.

Dr. Wilton Sanders asked for clarification about Astro-H as an MO. Dr. Hertz said that the Astro-H mission was selected more than 10 years ago.

Dr. Maryam Modjaz, from New York University (NYU), said that it is important that NASA expand its role to broaden opportunities. In addition to the protests, COVID-19 has impacted minorities greatly, and the postponement of the ADAP deadline is a problem. The minority community is being asked to be on committees, and it is a rushed time to think about science and work on proposals. NASA should reconsider the ADAP cadence and even make it twice a year.

Dr. Yilen Gomez Maqueo Chew, a professor at Universidad Nacional Autónoma de México (UNAM) in Mexico City, said that she did her graduate work in the United States. She has been a NASA reviewer and used NASA mission data. Most of the discussion the previous day was very disappointing. It is clear from the lack of BIPOC scientists at NASA that NASA has not done enough. There were comments about outreach and education, but we have been doing this for decades. We have been doing this work on bias for so long and it is has not made our communities more equitable, and it is not working. In any other setting, would we allow the same activities that are not working to continue like this for so long? There are many mentions of accommodations made as a result of COVID-19 but the discussion did not mention how the murders of Black people might be affecting our community, or what kind of accommodations ought to be made. It is good that individuals are talking about doing the work and how to become better people. But what we really need is a change of culture in the community, and so the question is how will APAC work to effect this needed change of culture? Doing nothing, or only continuing to do what we have done thus far, will not help BIPOC.

Dr. Hertz noted that APD is not going to alternate years on ADAP, it is just this one time.

Science Activation Update
Ms. Kristen Erickson of SMD explained that the Science Activation (SciAct) program has been in place since 2016 and is on a 10-year timeline, which is 5-year effort and one 5-year extension. SciAct also integrates SMD's recently released Science Plan. The objective is to connect NASA assets with learners

of all ages. Community partners are key. The emphasis is on diversity, equity, inclusion, and access (DEIA), though the team has not been as successful as desired in reaching underserved groups. There are 23 awards. each with independent evaluators, and the Program relies on over 1,100 volunteers and 220 partner networks. NASA asked NAS to assess SciAct in 2019. The evaluation was to be similar to that of a science mission, so the Program could determine what does and does not work, then adjust. Ms. Erickson provided an example of how one awardee scales SMD science by developing hands-on kits for informal institutions and then distributing them in a competitive selection process to 350 institutions. A similar process is used for 52 traveling or stationary exhibits.

Science Activation is a much more integrated and strategic approach to sharing science than the previous model. Prior to 2015, each NASA science mission had a percentage of its budget set aside for education and public outreach. However, SMD has over 100 missions in any given year. Stakeholders determined there could have been a lot more coherence and less duplication of effort. So, in 2014, NASA SMD lost $42 million/year in that area and was told to restructure its efforts. Subsequently, the SMD created the Science Activation Program, which exists today and was recently validated by NAS. The model connects our unique assets (content and Subject Matter Experts (SMEs)) through the use of cooperative agreements and partners, to achieve objectives we could not have done alone , like enabling STEM education, improving U.S. science literacy, advancing national education goals, and leveraging partnerships. All to bring science to learners of all ages, wherever they may be located.

Ms. Erickson reviewed 2019-20 accomplishments. In the last year, 4,600 of the country's 17,000 libraries registered for the summer programming. SciAct also used the ESD GLOBE Observer app to create a mobile lab. This was used to identify Zika mosquito habitats, for example. Also, for the PBS Learning Media where materials available are all free, the use of these modules during the pandemic has increased 650%. Ms. Erickson also described virtual student challenges to create a rover with items the students have at home.

Planned accomplishments for FY20-21 were affected by COVID-19. A ROSES solicitation was issued to fill gaps in two areas: SME engagement, and broadening participation. SciAct is active in all 50 states, but there is a need to improve in some. Not all 23 Cooperative Agreements will be extended, and SMD will rebaseline SciAct 2.0 in 2021. This effort will incorporate all seven of the NAS recommendations. She can come back next year to discuss the changes. Ms. Erickson noted the alignment between SciAct and the 2018 Co-STEM effort. Rural learning is one area of expansion. COVID-19 has illustrated the extent to which there is a lack of Internet access, and the program needs to address that.

Among the SciAct awards are three for astrophysics, of which the largest is the Universe of Learning (UoL), which has five teams and many partners. UoL held a photography challenge connecting images by SMEs and learners. UoL's ViewSpace uses real data that are displayed at almost 250 museums, science centers, and planetariums. It allows users to see the images at multiple wavelengths. Another effort, she highlighted is ASTRO CAMP, a collaborative program that used to be run out of the Human Exploration and Operations Mission Directorate (HEOMD). SciAct does virtual training of the people who run these camps, and there are 81 such community collaborations nationwide. She described the Citizen Science Initiative, which holds training sessions with scientists and amateurs each year. Ms. Erickson would like to see this initiative do better in terms of access. One element that seems to be missing is identity.

Dr. Woodward had a question about the budget. SciAct's current funding is $46 million, of which $1 million is for citizen science. Regarding a comment about an identity matrix, Ms. Erickson clarified that she meant to underscore the complexity of the issue. She has been with the Agency for many years, and when she looked back at some of these efforts, she wondered why NASA has not done better. She feels that first, this is not simple. In addition, it seems that NASA is either asking the wrong questions or not addressing something that is structural and fundamental. She thinks the identity issue is a big part of it.

She has spoken at length with APD's Dr. Sheth, who is a thought leader in this area and had done a lot in this area before coming to NASA. Dr. Julie Johnson from NSF has spoken with them as well. A key is being intentional in these efforts.

Dr. Moustakas wanted to know about coordination with other parts of NASA that have similar intent and charter, and expressed concern about unintentional siloing across NASA. He was specifically interested in what kind of coordination SciAct might have with MUREP and similar NASA programs. Ms. Erickson said that there has been consistency for SciAct since 2015, but other programs have less secure funding. Mr. Torry Johnson has consulted with SciAct; he is the officer for STEM engagement manager. SciAct has been working with MUREP over the years. It is not enough to just have a funding opportunity and expect responsiveness. NASA needs to build relationships with the institutions and ensure they know about ROSES, the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES), and other programs. Long-term relationships are crucial to overcome barriers to entry; it is not effective to just make things available, there is a need to reach out.

Dr. Walkowicz asked if it would be possible to see the Rover project results. Ms. Erickson said that she would provide links. SciAct has museum partnerships and planetarium content that is free and online, with a whole series of STEM-at-home resources. Rather than be prescriptive, SciAct gave the Rover challenge a framework to encourage creativity. Dr. Walkowicz asked about barriers to Internet access. Ms. Erickson said that a rural collaborator pointed out that while people might not have Internet access, they all have phones. SciAct is following up on this and is talking to Microsoft about it. Access is something they are staying on top of.

Dr. Gaskin thanked Ms. Erickson for the presentation and asked how they know when they are reaching every part of the community. She also wanted to know about the metrics used to gauge program success, and asked if the funding is sufficient to make necessary changes. Ms. Erickson said that it is quite a task. The NAS recommendations said to think about the focus in order to get the scaling to occur. Without that, it would be hard to demonstrate success. SciAct relies on its network of networks to feed that back into the portfolio at large. The Program will select focus areas, such as science literacy and the process of science. The funding SciAct has is what they can work with, and it is essentially a flat budget. Therefore, the Program tries to leverage partnerships.

Public Comment continued

Dr. Woodward read a statement sent in by Dr. Stuart Vogel, who wanted to speak to the racism that pervades NASA and the community. He was a department chair at the University of Maryland for 10 years. One thing he learned is that white people's experience, such as his own, is often not relevant and is often the problem. The more he learned, the more he realized that his experience and that of his white colleagues did not help, and that they needed to bring in BIPOC. Universities have at least as far to go as NASA in putting BIPOC in leadership roles and in making astronomy more equitable and inclusive, and actively combatting racism. However, that is not an excuse for inaction at NASA. He recommended that APAC advise NASA leadership of the following:

- Structural racism is invisible to white people. It advantages white people.
- Seek out BIPOC advice (especially from leading advocates within the BIPOC community) and actively solicit their guidance.
- Then, and this is essential, use your platform to amplify their voices and ideas, and most important of all, act to implement their advice.

Dr. Woodward next read a statement from Dr. Kamai, who also spoke the previous day: It is not clear who NASA refers to as the astronomy and astrophysics community, or who are they engaging with. The main places that I see NASA's presence is at AAS and American Physical Society (APS) townhalls. Those meetings have a large selection bias for who have the privilege to attend and many people who are

not aware of that as the primary way to learn from NASA do not attend. Where I do not see a presence of NASA is at Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS) or National Society of Black Physicists (NSBP), which are science conferences that have broad scientific expertise and very diverse demographics. In fact, how was anyone supposed to know about this APAC meeting and all the steps to go through to join and how anyone could participate? There are many barriers to participation, and I would like to see NASA actually provide resources and online seminars about opportunities, i.e., funding, etc. There are more opportunities for a broader audience to participate. This should be done through social media channels, departments, etc. There is a bottleneck of information at PIs who have directly had funding. I have been with the University of Hawaii, Fisk University, Vanderbilt University, University of Chicago, Caltech, and now UC Santa Cruz. I have been in instrumentation, and through all those places, my PIs were not directly working with NASA funding, which meant I had no way of knowing this information. Similarly, this is not being presented for opportunities to engage. My story is not unique.

Dr. [unintelligible] from JPL was glad to hear the presentation on SciAct and would like to hear more in the future about metrics.

Dr. Theresa Brandt of GSFC said that, regarding the SciAct "K-Grey" initiative, she only heard about students. She asked how non-student initiatives integrate into the program and serve the mission and goals. Ms. Erickson said that there is a lot of engagement in both English and Spanish, not just for students, but for the adult learner population as well.

Dr. Moustakas read a statement from Dr. Janice Lee: She wanted to share some thoughts regarding diversity, inclusion, and equity. Clearly, we should not make decisions (structural and otherwise) that may have a disproportionate negative impact on underrepresented groups. But yet, those decisions continue to be made because those groups do not have meaningful representation and are not at the table from the start, and so they are not able to point out when there is the possibility of that happening, or to suggest how decisions can be made in a better way for all. Then those from the underrepresented groups not only suffer from those decisions (and other serious impacts from not having a seat at the table), but need to allocate time and energy to try to correct them. Over the next year, we need to bring people from underrepresented groups into the leadership and decision-making structure at all levels. Dr. Moustakas added that this level of community input is essential for APAC to do its job, and the Committee members were grateful.

Discussion, Recommendations, Actions

Dr. Woodward reviewed the components of the letter APAC would send to APD. They needed a recommendation on the cadence for ADAP. Second, there were two Terms of Reference (TORs) to approve for ExoPAG. They also needed to convey to SMD the importance that the foreign student and science workforce has to the United States, an issue due to the change in status of a number of visa holders at science institutions. There would be discussion of the mission presentations, and a return to the overarching theme of the status of the profession.

He asked for approval of the TORs from ExoPAG. All of the members voted via the WebEx chat box, and the vote was unanimous to approve. Dr. Woodward said he would put in the letter a recommendation that Dr. Hertz consider these TORs.

Dr. Jones asked about what impact an APAC recommendation on visas could have, given that the consular offices are all closed. Even if there were no change, the Administration has shut down all pathways to apply. Dr. Galeazzi said that most of those affected already possess the permits, and Dr. Mahadevan said the impact is serious and destructive. It was suggested that APD report on the impact. Dr.

Galeazzi wanted to make a statement of concern as well. Dr. Jones added that a tone has been set of making such participation more difficult.

Dr. Woodward said that Dr. Hertz wanted a sense of the Committee on the ADAP cadence. Dr. Hertz noted that it was possible to reverse the decision and have a call in FY21, making the usual number of selections in FY20. Dr. Holley-Bockelmann said that APAC had data showing the change to be a disadvantage, so NASA should state that they will roll back the decision. Dr. Meyer seconded it. Dr. Conklin said that part of the decision had to do with the stress on the NASA headquarters team. Whatever they recommend, APAC must recognize the extra work done by NASA at times like this. Dr. Hertz thanked him, noting that now it is clear there will be a disparate impact, which APD did not know at the time of the initial decision. Dr. Moustakas said he was impressed with the community response. He hoped this discussion would increase awareness. Dr. Woodward cited the need to ensure that the information goes out to the community; the more communication on this issue, the better. Dr. Meixner volunteered to write this recommendation.

Dr. Woodward said there was a suggestion about using the Earth Venture policy on the Pioneers program. Dr. Hertz said that the intent is to have it in the final call. When he reviews it, he will ensure it is clear.

Dr. Woodward said that regarding the state of the profession, they should keep this issue on the front burner. There were suggestions on having another meeting on the topic before the fall meeting. The issue is relevant to the community and NASA's ability to effectively conduct science. Dr. Hertz said that some time will be needed to ensure proposed changes to fellowships or other programs do not violate federal regulations or laws. Otherwise, they can make changes up to 90 days before a due date. Dr. Walkowicz suggested having it as a regular agenda item, as there is a lot to discuss, and she endorsed having a meeting dedicated to the topic prior to the fall meeting. She received messages from the community saying that the time for comment was too short, and APAC might consider ways in which they can devote more time to that. Dr. Woodward said that APAC members need to use their networks to get this information out. Dr. Moustakas advised having a forum through the PAGs and a follow-on to the next APAC. They should not wait for the DS, however. APAC has the responsibility and obligation to give recommendations that are actionable. They need to listen to people with a range of backgrounds and think of effective ways to give them voice.

Dr. Woodward said the existing members should consider recommending BIPOC names for new members of APAC. He advised the Committee to take that as an action item. Dr. Moustakas said that the network of networks is critical. The most effective way to recruit diverse individuals is to get out there and talk, and leverage the proactive engagement of the communities they want to see. Dr. Meixner asked if there is a role for the PAGs in this. Dr. Woodward advised trying all avenues, and discussing how to get messages out and feedback in. There is a gap. Dr. Moustakas noted that there is currently no clear way for the community to communicate with APAC, and to communicate with any one of the three PAGs; there is still a barrier to understanding how to contribute.

Dr. Gaskin added that they need to set some clear milestones. A lot of this is continuously defined. They need to put together a solid plan. Dr. Hertz suggested a recommendation that subcommittees be created, though they would need to fall under FACA regulations. However, APAC members are already SGEs. The best thing to do is figure out what they want, and APD will figure out how to get it. PAGs are not connected to APD formally. A working group could be the right frame of mind. Dr. Conklin observed that they need to decide what they want the group to do. Dr. Galeazzi cautioned that there is a need to expand the community, and if they turn to their usual sources, like the PAGs, they will get the usual feedback. They need to expand in order to do something different. Dr. Meixner agreed. The COPAG email list is very dated, and the PAGs ought to think about how to communicate beyond the email lists.

Dr. Woodward said that they will need to define members of the communities they wish to reach, and ask how they receive communications.

Dr. Conklin said that Dr. Rocha, the PhysPAG chair, is not a member of APAC. However, she contacted him to pass along that PhysPAG will help and participate. Dr. Gaskin said that this is a multi-pronged problem. She wanted to know if they could make any recommendations before they get a subcommittee together. Dr. Jones mentioned the discussion of mechanisms for reporting, and Dr. Meyer stated that toxic work environments go beyond sexual harassment, and they should not just rely on universities to report to NASA. Dr. Walkowicz said that in parallel to having a subcommittee or group to focus on this, they need to know that these problems have been studied. She would like to see NASA engage with the recommendations from the reports of those studies. The goal of a working group should not be to get up to speed on this but to think instead creatively. Engagement with the literature is very important. Dr. Holley-Bockelmann said that a simple and immediate action is to allow NASA employees to attend these meetings.

Brief to Division Director

Dr. Woodward said that the charge to APAC was to work diligently over the next week to get something to Dr. Hertz. He thanked the APAC members for participating. It was good to have these comments. Dr. Hertz thanked APAC and the community for speaking up. He heard many ideas that are immediately implementable that he would not have thought of himself. So he appreciated and looked forward to the letter, but he would not waiting for it.

Dr. Hasan thanked everyone for attending the meeting. She looked forward to the recommendations and hoped to make a difference.

Adjourn

The meeting was adjourned at 5:19 p.m.

Appendix A
Participants

Committee members
Charles Woodward, University of Minnesota, *Chair, Astrophysics Advisory Committee*
Laura Brenneman, Smithsonian Astrophysical Observatory
John Conklin, University of Florida
Asantha Cooray, University of California, Irvine
Massimiliano Galeazzi, University of Miami
Jessica Gaskin, NASA Marshall Space Flight Center
Kelly Holley-Bockelmann, Vanderbilt University
William Jones, Princeton University
Suvrath Mahadevan, Penn State
Margaret Meixner, Space Telescope Science Institute
Michael R. Meyer, University of Michigan
Leonidas Moustakas, NASA JPL
Lucianne Walkowicz, Adler Planetarium

NASA
Paul Hertz, NASA HQ, *Director, Astrophysics Division*
Lorella Angelini, GSFC
Megan Ansdell
Simon Bandler, GSFC
Dominic Benford
Gary Blackwood, JPL
Jeff Booth, JPL
Patti Boyd, GSFC
Teresa Brandt, GSFC
John Callas, JPL
Felicia Chou
Knicole Colon, GSFC
Lucien Cox
Jeanne Davis
Patricia Daws, AFRC
Kristen Erickson
Dan Evans
Mike Fanelli, NASA Ames
Ingrid Farrell
Richard Fisher
Thomas Fox
Johnathan Gardner, GSFC
Hashima Hasan, NASA HQ, *Executive Secretary, APAC*
Elizabeth Hays
Douglas Hudgins
Keith Jahoda, GSFC
David Jarrett
Jennifer Kearns
Carolyn Kierans, GSFC
Patricia Knezek
Robin Krause, GSFC

Sam Krieger
William B. Latter
David Leisawitz, GSFC
Janet Letchworth, WFF
David Lieberhardt
Sean McCarville
Teresa Monfue, GSFC
Susan Neff, GSFC
Thomas Hams
Mario Perez
Rob Petre, GSFC
Thai Pham, GSFC
Andrew Ptak, GSFC
Naseem Rangwala, Ames
Graca Rocha, JPL
Thomas Roellig, Ames
Mary Romejko, JPL
Rita Sambruna
Evan Scannapieco
Nick Seigler, JPL
Kartik Sheth
Kendra Short, JPL
Michelle Silverstein, JPL
Eric Smith
Erin Smith, GSFC
Linda Sparke
Karl Stapelfeldt, JPL
Amber Straughn, GSFC
Mark Swain, JPL
Ira Thorpe, GSFC
Stephen Unwin, JPL
Eric Tollestrup
Azita Valinia, GSFC
Monica Vidaurri, GSFC
Joyce Winterton, WFF
Jennifer Wiseman, GSFC

Non-NASA
Branden Allen, Harvard University
Steven Allen, Stanford
Johanna Ateske, Carnegie Observatories
Mark Bautz, MIT
Jacqueline Beechert, UC Berkeley
John Bennett, University of Alabama
Edwin Bergen, University of Michigan
Katelyn Breivik, CITA
Edward Buie II, Arizona State University
Amy Chaput, Stellar Solutions
Mark Carreau, Aviation Week & Space Technology
David Chiari, Orbit
Jessie Christensen, CalTech

Effie Christian, CalTech
David Ciardi, CalTech
Stephen Clark, Space Flight Now
Khadeem Coumarbatch, Georgia State University
Abby Cripe, CalTech
Monty DiBiasi, L. DiBiasi Associates
Mark Dickenson, NSF
Alan Dressler, Carnegie Institution of Science
Sylvie Espinassa, European Space Agency
Jeffrey Filippini, University of Illinois
Kevin France, University of Colorado
David Gaba, Stanford
David Garod, Orbit
Dawn Gelino, CalTech
Hannah Gulick, UC Berkeley
Ryan Hickox, Dartmouth College
Cat Hosacker, Aerospace America
Grace Hu, OMB
Teresa Jensen, Space Dynamics Laboratory
Brittany Kamai, UC Santa Cruz
Kelsie Krafton, American Astronomical Society
Hadar Lazar, Berkeley
Janice Lee
Monty Leiciasi, LCB Associates
David Li
Sara Lipscey, Ball Aerospace
James Lochner, USRA
Tariq Malik, Space.com
Emma Marcucci, STScI
Stephan McCandliss, JHU
Gene Mikulka, Hawkins Space Podcast
Richard Miller, APL
Maryam Modjaz, NYU
Sarah Moran, Johns Hopkins University
Daniel Morgan, Congressional Research Service
John O'Meara, WMK Observatory
Joshua Pepper, Lehigh University
Trona Prescott-Weinstein, University of New Hampshire
Abagail Rhymer, Johns Hopkins
Jarred Roberts, UC San Diego
Suzanne Romaine, Smithsonian Astrophysical Observatory
Ezgenya Sakolnik, Arizona State University
Wilton Sanders
Marcos Santanver, University of Alabama
Elizabeth Sheley, Electrosoft
Denise Smith, STScI
Hale Stolberg, AIP
Kate Story-Fisher, NYU
Steve Thompson, Millennium Space Systems
Alan Thurgood, SDL
John Tomsick, UC Berkeley

David Traoye, Orbit
Greg Tucker, Brown University
Giulia Urini, Miami University
Stuart Vogel, University of Maryland
Eliot Vrijmoet, Georgia State University
Christopher Walker, University of Arizona
Stuart Wiens, Lockheed Martin
Nicholas White, GWU
Ashley Wilkins, House Science Committee
Allison Youngblood, University of Colorado
Andreas Zoglauer, UC Berkeley

Appendix B
Astrophysics Advisory Committee Members

Charles Woodward, APAC Chair
University of Minnesota

Hashima Hasan, Executive Secretary
Astrophysics Division
Science Mission Directorate
NASA Headquarters

Laura Brenneman
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William Jones
Princeton University

Suvrath Mahadevan
Pennsylvania State

Leonidas Moustakas
Jet Propulsion Lab

Margaret Meixner
Space Telescope Science Institute

Michael R. Meyer
University of Michigan

Lucianne Walkowicz
Adler Planetarium

Appendix C
Presentations

1. *Astrophysics Division Update*, Paul Hertz
2. *State of Profession Discussion,* Charles Woodward
3. *ExoPAG Report*, Michael Meyer
4. *PhysPAG Report*, Graca Rocha
5. *COPAG Report,* Margaret Meixner
6. *SOFIA Update,* Margaret Meixner, Naseem Rangwala
7. *Webb Update,* Eric Smith
8. *ESCAPE Update,* Kevin France
9. *Athena Update,* Rob Petre
10. *GUSTO Update,* Chris Walker
11. *COSI Update,* John Tomsick
12. *CASE/ARIEL Update,* Mark Swain
13. *Science Activation Update,* Kristen Erickson

Appendix D
Agenda

Astrophysics Advisory Committee
Telecon/WebEx
June 23-24, 2020

Tuesday 23 June

12:00 p.m.	Introduction and Announcements	Hashima Hasan/Charles Woodward
12:10 a.m.	Astrophysics Division Update	Paul Hertz
1:45 p.m.	State of Profession Discussion	Charles Woodward/APAC members
2:15 p.m.	Break	
2:30 p.m.	ExoPAG/PhysPAG/COPAG Updates	Michael Meyer/Graca Rocha/ Margaret Meixner
3:30 p.m.	SOFIA update	Margaret Meixner/Naseem Rangwala
4:30 p.m.	Public Comment period	
4:35 p.m.	Discussion	APAC members
5:00 p.m.	Wrap up for Day 1	Charles Woodward

Wednesday 24 June

11:00 a.m.	Opening Remarks	Charles Woodward
11:05 a.m.	Webb Telescope Update	Eric Smith
11:40 a.m.	ESCAPE Update	Kevin France
12:10 p.m.	Athena Update	Rob Petre
12:40 p.m.	Break	
1:00 p.m.	GUSTO Update	Chris Walker
1:30 p.m.	COSI Update	John Tomsick
2:00 p.m.	CASE/ARIEL Update	Mark Swain
2:30 p.m.	Public Comment Period	
2:35 p.m.	Discussion	APAC members
2:45 p.m.	Break	
3:00 p.m.	Science Activation Update	Kristen Erickson
4:00 p.m.	Discussion, Recommendations, Actions	APAC members
4:45 p.m.	Brief to Division Director	Charles Woodward
5:00 p.m.	Adjourn	