

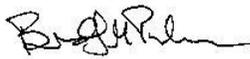
## NASA ADVISORY COUNCIL

### ASTROPHYSICS SUBCOMMITTEE

August 11 - 12, 2014

NASA Headquarters  
Washington, DC

MEETING MINUTES



9/4/14

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Bradley M. Peterson, Chair



9/4/14

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Hashima Hasan, Executive Secretary

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Monday, August 11, 2014

Introduction and Announcements

Dr. Bradley Peterson, Chair of the Astrophysics Subcommittee (APS) of NASA's NASA Advisory Council (NAC), called the meeting to order. He welcomed five new APS members: Drs. Rachel Somerville, Neil John Cornish, Nathalie Batalha, Yun Wang, and Jason Kalirai.

Astrophysics Division Update

Dr. Paul Hertz, Director of NASA's Astrophysics Division (APD), began by noting that this is the fifteenth anniversary of the Chandra mission's launch and deployment. This mission helps in the understanding of heavy element dispersal through supernova explosions. The Kepler mission recently discovered Kepler 186f, the first Earth-size planet to be found in a habitable zone. One of Kepler's prime objectives is to find how frequently such planets exist. The Hubble Space Telescope (HST) recently conducted transit spectroscopy observations of three exoplanets to gauge water through absorption lines. This effort found only 10 percent as much water as the models predicted; if this can be extrapolated, it could mean that finding wet rocky habitable planets might be harder than envisioned. There have been many other significant announcements from APD missions, many of which received media coverage.

APD's strategic objectives revolve around three questions:

- How did our universe begin and evolve?
- How did the galaxies, stars, and planets come to be?
- Are we alone?

The Decadal Survey (DS) has guided APD in identifying priorities. Other guidance comes from the NASA Strategic Plan, Astrophysics Visionary Roadmap, Astrophysics Implementation Plan, and Science Mission Directorate (SMD) Science Plan. The Division is working to update the Astrophysics Implementation Plan by December 2014 with an appendix.

APD addresses the DS priorities to the extent that the budget allows. With the James Webb Space Telescope (JWST) included, the NASA astrophysics budget is \$1.33 billion for Fiscal Year 2014 (FY14). The President's FY15 budget request is for \$1.25 billion. JWST is progressing on schedule, and it is fully funded in both the FY14 appropriation and the FY15 budget request. APD is pre-formulating the Wide-Field Infrared Survey Telescope/Astrophysics-Focused Telescope Assets (WFIRST/AFTA). This version of WFIRST uses the telescope assets made available by the National Reconnaissance Organization (NRO). At this point, the baseline version includes a wide-field camera and a coronagraph. Earlier this year, a National Research Council (NRC) ad hoc study committee compared the AFTA concept against the DS.

The Stratospheric Observatory for Infrared Astronomy (SOFIA) has completed development and entered the operational phase. NASA is developing new Explorer missions and contributing to international partnerships. A recent Senior Review resulted in APD deciding to continue six of the nine reviewed missions.

The budgetary future remains uncertain. The President's FY15 budget request is a 10 percent decrease from FY14. NASA is often without a budget at the start of a new fiscal year. Although both the House and Senate have marked up appropriations bills, no one expects this to be resolved before the November elections, which means that NASA will operate under a continuing resolution at the beginning of the new fiscal year. There are areas of uncertainty in which programs do not know whether to operate at the low or high end of the potential budget. Both approaches have downsides. Dr. Hertz presented a graph of budget

numbers for the last 10 years and the notional 5-year run-out. The planning numbers allow APD to plan for a follow-up to JWST. In FY14, Congress gave the Division unrequested funds to begin planning for WFIRST/AFTA.

Dr. Hertz explained that WFIRST/AFTA is the only version of WFIRST currently under study. The FY14 budget includes \$56 million for pre-formulation, which supports risk reduction, among other things. Technology development is being cosponsored by the Space Technology Mission Directorate (STMD). This is the first year WFIRST has been called out in the NASA budget, which is a strong vote of support from Congress and the White House. Dr. Fiona Harrison led the NRC ad hoc study committee that laid out some concerns regarding technology and cost risks. APD has responded to the recommendations from that report. NRO made available two mirrors, one of which will be an engineering unit and a pathfinder in front of the flight unit. NASA can make it available to others after WFIRST is launched. It cannot be used on the ground because of gravity sag, so it must have a space mission designed around it.

Dr. Gary Melnick asked whether WFIRST would be managed entirely within APD or broken out into its own unit as with JWST. Dr. Hertz replied that the plan is to keep it in APD. Unlike JWST, WFIRST is not substantially larger than other missions handled within Science Mission Directorate (SMD) divisions. The WFIRST science definition team (SDT) and Goddard Space Flight Center (GSFC) are working on a report, due in January. The costs will come in at that point, but APD gave NRC an estimate of \$2 billion without the coronagraph, and \$2.3 billion with it. However, those are not studied or assessed numbers. APD reserves the right to drop the coronagraph. The planning budget provides a notional timeline, with a start in 2017 at the earliest if budget is available. That will be an Agency decision due to the level of cost. The WFIRST preparatory science call was announced in April. APD received 53 proposals and hopes to fund about 12.

#### *Missions*

SOFIA has entered its operations phase. In April and May, it demonstrated a high cadence of science operations and flew more hours than planned or expected. Two second generation instruments are under development, one each by the US and Germany. At the moment, the aircraft and telescope are in Germany for scheduled heavy maintenance. In the FY15 budget request, SOFIA was defunded due to budget issues alone. However, Congress has directed APD to continue during FY14 as planned. Both houses of Congress have included FY15 funding for SOFIA in their budget markups – \$70 million from the House, and \$87 million from the Senate; APD had been planning to the latter amount prior to the FY15 budget request. Dr. Hertz showed commissioning data from the six instruments. FY14 science flights totaled 258 research hours.

Dr. Hertz convened an informal review of SOFIA by senior experts, who gave a great deal of feedback on how to optimize the science. At the same time, an Inspector General (IG) study looked at whether the project was being managed well against the requirements of a 20-year planned mission lifetime. The two reports had some good recommendations that dovetailed with each other. One of the IG's recommendations was to reassess the flight hours requirement. The senior experts suggested that NASA not focus so much on flight hours but put more emphasis on science output. Both groups found that there should be more emphasis on developing new instruments, funding guest observers, and the data pipeline bottleneck. The senior experts said to focus on unique capabilities such as the mid-infrared and very high spectral resolution. APD is now looking at these inputs and how to increase and optimize SOFIA's productivity.

The 258 flight hours were just shy of SOFIA's FY14 performance goal of 260. The current requirement is to develop a capability of 960 hours per year, and the period of high cadence flights demonstrated that that is possible. The intent had always been that it would take 4 years to get to the 960 because of the spiral development needs for staff, processes, and so on. The implementation of possible new metrics will

depend upon whether or not there is a change to the plan. Dr. Kenneth Sembach agreed that the focus should be on something other than flight hours, adding that it would be useful to know both NASA and community expectations for productivity. Dr. Hertz said that APD would welcome more information about community expectations. SOFIA just entered operations, so there is not yet much output. The U.S. portion of the mission will continue to function out of two centers, with the science based at the Ames Research Center (ARC) and the flight operations based at the Armstrong Flight Research Center (AFRC). At some point, SOFIA will be subject to a Senior Review, but it is too early to know if it will be reviewed alongside other missions or separately like the Hubble Space Telescope (HST) and Chandra.

HST is working wonderfully and is searching for a Kuiper Belt Object (KBO) suitable as a New Horizons flyby destination following the Pluto flyby. A pilot program to validate predicted source counts and expected probability of success was also recently completed. Processing of Kepler's prime mission data continues. The Kepler/K2 observing program is ongoing and performance is almost flawless.

All of the U.S. hardware for ASTRO-H has been delivered to the Japanese Space Agency (JAXA). The Neutron Star Interior Composition Explorer (NICER) was confirmed in February and the critical design review (CDR) is about to start. The mission will be launched on the twelfth SpaceX Falcon resupply mission to the International Space Station (ISS) in October 2016. The Transiting Exoplanet Survey Satellite (TESS) preliminary design review (PDR) is also to occur soon. NASA is contributing detectors for the Euclid mission, but the European Space Agency (ESA) is still working on engineering specifications. NASA has not signed anything official to participate with ESA's Advanced Telescope for High Energy Astrophysics (ATHENA) but has a member on the study team, and the activity is in the planning budget. APD expects to provide a data center for U.S. users.

The suborbital program continues aggressively with the balloon program, which APD operates for the entire Agency. The Antarctica has three long-duration balloon payloads that were to have flown last year. One might go for 100 days, which means it will spiral off of the ice and the team will likely lose the payload. Seventy comments were received for the recent draft Explorer Announcement of Opportunity (AO). The final AO is scheduled for the fall. Cosmic Ray Energetics and Mass (CREAM) is a balloon payload for the International Space Station (ISS) preparing for launch in early 2015. APD is participating in ESA assessments on a gravitational wave observatory; Dr. Hertz will provide more information about that at a later time.

The Senior Review resulted in the extension of HST, Chandra, the Swift gamma-ray burst Explorer, the Nuclear Spectroscopic Telescope Array (NuSTAR), Kepler/K2, Fermi, XMM-Newton, and Suzaku. Spitzer was identified as being important and is receiving funding from both APD and the Planetary Science Division (PSD) and will operate for 2 more years. The Spitzer mission was extended after the original decision. For ESA's Planck mission, a reduced augmentation was approved; there are insufficient funds to complete the full augmentation. The data analysis proposal to combine, characterize and release the full datasets from both the Wide-field Infrared Survey Explorer (WISE) and the Near-Earth Object Wide-field Infrared Survey Explorer – Reactivation (NEOWISE-R) was not approved. Dr. Kalirai commended on the extension of Spitzer, as many in the science community were concerned. Spitzer works well with other missions, and will relate well with JWST. Dr. Joel Bregman explained that the Senior Review looked at Spitzer and found that its productivity is not comparable to that of HST and Chandra. Dr. Hertz said that he believed the Senior Review was driven by science, not the budget.

Dr. Hertz presented a graph that showed funding for Guest Observer programs from FY1990 through FY2018 in real year dollars, noting that the data prior to 2005 has not been corrected to a "full cost accounting" basis. HST has had the largest wedge since FY91, and Chandra's wedge has been consistently large since shortly after deployment. The Spitzer and Herschel missions had extensive programs that ended, and Fermi is winding down. As other missions end, total Guest Observer funding

will be reduced for a while. Total funding to the community as a fraction of the APD budget has been very stable over the years. In an era of flat funding, should community funding go up as a proportion? Dr. Hertz does not believe the balance should change, but invited APS to advise on that.

As mentioned, the FY15 budget will include WFIRST/AFTA pre-formulation funds. The President's budget request, the House bill, and the Senate mark-up all fund JWST at the planned \$645 million. The President requested \$607 million for APD; the House has approved \$680 million (a \$73 million increase over the request) and the Senate mark-up is for \$750 million (\$143 million over the request). Both the House and Senate reject termination of SOFIA and include funds for SMD education and public outreach (EPO). Eventually, the House and Senate will have to develop a single set of numbers. Any continuing resolution (CR) will probably continue at the FY14 rate. Usually CRs include no instructions about the programs. The WFIRST funding for FY15 will remain uncertain until there is a final budget, but APD has prepared both aggressive and slow spending scenarios that can be followed, and is retiring as much risk as possible. The earmarks from the House and Senate are not fully addressed in the funding, so APD might have to find general reductions to make up the difference.

Regarding the exoplanet probes that had been discussed in the event that WFIRST was not funded, Dr. Hertz did not think it was appropriate to maintain the need for probes as back-up now that the Administration has requested funding for, and Congress has begun funding, WFIRST. However, they are critical for assessing future exoplanet missions.

#### R&A Update

Dr. Linda Sparke, APD Research Program Manager, presented data from the most recent Research Opportunities in Space and Earth Sciences (ROSES) competition. The rate of increase in the number of proposals has exceeded the rate of increase in the budget, the latter having been flat since 2010. The selection rates have therefore dropped, some quite significantly. At the same time, funding per proposal is essentially flat.

One issue that has been raised is that of principal investigators (PIs) submitting multiple proposals. For the Astrophysics Data Analysis Program (ADAP), Astrophysics Theory Program (ATP), WFIRST Preparatory Science (WPS), and Exoplanet Research Program (XRP) competitions in 2014, there were 635 total proposals. Most proposals (420, or 66 percent) were submitted by a PI who sent in no other proposal to these competitions.

The National Science Foundation (NSF) Astronomy Division (AST) is asking that investigators submit no more than one proposal. Dr. Bregman said that PIs have an obligation to their graduate students. Dr. Sembach said that if the goal is to maximize science, it would not make sense to limit the number of proposals. Dr. B. Scott Gaudi said that there is some benefit from spreading the funding. Dr. Sembach countered that that will occur naturally, but to actually limit good ideas is a terrible mistake.

Dr. Bregman maintained that the obligation is to do the best science. Reviewers are sympathetic to younger people. Dr. Chryssa Kouveliotou observed that there is a concentration of submissions and that three of the top four submitting organizations are NASA Centers, as expected, since this is the main source of funding for NASA scientists. Dr. Melnick pointed out that submissions by institution would be more meaningful with per capita data. Dr. Sparke added that she would like to see if the success rate per proposal is comparable for those who submit multiples versus those who only submit one. APD always checks to make sure that the work is not funded elsewhere before selecting a proposal for funding. She added that NSF is funding less, so there are more investigators seeking APD funds. There is the impression that more post-docs apply for funding, as well, though she did not have data on that. Dr. John Nousek said that funding flows irregularly. There was a stimulus increase in 2009, which is now finally wearing out, so investigators are applying to more programs.

Dr. Sparke showed evaluation data, noting that APD is funding many fewer proposals rated “very goods.” There is a lot of good science that the Division cannot fund. Dr. Melnick observed that he sees fewer younger scientists joining the American Astronomical Society (AAS) so that any estimate of community size based on AAS membership may be an underestimate. Dr. Sparke explained that NASA is concerned about low selection rates, as the work involved in proposing and reviewing is a tremendous drain on the community. She calculated for one competition what funding went back into the community against what the community put into preparing and reviewing proposals. She found that the funds awarded are roughly double the implied total costs to the community, based on the total estimated time spent proposing and reviewing. This is worrisome for the future. Dr. Nousek added that his management uses proposal awards as a metric of productivity. He also funds graduate students.

Dr. Sparke said that the review process has not changed over the past decade. The Division is using more reviewers, not giving more proposals to each reviewer. Dr. Wang suggested capping the number of proposals a person can submit. Since it seems that a lot of great science is not being done, APS should try to endorse the idea that there be an increase in available research funds. Dr. Bregman noted that hardly anyone sends in more than two proposals. Dr. Peterson pointed out that in some European programs, a proposer who gets a terrible grade cannot reapply for some period.

Dr. Sparke added that the Astronomy and Astrophysics Advisory Committee (AAAC) plans to study the causes and effects of the decreasing selection rates. The availability of relevant information varies. For example, certain demographic information, such as the Ph. D. year, and academic status of proposers, are not collected. It would be hard to determine how many proposals were submitted by given investigators over multiple years. More easily collected would be the number of proposals submitted to a given competition, funding required, success rate, total proposal budget, students included in a budget, and success rate by institution. The AAAC is still deciding which data to collect. Privacy is an issue in some cases.

Dr. Sparke presented several ideas on what APD could do:

1. Almost no proposals rated below Very Good are selected, so should a PI who proposes 2 consecutive years with no proposal rated better than Good be asked to sit out a year? Roughly one in three proposals is rated Good or below.
2. Should each PI be restricted to an average of 1 proposal per year?
3. Should the competitions run in alternate years?
4. Should organizations be restricted in the number of proposals they can submit?

Dr. Kouveliotou said that she was not sure they were asking the right question. To her, the right question is “are we losing a lot of good science?” She thought there was too much focus on the reviewer burden. She did not like the first option because it sometimes takes several attempts to succeed. She wondered if it was realistic to expect another doubling in the proposal rate, and she also asked if this is catastrophic.

Dr. Batalha was concerned about penalizing those who do their jobs well. Dr. James Bock noted that some organizations have a one-page pre-proposal, which is much more efficient. Dr. Sparke said that other SMD divisions have done that with internal review of a proposal of three to five pages, which is essentially an encourage/discourage decision. Those who write a proposal essentially do it twice, however, and it is still a lot of work for the reviewers. Dr. Bregman thought that there are not enough dollars going to science to begin with, so he did not like any of this.

Dr. Somerville said that when the selection rate is only 1 in 20 or 25 proposals, reviewing becomes a negative experience. The average term for a graduate student is 6 years, which means that academics often find themselves scrambling to help them, and therefore apply to everything. In Europe, funding is

to a student for the duration of the graduate degree studies. She did not like the first suggestion on Dr. Sparke's list. HST conducts triage. Proposals that are triaged out can be brought back, though they rarely make it through, but it is a fairly effective way to make the first cut.

Dr. Gaudi thought that the discussion did not address the issue. Given the level of funding, maybe there are too many people in the field. It is important to support more astronomy, but should scientists control their appetite if the country's willingness to support astronomy has diminished? Dr. Karl Stapelfeldt observed that that would start with the universities. He did not like the options, but he found the last one to be the least odious.

Dr. Melnick wanted to know the extent to which the JWST Guest Observer program would affect this problem. More specifically, he wondered if they were looking for permanent solutions to a short-term problem. Dr. Hertz explained that the Guest Observer program will be comparable to the HST Guest Observer program. He worries about creating another bubble, including a JWST bubble. The JWST data will be so rich and wonderful that it will call for a substantial Guest Observer program, but he wondered where the community would be if that funding and program came to an end. Dr. Melnick said that the community will have endured almost two decades of sacrifice to deploy an \$8 billion facility. After that, they cannot afford to leave a lot of science on the floor. When you build a mission, the point is to get science. If you do not do the science, why do the mission?

Dr. Cornish pointed out that if more money goes into R&A, it would have to come from another mission. That could mean one less Explorer, for example. He wondered if the data already available were being fully exploited, and suggested that that might be the trade that should be made. Dr. Kouveliotou agreed. She added that AAS membership has been flat for the last couple of years, though Dr. Giovanni Fazio pointed out that there was a large increase in PhDs granted from 2005 to 2008, and over the last 30 years, the number of PhDs has doubled.

Dr. Nousek said that he never felt entitled to grants, but he did feel that there were opportunities to be successful. He is against anything that eliminates opportunities for people to come up with good science. There are people leaving field, but that always happens. Astronomy requires that those who pursue it be excellent. The physics and astronomy PhDs have the lowest unemployment rates. APD is not destroying people's lives by allowing them to write proposals.

Dr. Hertz said that funding for the theory program is flat. APD has not grown theory differently from other parts of budget, but it now has more proposals. Dr. Sparke said that an analysis of oversubscription would look at NSF, where these proposals could have gone as well. Dr. Gaudi said that, in regard to wanting a sustainable field, astronomy is drawing in good people who could have done something else. However, many of the excellent astronomers must pursue other work due to the lack of opportunities. That is not good for the field. There needs to be a better match with what the United States is willing to fund with astronomy. Dr. Julianne Dalcanton pointed out that a mid-career person is not as transferrable as an early career person.

Dr. William Oegerle explained that GSFC competes internally. The Center has five sounding rocket programs, and seeks partnerships with universities in which GSFC handles the hardware. Limitations would affect both sides of this arrangement. Dr. Cornish observed that many of the suggestions have two goals: to make the numbers seem better, and to not overburden the proposers and reviewers. A short proposal would still take 80 percent of the time that a full proposal would, but a triage system might help the reviewing side.

Dr. Kouveliotou asked how much money it would take to fund the Very Good proposals that are currently unfunded, along with some of the Good proposals. Dr. Sparke replied that the R&A funding would have

to increase by a factor of 2.5. She also thought that that would lead to even more proposals after the first year. Dr. Bregman said that too much good science is being left undone. If the APD budget were a constant fraction of the Gross Domestic Product (GDP), APS would not be having this discussion, but the percentage has been going down.

#### Working Lunch

Dr. Hertz clarified several points. First, the R&A selection ratio is 1 in 5 or 6 proposals, not 1 in 25, and the panels are good at picking out the top third. Second, if the panel does not understand something because the proposer did not explain it well enough, that is on the proposer. Third, when APD decides which proposals to fund, the program managers do not simply follow the rank order coming from the panels. The program scientists look at the balance and the types of things being proposed. There are occasionally Excellents that are not chosen, and lower-ranking proposals that are.

Regarding the proposals from NASA centers, Dr. Sparke explained that her compilation excluded the technology proposals, where the NASA centers might be more heavily represented. In addition, the civil servants who are proposing may be funding contractors. That is certainly the case if the proposal comes from the Jet Propulsion Lab (JPL). Those civil servants cannot apply for NSF funding. Dr. Nousek said that one can normalize by the number of astronomers. Harvard/Smithsonian and Goddard are first and second in employing astronomers in the United States, so it is unsurprising that they submit many proposals.

Dr. Hertz added that historically, one third of R&A funds go to civil servants. He had the impression that APS was starting to think the low selection rate is a consequence of this country's direction. Possibly some of the suggested solutions were worse than the problem, however. He asked for feedback on this, since APD has been thinking quite a lot about getting the selection rate up. Dr. Melnick suggested defining the problem's parameters. He wondered if the JWST Guest Observer funds, starting in 2019, would ameliorate the problem. He was thinking in terms of the number of people to support in the community and less about specific programs. It would be an additional source of funding, assuming HST funding does not come down by the same amount that JWST goes up. Dr. Bregman said that there is great science that is not being done and that still will not be done under JWST.

Dr. Peterson said that the fundamental question is whether we can live within a budget, specifically the U.S. astronomy budget. Some science will not be done. Dr. Gaudi asked if APD should fund more people on small proposals or fund large missions. Dr. Hertz noted that every Explorer call gets about 30 proposals, and APD funds one. Dr. Nousek explained that he has been on both sides of Explorer competitions and believes the right missions are funded overall. It takes many, many hours from many people to make those selections.

Dr. Bregman asked about the yield per mission. There is a sense that the community is not getting the most from these missions. There is great science that is not being done, and the missions that are funded are also shortchanged. In the early 1990s, there was more money than there were great ideas. Dr. Hertz said that the selection rate for ADAP used to be higher because there were fewer proposals. At some point, the proposal rate corrects itself, though that is not ideal. The United States is spending less on R&D, and the total U.S. budget is going down. In addition, a lot of other funding sources have dried up, so there is less non-NASA funding. That has to affect the number of proposals that come to APD.

Short of reprogramming funds from elsewhere, Dr. Sembach was not sure what options were available. Dr. Peterson said that the AAAC is looking into this. If APS does nothing, they are accepting the Darwinian solution. He asked if someone on the Subcommittee could follow AAAC. Dr. Hertz noted that

AAAC advises NASA, NSF, and the Department of Energy (DOE). It is Congressionally chartered, so civil servants cannot participate and APS member cannot be on both committees. However, there can be an APS liaison.

Dr. Somerville expressed concern that a number of APD involvements in the future will be as minor partners in ESA missions. Dr. Hertz explained that the partnerships will have Guest Observer funding. In addition, the partnerships involve U.S. scientists as members of the science team, and often a U.S. science center funded by NASA, as well as hardware. These partnerships enable the U.S. science community to realize the science that that mission is doing. APD will continue to launch missions, including Explorers. The last DS emphasized partnering. The Division will build some Great Observatories on its own, and some with others.

Dr. Melnick said that one suggestion was the idea of changing the cadence of the calls to every 2 years. With a finite number of people in the field, the number of proposals would go up but probably not double. Dr. Nousek said that while that would address concerns about the acceptance rate, he still thinks 15 percent is viable. Others disagreed. Dr. Bregman said that while this would help with post-doc planning, a research scientist who misses a year would have to go to industry.

Dr. Peterson heard a weak consensus that APS should not do anything until it receives the AAAC findings. He asked again for a liaison. Dr. Hertz added that APS could ask AAAC to make a presentation at the Subcommittee's next meeting.

#### Mid Decadal Update

Dr. Hertz explained that the Mid-Decade Review will take place next year, in conjunction with NSF. He wanted APS feedback and suggestions for what APD might do in preparation for the Review. As charged by Congress, an NRC committee will do a short report at the mid-point between Decadal Surveys, in order to address the implications of science and technology developments. He expects the Review to assess APD's progress against the DS in light of the constrained budget.

Dr. Hertz reviewed APD progress in addressing DS priorities. WFIRST is now on its fourth design reference mission (DRM), and there are plans to include a coronagraph. APD has augmented the Explorer program, and is working with ESA on missions to accomplish much of the science of the Laser Interferometer Space Antenna (LISA) and an International X-ray Observatory (IXO). The Division is also making selections in the Strategic Astrophysics Technology (SAT) program. Dr. Nousek thought that there was a lot of checking off from a list and a deceptive sense of balance. The funding indicates more spent on WFIRST and reductions on Explorers, LISA, and IXO. Dr. Hertz said that he expects to be asked about all of this for the mid-Decade review. The dollar amounts that the DS assigned for this decade come to four times what APD actually has. He is taking the rank ordered recommendations of the DS extremely seriously and making these things happen. He is not asking APS for validation, but is noting what has been done. He will provide that information and the corresponding rationales to the Mid-Decade Review committee.

Dr. Bregman said that one has to discuss what is being done in other agencies such as JAXA and ESA, and how it impacts our science. The biggest change since the DS is how much Europe is doing. Dr. Hertz replied that APD has not been shy about going back to NRC for help in working through these issues. The Division is not implementing the architecture from the DS, but he believes they are implementing the recommendations to the extent possible.

The Review will need to reconsider LISA's prioritization. NASA is participating in ESA's LISA Pathfinder and has increased the Agency's engagement. For IXO, NASA has continued investing in

critical capabilities, some of which would further future missions. There have been many proposals selected in the area of exoplanet technologies. We now know that Earth-sized rocky planets are common, so the question is whether to change direction and emphasis. On the inflation probe, there are three balloon payloads developing detector technology that might be appropriate.

Dr. Dalcanton asked how the 30-year Roadmap fits into this review. Dr. Hertz explained that when the next DS takes place, NASA should have some mission concepts that are mature enough to enable a decision on the next large mission after WFIRST. He has had some informal discussions to identify the mission concepts, all of which are captured in the Roadmap. He will probably come to APS to select some of these for mission concept studies leading to the next DS. He has not heard any ideas that were not included in the Roadmap. The Roadmap will be helpful there, and that was its purpose. It is also being referenced in technology proposals. There was a broad representation of the community on the Roadmap committee, and he does not expect to put out another call. Dr. Gaudi added that it became obvious to the Roadmap team what the five top missions would be.

Dr. Cornish expressed concern that ESA is doing the high-ranking missions from the DS, such as LISA and IXO, rather than NASA. In addition, the NASA contributions are low. The danger is that if NASA commits to that path and if anything were to happen to the European budgets, there may be lost opportunities to advance the science. Dr. Hertz said that that is implicit. He is not sure whether the Review will see a need for APD to revise its priorities. However, it will look at how the Division is doing in addressing those priorities. Europe is doing Athena before NASA could ever get to it, for example, so the question is whether it makes more sense to partner or to wait. In addition, Congress and the White House have now demonstrated support for WFIRST, which was the top priority in the DS.

#### SMD Communications and Education Update

Ms. Kristen Erickson, SMD Director for Science Engagement and Partnerships, provided an update on SMD communications and education planning. The President's FY15 budget included \$15 million for SMD to do education; the House has \$30 million, and the Senate mark-up specifies no less than \$42 million. These numbers do not include funding for the Earth Science GLOBE activity. What had been called EPO is now called Education and Communication. Each division has a forum that is to help get word out on the restructuring while also bringing in community feedback. SMD hopes to hold a November workshop to feed into the process. There are plans to participate in the upcoming International Year of Light, which corresponds with the HST anniversary planning. Objectives for SMD education include enabling science, technology, engineering, and math (STEM) education, improving U.S. scientific literacy, meeting the President's Committee on STEM Education (CoSTEM) goals, and leveraging partnerships.

Dr. Nousek said that the \$15 million is less than what was spent before. It is all well and good to say that SMD will do these things, but there are fewer resources. There needs to be a strategy for why NASA does education. Ms. Erickson said that NASA is the only STEM agency in the FY15 budget proposal still allowed to do education, and this is because the Agency already does a great job of it. The question of resources remains, however. Because the program was almost ended, SMD is taking an incremental approach and trying to build support. If education and communication are not done better going forward, they might fail. Having an open and transparent reporting system is important. The White House still wants to consolidate overall STEM education efforts government-wide.

SMD has a teacher website, though there are other sites with materials. What has shifted are the next-generation science standards, which will be implemented in the next school year. Also, some states have their own standards. The trick is to get SMD information to the teachers. Dr. Kalirai said that synergy and partnership with scientists have seemed to work best. Ms. Erickson agreed that the decentralized

relationship is important, to keep the communications with the science. Dr. Melnick said that this does not work so well with smaller missions, which lack a critical mass.

Ms. Erickson said that it should not be mandated that a project must have 1 percent of its budget go to communications and education functions if there are others who can do it for the project reliably. At NASA, there are three communications areas: media (public affairs), multi-media (including social media), and outreach. Dr. Sembach said that he has visited ESA's public outreach program, and NASA could learn a lot from them. Ms. Erickson promised look into that. Dr. Kouveliotou countered that often she has not found ESA press releases as inspiring as NASA press releases. Dr. Bregman said that smaller missions could learn from the universities and how they do it. Ms. Erickson explained that NASA attempted an open-source effort. Technology advancement enables a lot and should be part of the model.

#### Public Comment Period

The meeting was opened to the public for comment.

Mr. Ronald Polidan of Northrup Grumman asked Dr. Hertz if the concept study for projects beyond WFIRST will be an internal study or a call for concepts. Dr. Hertz replied that he envisions the study as being led by the NASA centers.

Dr. James Lochner of the Universities Space Research Association (USRA) asked the Subcommittee to keep in mind the work done by small missions within SMD. A lot of good has come from them.

#### Government Performance and Results Act Modernization Act (GPRAMA) Guidelines

Dr. Peterson explained that APS was required by law to provide feedback on APD accomplishments over the previous year, as part of the Government Performance and Results Act Modernization Act (GPRAMA). This involved writing summary paragraphs describing major activities that have occurred in the past 12 months. Prior to the meeting, APD staff provided examples for each strategic area, which APS was free to use, remove, and augment.

APS was also required to give a color rating of Green, Yellow, or Red.

- A rating of Green meant that the expectations of the research program were fully met in context of the budget;
- Yellow meant that there were some shortfalls but some science was achieved; and
- Red meant that there were major disappointments or shortfalls in scientific outcomes in context of resources invested, uncompensated by any positive results.

Ms. Jennifer Kearns of SMD presented background on GPRAMA, which used to be called GPRA. GPRA was passed in 1993, with an update in 2010. GPRAMA requires each Federal entity to provide a strategic plan, an annual performance plan, and an annual performance report. This Act was geared more to other types of agencies, not those with an R&D orientation, but NASA has adapted. The Agency measures mission milestones that are objectively verifiable, and also looks at science accomplishments through the SMD advisory subcommittees.

Ms. Kearns further explained that this is not the place to consider future work or issues such as under-investment. There have been instances in which delays and missed milestones were noted, but this is not supposed to be about the consequences of the level of investment. SMD needed the color rating and the text. She asked that for any rating less than Green, APS provide detail. Because the text would be further edited as it moved up through NASA, she requested that APS flag anything particularly important.

GPRAMA Discussion

Dr. Peterson said that the selected projects were required to have NASA funding. He then led the Subcommittee through a review of the press releases.

Dr. Peterson began with the first APD related NASA Objective and Performance Goal:

**Objective 1.6.2:** *Improve understanding of the origin and destiny of the universe, and the nature of black holes, dark energy, dark matter, and gravity.*

**Performance Goal 1.6.2.1:** *Demonstrate planned progress in understanding the origin and destiny of the universe, and the nature of black holes, dark energy, dark matter, and gravity. Progress relative to the objectives in NASA's 2010 Science Plan will be evaluated by external expert review.*

There was discussion about which topics to include. For the first pass, Dr. Sembach agreed to write a paragraph about frontier fields and CLASH clusters, and Dr. Peterson said that he would write about the gas stream in NGC 5548. An article about the Rossi X-ray Timing Explorer (RXTE) satellite revealing cloudy covers of active galaxies was based on archival data but stayed in. An article on Fermi data providing new clues to dark matter needed work. Ms. Kearns noted that APS should identify the items that advance the state of knowledge and not worry about the number. SMD will highlight two to four. It was agreed to include articles about Chandra and XMM measurements of black hole phenomena. Dr. Nousek agreed to write the summary for this section.

The next objective and performance goal were:

**Objective 1.6.3:** *Improve understanding of the many phenomena and processes associated with galaxy, stellar, and planetary system formation and evolution from the earliest epochs to today.*

**Performance Goal 1.6.3.1:** *Demonstrate planned progress in understanding the many phenomena and processes associated with galaxy, stellar, and planetary system formation and evolution from the earliest epochs to today. Progress relative to the objectives in NASA's 2010 Science Plan will be evaluated by external expert review.*

Articles to be included under this objective included one on astronomical forensics uncovering planetary disks. Others addressed HST and ultra-compact burned out galaxies, supernova blast and the age of a binary star system, planet-forming disks explained by magnetism, and a survey finding thousands of new stars. Dr. Sembach committed to writing the introduction for this section.

The third objective and goal were:

**Objective 1.6.4:** *Generate a census of extra-solar planets and measure their properties.*

**Performance Goal 1.6.4.1:** *Demonstrate planned progress in generating a census of extra-solar planets and measuring their properties. Progress relative to the objectives in NASA's 2010 Science Plan will be evaluated by external expert review.*

Dr. Gaudi said that he and Dr. Batalha had worked out what should go in this section. One item would be about Chandra seeing the transit of a planet in the X-rays for the first time. After that, the theme was water and clouds in other worlds. Another category was Kepler results and the diversity of planetary systems, followed by NASA's expanded search for Earth-like planets, highlighting Kepler 186. Each of these had multiple results.

Wrap Up for Day 1

NAC Astrophysics Subcommittee Meeting Minutes, August 11-12, 2014

Dr. Peterson asked the Subcommittee members to work on their assignments, and adjourned the meeting at 3:37 p.m.

Tuesday, August 12, 2014

Opening Remarks

APS Vice Chair, Dr. Gaudi, filled in as Chair in place of Dr. Peterson, who was unable to attend the meeting.

ExoPAG/PhysPAG/COPAG Updates

*PhysPAG*

Dr. Nousek, Chair of the Physics of the Cosmos Program Analysis Group (PhysPAG) Executive Committee (EC), presented an update of the PAG's activities. He began with a list of the Executive Committee members. Next year, Dr. Bock will take over as chair.

The Inflation Probe Science Interest Group (IPSIG) produced a white paper on cosmic microwave background (CMB) polarization. The Background Imaging of Cosmic Extragalactic Polarization 2 (BICEP2) telescope team announced the possible detection of B-mode polarization in CMB @ 2 mm. If confirmed, this result would provide indirect evidence for the existence of gravitational waves in the first moments of the universe, and could give a sense of the energy scale at the moment of inflation, opening the door to new physical insights. A joint Planck/BICEP2 task force is at work to confirm the BICEP2 results by adding Planck information of foreground polarization, which characterizes the background more precisely. The IPSIG white paper also covers current NASA and other agencies' plans for CMB measurements and proposes a roadmap to support critical activities. Dr. Bock added that the main purpose of the paper is informational. The field is moving quickly, and the SIG wanted to outline possible scientific steps. This is not a call to action, but rather a look down the road.

Dr. Bock reported that the IPSIG also sent a letter of concern to the PhysPAG EC regarding the completion of the Planck data analysis. The main concern is that the Planck data underpin all future studies of cosmology, such as those to be conducted by WFIRST, so it is essential to complete the data analysis. The Planck budget request to APD also included support for a U.S. data archive and additional science components. The Project however indicated that the final analysis and calibration of the data would take highest priority. They also stressed that disbanding the team before completion of this task would result in the loss of unique expertise.

Dr. Bregman explained that the 2014 Senior Review, of which he was a member, recommended a certain amount of funding for Planck; it was less than what than the Project requested. The additional funds approved by APD based on the findings of the Senior Review will assist in the timely completion of Phase F operations. In the absence of new information, he did not see a basis for changing the Senior Review findings.

Dr. Nousek went on to describe recent activities of the Gravitational Wave SIG (GWSIG). The highlight was a LISA symposium at the University of Florida with 150 participants. The attendants discussed LISA Pathfinder and the case for a space-based gravitational wave observatory. They also examined synergies between a gravitational wave space mission and the Large Synoptic Survey Telescope (LSST), Athena, and WFIRST. GWSIG will push for a highly rated gravitational wave mission in the next DS, and to that end has produced technology concepts for future development.

Dr. Nousek thought that Dr. Hertz's way of ensuring NASA participation on Athena was helpful. The X-Ray SIG (XRSIG) was scheduled to meet in Chicago at the AAS High Energy Astrophysics Division

meeting the following week. Topics on the XRSIG meeting agenda include, the community role in Athena, as well as potential small-to-medium Explorer (SMEX) mission calls. This discussion will look at what might be achievable in context of a SMEX. This is nothing official, not an effort to coordinate proposals, but rather a conversation among people with shared interests. However, since Dr. Kouveliotou and others raised questions, he planned to ask the person who organized this agenda item for clarification. XRSIG will not recommend a SMEX. Dr. Bock added that a similar meeting is planned for the IPSIG.

Dr. Hertz answered questions about U.S. involvement in the Athena mission. The current U.S. science team participation is the equivalent of an SDT that will lead to an AO. NASA hopes to contribute hardware at about the \$100 million range, as well as a U.S. science data center.

Dr. Nousek concluded his presentation by discussing the Physics of the Cosmos (PCOS) Technology Gaps Activity. The draft report identifies 21 new technologies that could further the field.

### *COPAG*

Dr. Sembach provided an update of Cosmic Origins Program Analysis Group (COPAG) activities. The Group was in the midst of recruiting new members to the executive committee. The bi-weekly teleconferences with executive committee members have an 80-90 percent participation rate. COPAG has also been soliciting community input to identify cosmic origins technology gaps, and this information will be used in APD's Cosmic Origins (COR) program office planning. Science Analysis Groups (SAGs) 6,7, and 8, and SIG 1 met at the June AAS meeting, where COPAG had a joint session with the Exoplanet Program Analysis Group (ExoPAG). COPAG hopes to have another joint meeting with the two other PAGs at the January AAS meeting in Seattle.

Kicking off SIG 1 was a May workshop at GSFC on future of far-infrared (FIR) space astrophysics. Three open SAGs are supposed to complete their work this summer:

- SAG #6: Cosmic Origins Science Enabled by the WFIRST-AFTA Coronagraph
- SAG #7: Science Enabled by Operations Overlap of the Hubble Space Telescope and the James Webb Space Telescope
- SAG #8: Science Enabled by the WFIRST-AFTA Data Archive

Dr. Sembach hopes to report out on all three at the next APS meeting. SAG #5, Science Objectives and Technology Requirements for a Series of Cosmic Origins Probes, is ongoing but will write its final report soon.

COPAG had a request before APS to launch a new SAG. This would be #9: Science Enabled by Dedicated Spitzer Observing Campaigns Prior to JWST Launch. The Spitzer project users requested this. The SAG will also analyze the results of SAG #7 to determine whether the science cases identified by that SAG would benefit from new Spitzer observations. There was some discussion among APS members about how SAGs are created. Dr. Gaudi said that while APS can suggest SAGs, these are typically self-organized. Dr. Nousek was concerned about the direction of the SAGs, while Dr. Gaudi thought the proposed SAG #9 sounded too much like it was devised by NASA. Dr. Sembach explained that the executive committee was unanimous that this would be a good thing to do. He feels like he works for the cosmic origins community, not NASA, and serves as a liaison between the two. Dr. Nousek did not understand why this was not a Spitzer or JWST activity. Dr. Michael Werner, the Project Scientist for Spitzer at JPL, explained that this grew out of the synergies between Spitzer and JWST.

Dr. Sembach noted that there was misinformation in the public that HST would be deorbited in 2020. Dr. Hertz replied that there are no such plans.

Dr. Gaudi motioned that APS approve SAG 9. The vote carried, and the SAG was approved.

### JWST Update

Dr. Eric Smith, JWST Acting Program Director, provided an update on the mission's activities. The Integrated Science Instrument Module (ISIM) cryovac test is underway at GSFC. There have been no hardware problems but the project team has encountered a few fixable software issues. The team is also making new focal plane arrays for the Near-Infrared Spectrograph (NIRSpec) and Fine Guidance Sensor/Near-Infrared Imager and Slitless Spectrograph (FGS/NIRISS) instruments. The four science instruments are sitting at ~40 Kelvin, which is what they see in space. The NIRSpec has microshutters, which will be replaced with a newly manufactured set after this test. The new microshutters are performing as expected. The Spacecraft CDR was earlier this year, and passed successfully. The flight primary mirror backplane, which holds the mirrors, is being tested at Northrup Grumman.

For the first time, the project had to use some of its funded schedule reserve. This was because the sunshield Unitized Pallet Structure (UPS) flight unit did not have adequate strength margin, and building the replacement will take some time. Northrup Grumman conducted a fully deployed engineering sunshield test. There has been a lot of Optical Telescope Element/Integrated Science Module (OTIS) hardware installed in the Johnson Space Center (JSC) Chamber A. The biggest technical challenge has been the Mid-infrared Instrument (MIRI) cryocooler. MIRI is the only instrument that is not passively cooled and therefore requires a cryocooler.. The issue experienced by the cryocooler team is manufacturing it on time.

Prominent items on the watch list include:

- Cost: FY14 reserves are tight, though the project will make it out of the year successfully and carry some over. FY15 will have the same level of reserves to start the year as FY14 did, percentage-wise.
- Schedule Reserve: The mission dropped from 13 to 11.25 months of reserve.
- Cryocooler: If the delivery schedule slips, there could be additional cost.
- The 20 micron Mid-Infrared (MIR) stray light level 2 requirement is not being met.
- New International Traffic in Arms Regulations (ITAR) rules could affect rework or new licenses.

Dr. Smith showed the top-level schedule, with the GSFC requirements, the plan, and the current reserve. Three issues have taken reserve time: the government shutdown, installation of thermal sensors for OTIS testing, and the Aft Unitized Pallet Structure (UPS) manufacturing delay. The project schedule is still above the plan, however. A graphic representation of the high-level milestones shows that there have been some delays related to the ripple effect of the cryocooler delays, but this has not yet affected the critical path. The forecast is for the cryocooler compressor assembly to be delivered in February. This has been more challenging than anticipated. Dr. Melnick observed that a couple of items are being reworked or replaced, and wondered if the mission was accepting a higher risk associated with less testing of these parts. Dr. Smith replied that the components are tested but will not see as many cycles. He believes the level of risk increase is small. The error budget has lines to account for this kind of thing, as well as allowances.

Dr. Nousek expressed skepticism that the team knows how to fix the problem and asked how confident Dr. Smith was that they can build the cryocooler. Dr. Smith explained that the system is in three temperature regions, and the parts come in at different times. The compressor assembly is needed in 2016 for assembly. The management team has several JPL people at Northrup Grumman working on this, and GSFC has the person who got the Near\_Infrared Camera (NIRCam) back on track is dedicated to this. There are frequent teleconferences, and everyone is paying attention to the issue. There are still more than 11 months of schedule reserve, and the mission is carrying FY14 funds into FY15.

Dr. Smith next showed the primary technology performance metrics. One issue is the separation of the sunshield edges and the potential for increased heating of layer 5 of the sunshield (closest to the telescope). The project team is talking to ESA's Gaia team, about ice deposition on their sunshade.. There are also concerns about the number of deployments that must occur. Northrup Grumman has done about 2,000 consecutive successful deployments, however, and NASA participates in all of the deployment reviews.

NASA will be using the Ariane V launch vehicle for this mission. While the cryocooler design risk is retired, the team is not completely out of woods with it yet. Dr. Nousek expressed concern about how close the project is to a disruption of the critical path. Dr. Smith said that the hardware is being built, but it is taking longer than planned. The Sunshield UPS had a manufacturing flaw, in that it wicked moisture from the composite mandrel and did not meet the full strength margin.

What keeps him up at night is the cryocooler. In addition, many things have to happen on time. The software is a worry, too.

#### SOFIA Update

Dr. Pamela Marcum, Project Scientist for SOFIA, provided an update on the mission's science. SOFIA's six first-generation science instruments have all flown on the aircraft. The Echelon-Cross-Echelle Spectrograph (EXES) commissioning will be completed later in 2014. The High-resolution Airborne Wideband Camera Plus (HAWC+) is the U.S. second generation instrument and it will be commissioned in 2015. The aircraft is now in Germany for a heavy maintenance visit, which is a scheduled procedure. Cycle 3 call for observation proposals is closed, with proposal selections to be announced in October. Observations for Cycle 3 will begin in March 2015.

An example of SOFIA science includes findings in astrochemistry regarding the chemical formation pathways of molecules. Solar system results include data from across Jupiter, where SOFIA measured the circulation and gas convection between the Jovian stratosphere and lower atmosphere; this is not yet published. Another result is the strong global winds and lower atmosphere haze layer on Pluto. Finally, SOFIA had a unique view of Comet ISON, finding that the comet's mid-infrared radiation implied a lower than expected content of large-grain dust.

In terms of exoplanets, SOFIA's work has been primarily pilot studies. The Galactic Center is a big target for SOFIA, whose spatial resolution is stronger than that of any other active mission. SOFIA found that clumps in the circum-nuclear disk are transient features. In terms of star formation and evolution, the German Receiver for Astronomy at Terahertz (GREAT) instrument has provided unambiguous data on molecular clouds forming stars. SOFIA also investigates the continuous wavelength coverage spanning regions inaccessible from the ground.

Dr. Kalirai said that Cycle 2 was truncated due to maintenance, and wanted to know whether Cycle 3 will be full. Dr. Marcum said that she was not sure about Cycle 3 due to the budget situation, but the mission hopes to have 400 research hours. Dr. Stapelfeldt said that his team was awarded time for Cycle 2 that was truncated, and they had to reapply in Cycle 3, which was annoying and not done the same way as other programs. He asked how many Cycle 2 programs are in this position and how the mission will address this. Dr. Marcum did not know how many teams were similarly situated, but there were others, and that this situation was being addressed in Cycle 3 by designating a group of the top-ranked proposals for carry-over in the event that they are not completed within Cycle 3. With the flight schedule issues, SOFIA management decided not to do make-up flights. However, other Cycle 2 awardees have expressed the same frustration.

Dr. Melnick said that the project has had a recent review for contingency plans in regard to funding. He asked what the project would do with less than the program planning of a year ago. Dr. Marcum said that her team has developed detailed plans for scenarios at the values being considered. Dr. Kouveliotou asked if the proposal cycles included an option for joint investigations with other observatories. Dr. Marcum said that her team has had that input from other groups; this is an area where they could do better. Dr. Stapelfeldt noted that the Cycle 3 policy he found online said that there would be only 5 percent carryover from Cycle 2. He found that disappointing. Dr. Marcum promised to look into it.

#### Impact of NASA Travel Rules

Dr. Hertz reminded APS that they had requested this presentation on the NASA travel rules, which have broad implications for NASA employee scientists and NASA contractor scientists. In 2011, all U.S. government agencies were directed to spend 20 percent less on travel, and to conduct due diligence on conference spending. Amounts that could be spent were also capped. There is also a law that no more than 50 NASA employees can attend foreign conferences. There has been additional scrutiny on conference spending since 2013. There are reporting requirements, with the attendant paperwork issues. Most of this is about avoiding scandal and conducting due diligence, rather than saving money.

Under the current rules, any NASA scientists attending a conference must get advance approval, then report afterwards. The law limiting attendance at foreign conferences remains in place and does not expire. Reduced travel budgets remain in place, but the domestic conference attendance justification was significantly relaxed in 2014.

For reporting purposes, a conference is defined as, **not only actual conferences, but also any meeting** where more than 30 people attend and the meeting requires rental of a room outside of a U.S. government facility. In addition, for reporting purposes a conference is defined as being open to attendance by anyone in the community and involving attendee travel.. The travel and reporting rules are independent of whether there is a cost to NASA. For a foreign conference, it is not even an option for employees to go on vacation and show up on their own if the total number of NASA attendees would exceed 50. For domestic conferences, supervisors can determine if it is a valid use of time and money.

Dr. Oegerle spoke next. He works at GSFC, which has a dollar limit on travel. This includes the balloon campaign, sounding rockets, and science team meetings, as well as a conference attendance limit. The latter keeps GSFC from hitting the travel cap. The Space Act of 1958 created NASA to disseminate information, among other things. The travel restrictions run counter to that and hamper the ability of NASA employees to stay apprised of developments in new technologies that could be applied to NASA missions. The 50 person restriction covers all of NASA, including contractors. It restricts the ability of invited speakers to attend conferences, for example. It also restricts the career growth of young scientists and affects NASA's ability to recruit. Conferences are essential to being a scientist. He did not think that Congress realized the impact of this restriction on scientists. NASA's absence at conferences means that the United States cedes international leadership.

There are practical issues. Decisions on who attends are made late and prevent NASA from gaining the benefit of early registration discounts, while also disrupting individuals' ability to plan their lives. Uncertainty prevents NASA scientists from accepting invitations to speak. NASA has included direct-funded contractors in the 50-person limit for foreign conference attendance. At GSFC, 75 percent of the civil servants in astrophysics that had accepted talks or posters were denied attendance. The paperwork burden is enormous. In the last year, he has had to deal with over 2,400 emails related to travel, eight times more than several years ago.

Dr. Belinda Wilkes, who directs the Chandra X-ray Center, said that the new rules put NASA in a difficult position. The process is complex. For Chandra, travel is an integral part of achieving the science and is a contractual directive. It involves science meetings, regular major conferences and workshops for Chandra, software meetings, engineering meetings, and other travel. NASA has to approve attendance at any conference. Once a conference is approved, names and justifications must be submitted to Headquarters or the supervising center well in advance. There may be a need to submit exhibit costs, which does not include the supporting personnel. Approval is usually given 30 days before the meeting, and travel plans cannot be made until approval is received.

Conferences set programs and make other plans well in advance, but NASA personnel and exhibits cannot confirm attendance. Those unable to plan run behind, as some of their preparation must be done months in advance. Exhibit and personnel approvals are separate, but exhibits cannot be run without the right personnel. Cost increases due to late registration. Mission-hosted conferences are usually too late for effective planning and advertising.

The approval process is opaque and inconsistent. There are illogical decisions. NASA's leadership and international reputation are being damaged. Mission productivity is reduced due to loss of communications and discussions, and the impact on careers.

Dr. Wilkes presented a list of suggestions for addressing this situation:

- First, NASA should reassess need to include contractors in travel and conference restrictions.
- For regular conferences, there should be baseline, pre-approved attendance costs established for contractors, and contractors should be allowed to request an increase as needed for specific conferences.
- NASA should move up the schedule for conference approval.
- Finally, the Agency should remove the need for specific traveler names on domestic conferences. For foreign conferences, NASA should take contractors out of the 50-person limit.

Dr. Hertz said that there could be areas where NASA could improve in regard to timing and detail. If this is something APS wants to address, maybe the Science Committee would be interested in improving efficiencies for all of SMD. He added that, in regard to inclusion of contractors, one of the concerns is whether excluding them would raise a red flag in an audit.

Dr. Sembach thought that APS might help by urging NASA to have an Agency-wide set of standards. It is not clear that the centers are consistent in their interpretation. Dr. Kouveliotou explained that she is a civil servant, but she agrees that it is important to release the contractors from the regulations. She noted that the total amount spent is capped, so there must be some control. She wondered how it would affect civil servant travel if contractors were excused. Dr. Melnick noted that solving this problem would literally take an act of Congress. He was impressed by the letter APS generated on SOFIA, which was quoted by Congress back to the White House. Since APS letters are read, they should make that contribution here. Dr. Gaudi said that it would go in the letter.

#### Public Comment Period

Dr. Martin Harwitt of Cornell noted that the Senior Review gave the Planck mission high marks. The mission findings may be among the great landmarks in human history. As Planck approaches the culmination of its mission, it must have orderly completion of its work, along with the needed funding. NASA must ensure that the calibration of instruments is taken care of and that the mission produces the most accurate final results. This ultimately has to be done at a level other than the Senior Review. He

asked APS to support Dr. Hertz in making sure the calibrations are carried out. That amount would be \$3-5 million on a \$1 billion project. Planck recasts the map of what other missions will use in future work.

Dr. Josh Shiode from AAS said that there is a bill in the Senate that would raise the travel restrictions, and it was said that only DOD had spoken about the onerousness of this situation. He asked if NASA has said anything, and if the cost of all this extra work has been tracked. Dr. Hertz did not know.

### Working Lunch

#### *ExoPAG*

Dr. Gaudi presented highlights of recent ExoPAG activities. There are three new members on the executive committee, SAG and SIG work continue, the PAG held a meeting in June, and there are plans for another meeting at the AAS conference in January. SAG10, Characterizing the Climate of Transiting Planets with JWST and Beyond, has completed its draft report and will have the final version done by the end of the year. SAG11, Preparing for the WFIRST Microlensing Survey, has submitted its final report.

At the June ExoPAG meeting, participants discussed SAGs, had a presentation on ESA's Plato mission, and talked about the need for a new SAG on astrometry. An hour for open discussion resulted in three resolutions:

1. Participants of the ExoPAG 10 support the study by the Exo-S STDT of making WFIRST-AFTA Starshade compatible."
2. "Participants of the ExoPAG 10 encourages NASA to investigate possible opportunities to participate in the PLATO mission."
3. "Participants of the ExoPAG 10 are strongly in favor of continuing the important exoplanet science uniquely enabled by Spitzer, including both exoplanet atmospheres and microlensing."

The votes on all three were unanimous among those that voted, which were the majority of people in attendance.

ExoPAG has proposed a new SAG, SAG12: Scientific potential and feasibility of high-precision astrometry for exoplanet detection and characterization. One of the factors in seeking this SAG is that the community may want to use more than radial velocity in planet detection. Dr. Sembach said that he was strongly in favor of this and that COPAG would be happy to help.

Dr. Gaudi asked APS to approve the new SAG, which was done by a unanimous vote.

SAG11 has issued its final report on preparing for the WFIRST microlensing survey, focusing on several science programs that will enhance WFIRST science and reduce the mission's scientific risk. There was discussion of whether accepting the report was also an endorsement of its recommendations. Dr. Hertz said that APS would have to do its own recommendations if the Subcommittee wanted NASA to endorse the recommendations. One option was that, in accepting the SAG11 report, APS could state that it was not explicitly accepting the recommendations. The intent is that these come from the community.

The motion was made to accept the SAG11 final report as analysis and fact-finding with no recommendations. Approval was unanimous.

### HST 25th Anniversary Planning

Dr. Amber Straughn discussed the planning for the HST's 25th anniversary. The overall themes are celebrating HST engineering, the scientists who use it, and the public. There will be a focus on the

mission's bright future, and how JWST will move it further. There are also plans to celebrate the "Hubble Generation" of those who have lived with the telescope their entire life. Another emphasis will be on how Hubble has made science cool. The goal is to reach both the internal, expert audiences that include scientists, engineers, and astronauts, as well as the public and students.

Planning is underway for a possible capstone/kickoff event at the Smithsonian Air and Space Museum in April, and also possible events at the Udvar-Hazy Center. The Hubble 3D movie will relaunch in IMAX theaters nationwide. Media and social media plans are also in place to leverage resources like Twitter. One idea that still needs work is having an event in Times Square, similar to what was done for the Curiosity Rover landing. The Legislative Affairs Office has been helping to tie in political stakeholders. There will be science days on Capitol Hill, for example.

There will be many public events, like the SXSW festival and National Park Service activities, as well as the World Science Festival, Baltimore Museum of Art celebration, and others. Huge Hubble images will be posted on the walls of DC-area airports. There will be a nationwide university lecture series. The AAS and American Association for the Advancement of Science (AAAS) meetings will also have events.

Dr. Batalha suggested getting the images to more airports, especially the hubs. Dr. Sembach said that the team is working on that, though it is already getting late. The team hopes to develop a slide presentation that astronomers can all deliver on the same day. Dr. Straughn added that they are discussing tying the celebration in with the 100th anniversary of Einstein. Funding comes from a variety of sources, not all within NASA.

#### GPRAMA Discussion Continued

Dr. Gaudi asked if the Subcommittee members were comfortable enough with the materials they had selected for the three sections to move on to the voting. The text they were developing would serve as examples to support their ratings. It was agreed to hold the vote.

The first objective and performance goal was:

**Objective 1.6.2:** *Improve understanding of the origin and destiny of the universe, and the nature of black holes, dark energy, dark matter, and gravity.*

**Performance Goal 1.6.2.1:** *Demonstrate planned progress in understanding the origin and destiny of the universe, and the nature of black holes, dark energy, dark matter, and gravity. Progress relative to the objectives in NASA's 2010 Science Plan will be evaluated by external expert review.*

There was a unanimous vote for this section to receive a rating of Green.

Dr. Cornish asked about giving ratings other than Green. It was explained that this had been done by the Planetary Science Subcommittee (PSS), which once gave a Red rating. Ms. Kearns added that APS once rated an APD area other than Green due to continued delays with SOFIA for several consecutive years. This would apply to a major mission failure, for example.

The next objective and performance goal were:

**Objective 1.6.3:** *Improve understanding of the many phenomena and processes associated with galaxy, stellar, and planetary system formation and evolution from the earliest epochs to today.*

**Performance Goal 1.6.3.1:** *Demonstrate planned progress in understanding the many phenomena and processes associated with galaxy, stellar, and planetary system formation and evolution from the earliest epochs to today. Progress relative to the objectives in NASA's 2010 Science Plan will be evaluated by external expert review.*

Dr. Sembach said that he had written a summary. There were several good articles involving HST, Spitzer, Chandra, NuSTAR, and others. Dr. Gaudi was concerned that APS wanted to over-emphasize SOFIA, but Dr. Dalcanton advocated recognition of SOFIA in the document. Dr. Melnick pointed out that SOFIA was just declared operational in May, so it would be best left for next year.

There was a unanimous vote that this section receive a rating of Green.

The third objective and goal were:

**Objective 1.6.4:** *Generate a census of extra-solar planets and measure their properties.*

**Performance Goal 1.6.4.1:** *Demonstrate planned progress in generating a census of extra-solar planets and measuring their properties. Progress relative to the objectives in NASA's 2010 Science Plan will be evaluated by external expert review.*

There was no discussion of this area, which received a unanimous vote for a rating of Green.

Dr. Gaudi thanked Ms. Kearns and asked that the members send their text to both him and Dr. Peterson. The latter was writing the introduction for the entire piece.

#### APS Discussion

##### *Planck and the Senior Review*

The Subcommittee resumed discussion of Planck funding. Dr. Bregman reminded them that he was on the Senior Review, which considered Planck. The request to continue came from JPL, which always sends along requests for huge increases and which did so for two other missions. The guidance for Planck was for \$4 million, and JPL sought \$10 million. Planck has a data release scheduled for October and a late 2015 activity. The guidance from NASA was only for 2015. The Senior Review panel read a great deal of background material and listened to a long presentation in order to understand which tasks are truly necessary. One of the shortcomings of the presentation is that while a lot of calibration work is done through the polarization, the results were not presented, only information about the efforts. It was not clear whether there was a crisis or if the Planck team made terrific progress and had just a few more things to do.

The Senior Review created a spreadsheet set to a bottom line provided by Dr. Hertz. The amount above the guidance was reduced for Planck. There were some funds for Planck in 2016, and the Senior Review recommended some flexibility. Dr. Bock added that the letter ESA released has a deadline. Dr. Gaudi said that what he did not know was the degree of this problem, and it was not clear how to gauge it. The most disturbing potential outcome is that there might be systematic errors introduced into other missions due to the lack of final Planck data. He wondered also about the extent of any problem that might exist in the absence of the additional \$3.1 million.

Dr. Bregman said that Planck is the ultimate experiment with temperature variations in CMB. The work schedule indicates that the effort is now mostly focused on polarization. Dr. Bock explained that the large-scale polarization coverage is the source of the greatest gap, and where the most progress is being made at this time. He cannot provide measurement numbers, but the community would not be happy at the current level. There is a lot of work left to do.

Dr. Melnick saw two issues: the purity of legacy data, and the fact that the way cosmology progresses is through prior information. Euclid and WFIRST both assume a certain accuracy of the parameters coming from Planck. He thought they should invite the Euclid and WFIRST people to look at where the

cosmology will be if there are no further Planck funds, and determine the extent to which that will matter to them. If they find this significant, they should contribute funds. If someone proposes an Explorer mission and needs data, they are expected to include that cost, so that would apply here.

Dr. Sembach said that he was sympathetic to getting as much as possible from Planck, but he did not like to second-guess the Senior Review, which had a more extensive discussion than APS did. He therefore did not see how APS could make a recommendation on Planck. Dr. Bregman said that the question is about late 2015 and 2016, by which time the team will have the data. Several APS members expressed trepidation about over-riding the Senior Review. Dr. Kouveliotou was concerned about redistributing funding. There is no APD slush fund. Dr. Hertz said he would never ask APS to decide that, and he shared her concern.

Dr. Wang said that it will haunt them not to ensure the completion of the calibration work for Planck by the U.S. Planck team. It is mostly finished, but it is incomplete, and it would be a shame to leave it hanging. This decision has long-term implications. Dr. Melnick agreed that APS does not have the expertise to make a further decision, and he would not want to reverse the Senior Review. He repeated his recommendation of having the experts in WFIRST and Euclid weigh in on how much they need this information. If they feel that not improving the results will degrade their results, then those projects should cover the cost to complete Planck. If they need Planck, they will not meet their own goals or will have to find ways to compensate.

Dr. Bregman emphasized that the Senior Review wants Planck to be successful. The review panel did not see two things they wanted: how this compares to the theoretical limit, and how the difference between where they are now and the theoretical limit affects cosmological research. Dr. Hertz explained that one value of the Senior Review is that it is comparative. Dr. Bock pointed out that the PhysPAG letter on Planck was not meant to subvert the Senior Review. It was intended to state the problem.

Dr. Gaudi summarized the discussion. He saw agreement in APS that if this is to affect future missions, that is alarming. They also did not have enough information to determine that, they did not have as much time to discuss it as the Review panel did, and they did not want to circumvent the Senior Review. All they could do was to recommend that someone at NASA with the appropriate expertise review this.

The notion of a SAG to address the situation was presented. Dr. Melnick said that people who are up to speed on Euclid and WFIRST should be included. Dr. Gaudi said that in his experience, SAGs are slow. He suggested instead recommending that Dr. Hertz come up with a group to look to this further and quickly.

### *Explorers*

Dr. Bregman had two concerns. He thought there should be some sort of serious analysis of whether critical science is not getting done. His second point was in regard to Explorers. He presented the scenario in which NASA has built a mission for about \$200 million, it does well, and the mission needs another \$5 million to continue. It is a difficult issue. Over time, he has come to feel that NASA does not get enough from its Explorers. The typical Explorer goes on for a decade. For long-range planning, it would help to know how long the Explorers last. APD took a big hit on the Explorer cadence about 10 years ago, and it has never recovered. This is distressing. ESA has reserved so much of the critical science the U.S. community had hoped to do, and so we need to rely more on the Explorers.

Dr. Gaudi asked him what he thought of the Senior Reviews, and whether he thought Dr. Hertz had done well enough on the Explorers. Dr. Bregman replied that he thought Dr. Hertz was great. He himself has participated in a number of Senior Reviews, and believes the process works. However, there is too much

pain and not enough support for Explorers. Dr. Hertz explained that Explorers are cost capped, and any PI will cram as much as possible into that.

Dr. Harrison saw the Explorers as being turned into facility-class telescopes rather than PI-led team experiments. Dr. Bregman noted that there used to be a new Explorer every year, a rate that was cut in half in 2004 and never restored. Dr. Nousek mostly agreed, but recalled that Explorers back then were very simple. Now the Explorer program is where APD is largely competitive. The cost cap drives so much and yet causes inefficiency.

Dr. Dalcanton suggested having a pool of funds that could be competed for in order to extend the Explorers that were most successful. Dr. Sembach added that Swift and NuSTAR are Explorers that have succeeded in Senior Reviews. Dr. Gaudi reminded the members that Dr. Hertz cannot spend more on Explorers. Dr. Bregman brought up the idea of a changing point of view on what a mission is. He views it as a serendipitous discovery opportunity. NASA launches them as experiments, and if they prove to be more than that, NASA should be prepared to support them in that way. Dr. Hertz said that APD can optimize the science by spending its funds instead of holding them back. The Division pre-allocates funds every year and does active cost management. Dr. Gaudi did not see a concrete recommendation here.

#### *Other Discussion*

In a return to the topic of the Senior Review, Dr. Kouveliotou observed that while it would not be appropriate to second-guess the panel, she thought more questions had come up this time. She asked whether the missions are more desperate, or if there might be insufficient attention paid to operating missions. Dr. Melnick added that the lowest ranked mission had a score of 7 out of 10 possible points, which might indicate underfunding, and Dr. Bock asked if the separate line for large missions in the Senior Review might be part of the problem.

On the topic of SOFIA, Dr. Kalirai said that the science community has a lot of uncertainty. Going forward, APD will need to set expectations for SOFIA. He thought that the number of both proposals and papers should be consistent with those for other GOs. He wondered if something should be done to spur more publications. Dr. Melnick explained that he once reviewed SOFIA and compiled a list of parameters for GOs, including publication data and other metrics. The project is aware of the standards. The difficulty is that this is not a 24/7 operation like a space observatory. SOFIA gets GO funding but operates in a constrained way.

Dr. Sembach encouraged everyone to read the IG report. It identifies seven key areas for improvement. Some of these are significant, such as inefficiencies, cost issues, etc. Those suggestions could go a long way toward addressing SOFIA issues. The report is very specific and endorses a science-per-dollar review. APS should have this as a presentation topic. Dr. Hertz said that APD will look at the reports. APD will provide a plan. After that, APS can decide when to plan a presentation and weigh in on when SOFIA should be subject to a Senior Review. The IG interviewed a lot of astronomers, both those on and off the team. It is the best IG report he has ever read.

#### Recommendations, Actions

Dr. Gaudi asked Drs. Bock, Wang, Melnick, and Bregman to develop a recommendation on learning more about the Planck mission and the implications of the designated funding versus the funding requested in the Senior Review. Dr. Bock will lead the effort. Dr. Nousek said that he would write a statement complimenting Dr. Hertz on his handling of Athena and LSST.

Dr. Gaudi next held a vote to accept the IPSAG white paper as input. The vote to approve was unanimous.

It was decided that Dr. Peterson would be the liaison to AAAC. It was also agreed to not saying anything in the letter about SOFIA or the Explorer program. The GPRAMA actions were to be included. Dr. Gaudi asked Drs. Kouveliotou and Kalirai to draft language regarding the travel rules once they determine whether NASA has said anything about this to Congress. Dr. Hertz thought it unlikely that this issue had been raised, since NASA has so many other priorities.

Dr. Stapelfeldt volunteered to write something positive about Spitzer, in which he would address the synergies with JWST and the collaboration with PSD.

Dr. Gaudi promised to ask Dr. Peterson to communicate back to APS the outcome of the APS issues taken to the NAC Science Committee. He also committed to formally thanking Ms. Erickson and Dr. Straughn for their presentations, since APS had requested those.

Dr. Gaudi asked that the APS members send their writing assignments to him and Dr. Peterson within 48 hours.

#### Brief to Dr. Hertz

Dr. Hertz thanked APS for their attendance and hard work. Dr. Gaudi said that the next meeting will be a teleconference in October or November, with the next face-to-face meeting after the FY15 budget comes out, probably in March.

#### Adjourn

The meeting was adjourned at 3:26 p.m.

**Appendix A**  
**Attendees**

Subcommittee members

Bradley M. Peterson, Ohio State University, *Chair*  
B. Scott Gaudi, Ohio State University, *Vice-Chair, Astrophysics Subcommittee*  
Hashima Hasan, NASA, *Executive Secretary*  
Nathalie Batalha, NASA Ames  
James Bock, Jet Propulsion Laboratory  
Joel Bregman, University of Michigan  
Neil John Cornish, Montana State University  
Julianne Dalcanton, University of Washington  
Giovanni Fazio, Harvard Smithsonian Center for Astrophysics  
Fiona Harrison, CalTech  
Jason Kalirai, Space Telescope Science Institute  
Chryssa Kouveliotou, Marshall Space Flight Center  
Gary Melnick, Harvard University Center for Astrophysics  
John Nousek, Pennsylvania State University  
Kenneth Sembach, Space Telescope Science Institute  
Rachel Somerville, Rutgers University  
Karl Stapelfeldt, Goddard Space Flight Center  
Yun Wang, University of Oklahoma

NASA attendees

Paul Hertz, NASA HQ, *Director, Astrophysics Division*  
Joan Centrella, NASA GSFC  
Felicia Chen, NASA HQ  
Jeanne Davis, NASA HQ  
Kristen Erickson, NASA HQ  
Elaine Denning, NASA HQ  
Counk Huzmt, NASA HQ  
John Gagosian, NASA HQ  
Alaina Henry, NASA GSFC  
Jeffrey Jens, NASA HQ  
W. Vernon Jones, NASA HQ  
Jennifer Kearns, NASA HQ  
Lia LaPiana, NASA HQ  
Janet Larson, NASA HQ  
Susan Neff, NASA GSFC  
William Oegerle, NASA GSFC  
Mario Perez, NASA HQ  
Eric Smith, NASA HQ  
Linda Sparke, NASA HQ  
Amber Straughn, NASA  
Mary Voytek, NASA HQ  
Michael Werner, NASA JPL  
Dan Woods, NASA HQ  
Stefan Immler, NASA HQ

Non-NASA Attendees

Leandra Bernstein, Press  
Francesco Bordi, Aerospace  
Evan Linck, NAS  
James Lochner, USRA  
Richard Polidan, Northrup Grumman  
Elizabeth Sheley, Zantech  
Belinda Wilkes, Smithsonian Astrophysical Observatory

Webex

Ashraf Ali, NASA GSFC  
Gale Allen, NASA HQ  
Anya Biferno, NASA JPL  
Gary Blackwood, NASA JPL  
Geoffrey Bryden, NASA JPL  
Ann Cardiff, NASA GSFC  
Felicia Chou, NASA HQ  
Stephen Clark, Space Flight Now  
Dominick Conte, Millennium  
Alberto Conti, NGC  
Peter Eisenhardt, NASA JPL  
Michael Fanelli, NASA ARC  
Jeff Foust, The Space Review  
Jonathan Gardner, NASA GSFC  
Jessica Glover, NASA HQ  
Michael Greene, NASA JPL  
Hussein Jirdeh, STSCI  
Louis Kaluzienski, NASA HQ  
Don Kniffen, USRA  
David Ladler  
Janet Larsen, NASA HQ  
Dan Leone, SpaceNews  
Makenzie Lystrup, Ball Aerospace  
Pamela Marcum, NASA Ames  
Amaya Moro Martin, STSCI  
Kevin Miller, NASA  
Susan Neff, NASA GSFC  
Tracy Osborne, NASA HQ  
Deborah Padgett, NASA GSFC  
Robert Petre, NASA GSFC  
Thai Pham, NASA GSFC  
Andy Ptak, NASA GSFC  
Andrea Razzaghi, NASA HQ  
Stephen Rinehart, NASA GSFC  
Pete Roming, SWRI  
Bernard Seery, NASA GSFC  
Joshua Shiode, AAS  
Alan Smale, NASA GSFC  
Denise Smith, Space Telescope Science Institute  
Micheline Tabache, ESA

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Steve Thompson, Millennium Space  
Eric Tollestrup, NASA HQ  
Wes Traub, NASA JPL  
Stephen Unwin, NASA JPL  
Glenn Wahlgren, NASA HQ  
Alexandra Witze, Nature Magazine  
Mark Zastro

**Appendix B**  
**NAC Astrophysics Subcommittee Members**

**Bradley Peterson**, Chair  
Department of Astronomy  
Ohio State University

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

James J. Bock  
Jet Propulsion Laboratory

Joel Bregman  
Department of Astronomy  
University of Michigan

Neil John Cornish  
Department of Physics  
Montana State University

Julianne Dalcanton  
Professor of Astronomy  
University of Washington

Giovanni Fazio  
Harvard Smithsonian Center for Astrophysics

B. Scott Gaudi  
Department of Astronomy  
Ohio State University

Fiona Harrison  
Professor, Physics and Astronomy  
CalTech

Jason Kalirai  
Space Telescope Science Institute

Chryssa Kouveliotou  
Marshall Space Flight Center

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Gary Melnick  
Senior Astronomer  
Harvard University

John A. Nousek  
Professor of Astronomy & Astrophysics  
Pennsylvania State University

Kenneth Sembach  
Space Telescope Science Institute

Rachel Somerville  
Department of Physics and Astronomy  
Rutgers University

Karl Stapelfeldt  
Goddard Space Flight Center

Yun Wang  
Department of Physics and Astronomy  
University of Oklahoma

**Appendix C**  
**Presentations**

1. *Astrophysics Division Update*, Paul Hertz
2. *Astrophysics Research Programs*, Linda Sparke
3. *Planning for the Mid-Decade Review*, Paul Hertz
4. *SMD Communication and Education Update*, Kristen Erickson
5. *Physics of the Cosmos Program Analysis Group: Status Report*, John Nousek
6. *Cosmic Origins Program Analysis Group*, Kenneth Sembach
7. *ExoPAG Report*, Scott Gaudi
8. *JWST Program Office*, Eric Smith
9. *SOFIA Update*, Pamela Marcum
10. *NASA Travel Rules That Affect the Science Community*, Paul Hertz
11. *Impact of NASA Travel Restrictions on Civil Servant Scientists at NASA Centers*, Bill Oegerle
12. *Impact of NASA Travel Procedures on Contractors*, Belinda Wilkes
13. *HST 25<sup>th</sup> Anniversary Planning*, Amber Straughn

**Appendix D  
Agenda**

**Astrophysics Subcommittee meeting  
August 11-12, 2014**

**AGENDA**

**Monday, August 11, 2014**

8:30 a.m.	Introduction and Announcements	Brad Peterson
8:40 a.m.	Astrophysics Division Update	Paul Hertz
10:00 a.m.	Break	
10:15 a.m.	R&A Update	Linda Sparke
11:00 a.m.	Discussion	
12: 00 noon	Working lunch	
1:00 p.m.	Mid Decadal Update	Paul Hertz
1:30 p.m.	SMD Communications and Education Update	Kristen Erickson
2:00 p.m.	Public Comment Period	
2:10 p.m.	Break	
2:25 p.m.	GPRAMA Guidelines	Jennifer Kearns
2:35 p.m.	GPRAMA Discussion	APS members
4:30 p.m.	Wrap up for Day 1	Brad Peterson

**Tuesday, August 12**

9:00 a.m.	Opening Remarks	Brad Peterson
9:10 a.m.	ExoPAG/PhysPAG/COPAG Updates	Scott Gaudi John Nousek Ken Sembach
9:55 a.m.	JWST Update	Eric Smith
10:25 a.m.	SOFIA Update	Pamela Marcum
11:00 a.m.	Break	
11:10 a.m.	Impact of NASA Travel Rules	Paul Hertz William Oegerle Belinda Wilkes
11:40 a.m.	HST 25th Anniversary Planning	Amber Straughn
11:55 a.m.	Public Comment Period	
12:00 noon	Working Lunch	
1:00 p.m.	GPRAMA Discussion (cont'd from Day 1)	
2:00 p.m.	Break	
2:10 p.m.	GPRAMA Discussion (cont'd.)	
3:00 p.m.	Recommendations, Actions	Brad Peterson
3:30 p.m.	Brief to Hertz	Brad Peterson
4:00 p.m.	Adjourn	