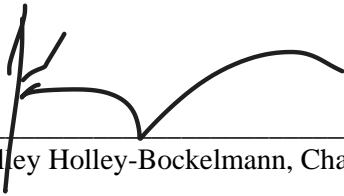


**NASA Advisory Council  
Astrophysics Advisory Committee**

**March 20-21, 2024**

**Hybrid Meeting**

**NASA Headquarters  
Washington, D.C.**

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Dr. Kelley Holley-Bockelmann, Chair

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Dr. Hashima Hasan, Executive Secretary

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*Report prepared by  
Joan Zimmermann, T&J, Inc.*

March 20,2024

### Introduction and Announcements

Dr. Hashima Hasan, Executive Secretary of the Astrophysics Advisory Committee (APAC), took roll, introduced new APAC members, Drs. Sarah Tuttle and Rebecca Oppenheimer, and made administrative comments. Dr. Hasan introduced Chair Dr. Kelley Holley-Bockelmann, who then introduced Science Mission Directorate (SMD) Associate Administrator (AA), Dr. Nicola Fox.

### SMD AA Comments

Dr. Fox acknowledged the challenging budget climate, but noted that NASA had actually fared well, notwithstanding. SMD has had to make tough choices in response. NASA always wants to do more science, and encourages the community to stand together. The Agency has been through restricted budgetary times before, and the community has been resilient in the face of obstacles. The path forward will involve setbacks in every area of SMD, but there are opportunities to be strategic and creative.

Dr. Fox addressed some pre-set questions and comments, and was asked about the catastrophic rampdown in the Chandra budget, as well as the prospect of the telescope being shut down. She said she appreciated the community's support during a tough time for both the Hubble Space Telescope and Chandra budgets. They are both on long Extended Missions (EM). NASA does not want to cancel these missions, but in order to address budget shortfalls, it does need to convene a "mini-Senior Review" to look at more efficient ways of operating these missions henceforth. NASA is asking the community to get creative and offer some ideas of how to operate these observatories going forward.

Dr. Sarah Tuttle asked, given Chandra's recent Senior Review (SR), whether NASA was thinking about changing the SR process in the long term. Dr. Fox affirmed that NASA is not changing the way it does SRs. The mini-review is intended to create the best possible outcome for these missions through the avenue of community input by means of a creative, mini-SR. NASA does great things when challenged, thanks to community ideas. Dr. Fox asked Dr. Mark Clampin, Director of the Astrophysics Division (APD) to comment on the process. Dr. Clampin noted that the last SR was in a very different budget environment, but given present circumstances, APD will have to make hard decisions in a short time, and is seeking the community's feedback in considering ways to streamline these missions.

Dr. Holley-Bockelmann referenced the oversubscribed Deep Space Network (DSN) and communications assets at NASA, as they are critical for Time Domain and Multimessenger Astrophysics (TDAMM). Dr. Fox said that NASA is very aware of these concerns, and is having discussions with the Space Communication and Navigation (SCaN) program and with Space Operations. Dr. Kevin Coggins is the new Deputy for SCaN, and has been fully engaged in discussions. NASA is looking at commercial solutions, having acknowledged that the Tracking and Relay Satellite System (TDRSS) will be retired soon. Unfortunately, the possible commercial solutions will not be ready on time, possibly impacting current operational missions. NASA is working with SCaN and with dedicated staff in SMD to develop a plan for supporting all of Science. NASA is looking to deconflict with the Artemis missions as well, via a new lunar communications system (Lunar Exploration Ground Sites; LEGS) now in progress. Dr. Fox pledged to keep APAC updated, and reminded the community that NASA will need support as planning goes forward. She noted that Dr. Jeff Hayes is also working with SCaN.

Responding to a question on streamlining the two-step proposal process in the Explorers program. Dr. Fox and Dr. Jessica Gaskin discussed the possibility of picking one mission only, in the science phase, to enable the review team to assist only one team going through phase A. In addition, the one selected team could get more funding in phase A. Dr. Erika Hamden added that she thought the Step 1 proposal process was onerous, and that in the higher cost category, there is more space to have more compelling science. She suggested either changing the cost cap or relaxing the risk requirements, and perhaps reducing the risk requirements for the missions of opportunity (MoOs) as well. If NASA is going to select only one

team, they need to give the teams clear guidance about what NASA is really looking for. More money in phase A, and a more constructive guidance process, would be more helpful. Dr. Fox thought that having a review team that helps was an interesting idea, that would also require a major rewrite of the program. Mission concepts are crucial, not just the science, and they are hard to evaluate through just a science presentation. There must be a mission concept behind the science in order for NASA to understand the true cost to carrying out the science. Dr. Fox said she would discuss the idea with the SMD Deputy Associate Administrator for Research (DAAR), Dr. Michael New, and asked that APAC write up its thoughts on this matter as findings and recommendations. Dr. Tuttle said she feared that institutions with more resources will get more missions. Dr. Rebecca Oppenheimer said she disagreed, for the record. Dr. Holley-Bockelmann commented that the best way to determine any changes to the program would be to have a review.

#### APD Update

Dr. Clampin presented a status of APD, first presenting an organization chart to remind people that there is now an Associate Director for Research & Analysis, Dr. Eric Smith, and an AA for Flight Programs, Dr. Tahani Amer. The Program Scientist lineup now includes cross-cutting staff members. He related that Dr. David Morris is now helping out with APAC. APD missions continue to do great science, as evidenced by the James Webb Space Telescope (JWST; or Webb) confirming the Hubble Tension, and by other observations that show how APD assets can continue to support TDAMM. Webb continues to do great exoplanet science. The Galactic/Extragalactic ULDB Spectroscopic Terahertz Observatory (GUSTO), an Explorer-class mission, was launched from McMurdo Station, Antarctica, at the end of 2023, where it set a new record for balloon flight: 57 days, 7 hours. GUSTO met and exceeded its mission success criteria and will address all five science questions it was developed to answer. APD is very happy with the results, and Dr. Clampin commended the entire team for its excellent work.

#### *FY24 Committee report*

Dr. Clampin highlighted FY24 Committee Report text relevant to budgetary matters, reminding the community that the Nancy Grace Roman Wide-Field InfraRed Survey Telescope (Roman) is subject to a cost cap of \$3.5B, and that NASA is committed to keeping it within its budget commitment. JWST will be provided \$187M in FY24 for continued operations, and the Stratospheric Observatory For Infrared Astronomy (SOFIA) will be provided \$20M to be closed out in an orderly way. The Committee also recommended spending up to \$289.9M for R&A, and \$10M for the establishment of a Habitable Worlds Observatory (for maintaining staff for the first year). NASA is currently in the process of putting together the Operations Plan for 2024, so more specific information is yet to be released.

Dr. Tremblay asked how much of the \$20M will be needed to close out SOFIA. Dr. Clampin said APD has been closing out SOFIA for some time at the Palmdale hangar, partnering with the Earth Science Division. The expectation is that there will be some modest work that needs to be done in 2025 to continue to close it out properly. It should be clear that money is already being spent in 2024 for this purpose. Dr. Gaskin asked if there was still a plan to set up a Program Office for the Great Observatory Maturation Program (GOMAP). Dr. Clampin said that both the Decadal Survey (DS) and the NASA Large Mission Study identified a need to mature technologies for future Flagship missions, and that APD does not intend to deviate from the plan. He expected that the first task will be coordination of technology maturation, given that the DS was clear about having an independent review of the technology before going forward to the normal program development phases. There is no intent to create two Program Offices. Dr. Clampin said he expected that as APD gets to the end of the decade, it may create a new office to deal with new developments for the next DS.

Dr. Clampin briefly reviewed Astrophysics fleet missions in prime science operations: Webb, Euclid, and the X-Ray Imaging and Spectroscopy Mission (XRISM; launched in 2023). Much of the portfolio is in EMs status, Hubble, Imaging X-ray Polarimetry Explorer (IXPE), Transiting Exoplanets Survey Satellite

(TESS), Fermi, etc., and several more are in formulation. Probes and Habitable Worlds missions have not entered formulation yet.

The FY25 President's Budget Request (PBR) is fairly flat through the outyears to 2029, and there will be continued challenges associated with inflation. Asked if any changes in the implementation plan would be necessary, Dr. Clampin said APD is not planning to do more than it's done in 2024, and is not "coasting" by any means; APD still expects significant headwinds in 2025. Dr. Ilaria Pascucci asked why the exoplanet exploration budget request was so much lower than others. Dr. Clampin said the exoplanet budget includes the Roman telescope, which will launch in early 2027, after which its development costs will quickly ramp down. Some science budget for Roman was added in the outyears. Dr. Hsiao-Wen Chen asked if the increase in the Explorers program signified a shift from science to mission operations. Dr. Clampin said that some of the accounting for other missions will go into the Explorers line for management, which explains the movement of some numbers.

Astrophysics priorities are to maintain a balanced portfolio during this decade and the next. APD has tried where possible to protect international partnerships. The DS recommendation on TDAMM is a key endorsement for continuing the NASA collaboration with the European Space Agency (ESA) Laser Interferometer Space Antenna (LISA) mission. NASA will need enough funding in place when it reaches phase A. Some international missions, such as Athena, have changed timeframes. Dr. Ilina Kiessling requested that future briefing charts identify where missions are placed (e.g., Hubble and Webb under Cosmic Origins). Dr. Clampin noted that while Roman has a cost cap, APD has added in funding for the science phase, which is a fairly significant number, and that the mission observations will be comprised of community-defined and proposer-led surveys.

Dr. Clampin addressed the concept of a mini-SR, or Operations Paradigm Change Review (OPCR), for Hubble and Chandra. Dr. Smith commented that this OPCR will not be a lengthy process, as APD needs to have the output from this process by the end of May, in order to inform the FY26 budget request. OPCR will not be making recommendations, because there is no time for a formal process. The audience will be internal, but the report will likely be public. Dr. Grant Tremblay (who declared himself conflicted on Chandra, for the record), asked if the teams would be allowed to consider an overguide request. Dr. Smith said Yes, but the teams will have to submit at least one recommendation that is within the budget guidelines. This is NASA's attempt to explore the parameter space governing ways to continue supporting these facilities, within these reduced numbers, differently than has been done in the past. There are some criteria listed for the teams, such as identifying the science associated with each option. The teams will be asked to find ways to balance operations efficiency and science. The review panel will be asked to provide findings, so that APD can get some assessment from the science community on how the options affect the science. There will be science impacts from the budget that cannot be avoided. Dr. Chen asked if there was some way to fold in how much science would be sacrificed into the decision-making tree. Dr. Smith asked for clarification: is it documentation of science lost? Dr. Chen said that for example, Chandra provides unprecedented angular resolution, and also supports the workforce and talent development. Asked if there was a way for the community to have input to the review panel on these subjects, Dr. Clampin said he fully expected the APAC to make recommendations, but he also said the mission teams are fully aware of the science and workforce impacts, and they will be informing the panels. He said he was confident that the mission teams will continue to prioritize science. Asked if grant support would be cut, Dr. Smith said that it is up to the projects to make decisions on grant support to the community, in the options it presents to the OPCR. Dr. Holley-Bockelmann commented that Hubble is well known in the Congress, while Chandra is not, and that a review might place an unequal burden on Chandra. Dr. Clampin said that APD is really focused on not canceling these missions, and is simply trying to find a cheaper way to operate them, and that second-guessing the PPBE process is not a productive exercise.

### *Decadal Survey Mission Progress*

The Roman Space Telescope Coronagraph Instrument is on track for delivery in May 2024; and is now undergoing thermal vacuum testing. Dr. Clampin gave kudos to the mission team, that successfully overcame a significant issue with a particular thin-film resistor, which was an industry-wide problem. The mission team had to replace over 14,000 resistors, representing 17,000 white wire adjustments. This did not impact the schedule thanks to the team's planning and dynamism in dealing with a major setback. The first optical tests on the IOA were performed at ambient temperature and pressure, and the team got its first image of a point source. Roman is the first survey Flagship, which will support the entire science community. Examples of proposed surveys include a Galactic Plane General Astrophysics Survey. Roman will also focus on the Time Domain science it is capable of.

NASA has been finalizing a Memorandum of Understanding (MOU) with the ESA Space Science Office for the last 6 months, after which LISA will be treated like any other mission under NPR 7120.5. NASA and ESA processes are similar, and the agencies will hold a Standing Review Board (SRB) to decide whether they will combine Key Decision Points (KDP-A and KDP-B), because much work at NASA has already been accomplished. The goal is to formally establish LISA as a project in 2024.

Euclid just released its first science images, publicly released in May; everything is in good shape with Euclid. SPHEREx, a near infrared spectroscopic sky survey, recently successfully completed its KDP-D. milestone, and is progressing to launch in February 2025. The Agency Launch Readiness Date (LRD) still holds at April 2025. An Operations Readiness Review (ORR) is scheduled for September 2024, and is looking good..

The MDEX Selection, UVEX, will include a rapid pointing capability and a broad data set for the science community. XRISM is performing well. Important dates for Cycle 1 have been released, and NASA is continuing discussions with the Japanese as to attempting to fix a gate valve issue on the spectrometer; the gate valve currently remains closed which diminishes the effective area of the instrument somewhat at all energies, especially below 2keV. The Pioneers program has not been canceled; NASA has just deferred announcements because of budget concerns, and is moving forward with all previously selected Pioneers missions, and has also added a new selection. Pioneers continue to do well for Early Career researchers. APD has made a big change for the Advanced Telescope for High ENergy Astrophysics (ATHENA); it is no longer providing the Marshall Space Flight Center high-energy beam-line testing facility for the telescope. There is still a discussion of either releasing the Request for Proposals (RFP) or deferring it for a year. APD is in the middle of the selection process for Probes.

In response to an APAC request on the naming of the Webb telescope, APD has reached out to Employee Resource Group (ERG) leads and LGBTQ+ champions and has initiated a dialogue. Dr. David Morris commented that there have been good conversations as APD tries to understand how Headquarters and NASA Centers can support the community, and what kind of control NASA actually has over these matters. Dr. Gaskin suggested reaching out to centers such as Marshall and Ames, and to include all the centers as a starting point. Dr. Holley-Bockelmann noted that some NASA centers are located in places like Texas. Dr. Morris said the effort was just beginning, and that NASA was planning to reach out to all centers. Dr. Holley-Bockelmann said that it is generally hard to find the ERG people on line, which is a problem. Dr. Tuttle commented that the matter is also an internal NASA Headquarters question, tied up by very diverse laws at the state level. As a federal agency, NASA will be asked about how it will interact with institutions that will be violating federal laws. What will happen when NASA tries to fund people in this atmosphere? What happens when people propose to states that forbid inclusion plans? Dr. Morris said he had begun the conversations with NASA's legal teams, and with other relevant Agency offices. Dr. Tuttle added that deportation laws will also be a problem.

Dr. Shardha Jogee asked Dr. Clampin to comment on how to protect Great Observatory (GO) grants, how to increase R&A growth by 15%, and how to increase funding to Theoretical and Computational

Astrophysics Networks (TCAN) and Future Investigators in NASA Earth and Space Science and Technology (FINESST). Dr. Clampin said that those elements are still in the budget, but at present, APD certainly can't grow programs like R&A.

Dr. Clampin continued reporting on the program of record. The Habitable Worlds Observatory (HWO) is the next Flagship mission concept recommended by the Astro2020 Decadal Survey. In preparation, GOMAP has been established, a Science, Technology, Architecture Review Team (START) and a Technical Assessment Group (TAG) have been formed, and about 1000 people are involved in the various working groups. Dr. Clampin promised more detail at the next APAC meeting, and said he just wanted to emphasize that these activities are going forward.

#### *APAC Recommendations and APD Responses*

Dr. Clampin reviewed APAC recommendations from October 2023 and APD responses. As to concerns about the OPCR, Dr. Clampin felt no need to reiterate Dr. Smith's explanation.

*Recommendation:* To determine future budget decisions, the APAC recommends that a decision matrix is generated that accounts for near- and long-term impacts to astrophysics and the astrophysics community for models that prioritize preserving irreplaceable scientific capabilities versus those that impose a flat cut for each mission.

*APD Response:* While APD understands the intent of the recommendation, a matrix can only serve as a guideline. In addressing budget guidance, APD tries to follow its principles for budget reductions, and of course Decadal Survey direction. However, a number of other considerations present challenges that preclude the application of a matrix approach.

- Earmarked budget items.
- Decadal Survey Priorities
- Congressionally cost-capped programs e.g. Roman
- Mission funding profiles
- Flat cuts to missions in development lead to significant cost overruns, breached cost-caps, and the potential loss of key personnel at critical points in the mission.

These considerations tend to generate an environment in which the fraction of available budget to make reductions, when required, is significantly below the annual APD operating budget, severely limiting options.

*Recommendation:* The APAC further recommends that this decision matrix be informed by community input, perhaps by a Request for Information (RFI), as we note that the Decadal did not weigh in on the relative prioritization of protecting the current program of record versus investing in future programs.

*APD Response:* Dr. Clampin stated that there is no practical way for APD to do an RFI on every iteration.

*Recommendation:* The APAC recommends that APD explore the benefits, feasibility, and possible future implementation of optical communications on astrophysics missions. Further, we recommend a Request for Information to better understand the space communication needs and concerns of the astrophysics community, as well as to explore the applicability and timescale of optical services to APD missions).

*APD Response:* Dr. Fox has discussed SMD's strategy for space communications. TDRSS will continue to exist in some form for the foreseeable future. The ability to address upcoming or existing mission on-demand communication needs will be addressed on a mission by mission basis.

In addition, Drs. Clampin and Fox noted that letters from APAC expressing concern do carry significant weight, and that they were pushing as hard as possible to ensure that science requirements are heard.

*Recommendation:* The APAC is pleased to learn that APD is considering pursuing its own graduate fellowship program to either replace or augment FINESST. We recommend that APD explore the feasibility of a graduate fellowship opportunity that has flexibility to address the unique needs and priorities of the APD community.

*APD Response:* The APD FINESST working group has concluded its analysis in February and discussion is ongoing within APD as well as with SMD on a possible stand-alone pilot program to be rolled out no earlier than ROSES-25.

*Recommendation:* Although it's clear that a new large Gamma-ray mission is not possible in the current budgetary climate, the APAC nonetheless endorses several of the other recommendations from the GTN SAG report that represent low-risk, relatively low-cost, yet high-reward changes to current mission operations. For example, the report made a convincing case that TDAMM science would be better enabled by increasing the Swift downlink cadence. The APAC recommends APD conduct a trade study on the recommendations from this report that concern existing mission capabilities (starting at page 42). Further, we recommend that the division explore cross-divisional partnerships to sustain and amplify the impact of the Interplanetary Network. The APAC also recommends that future SAG reports include an executive summary to spell out the findings and recommendations for APAC consideration.

*APD Response:* APD is very interested in the findings of the GTN SAG on the value of sustaining and revamping the Interplanetary Network. Cross-divisional partnerships are of keen interest to SMD leadership and we will follow up with discussions regarding those partnerships. Operating missions past prime phase submit proposals for continued operations (including enhanced capabilities) as part of the Senior Review process and these proposals are evaluated for science return in the context of the whole NASA fleet and available funding. We appreciate the suggestion regarding the executive summary and will so instruct our SAGs in the future should their findings come to the APAC for consideration and advice.

Asked about the status of Swift, Dr. Clampin said the spacecraft was in safe mode until a software patch can be uploaded to fix the gyroscopes (in about 2 weeks). Dr. Holley-Bockelmann (Chair) asked if there was a way to explore a previously proposed idea for Swift to download additional data in real time to search for counterparts to LIGO gravitational wave triggers. Dr. Valerie Connaughton commented that APD felt the proper way to address the Swift idea was contained in a report, and the idea was not requested by the team. If the Swift team wishes to use this mode, they should put it in their Senior Review (SR) proposal, or put it into the PPBE process. Dr. Rebecca Oppenheimer noted that the SR process works very well, because they are the means of balancing the portfolio, and therefore should not be circumvented.

*Recommendation:* The APAC approves the terms of reference for the Future Innovations in Gamma-ray Science Study Analysis Group (FIGSAG) within PhysCOS.

*APD Response:* Dr. Clampin said the idea (behind FIGSAG) was to ensure that the APD reaches out for TDAMM science. Dr. Connaughton commented that any questions on FIGSAG would be answered in a briefing during this meeting.

*Recommendation:* The APAC would like the Roman team to consider mechanisms to increase community participation from researchers at less resourced institutions. It may be useful to consult the Rubin Observatory on its Discovery Alliance program for a potential framework. Dr. Clampin said he would retrieve the APD response to the recommendation.



*Recommendation:* The APAC recommends that APD consider the legal, financial, logistical and scientific ramifications of after-launch international partnerships.

*APD Response:* APD coordinates all international partnerships with the Office of International and Interagency Relations (OIIR), consistent with USG priorities for international cooperation. The terms, including the financial, logistical, and scientific responsibilities, are captured in legally binding Space Act Agreements. APAC's recommendation will be considered during the development of such documents.

*Recommendation:* The APAC was impressed by the plans to decrease the burden on PIs and Institutions by simplifying the ROSES solicitation and associated proposal requirements and considering requesting a simplified budget for R&A proposals. While APD is planning on a pilot program in ROSES25 for an investigation that is non-technology based, the APAC recommends APD develop a plan to test this out on a technology-based program such as APRA or SAT and, if feasible, implement a similar pilot also in ROSES25.

*APD Response:* For FY24, the Division will run a pilot program with a non-technology solicitation, the Astrophysics Data Analysis Program (ADAP) to require only a single page budget justification instead of a detailed budget. ROSES-2024 ADAP solicitation currently states: "No NSPIRES-based budget is required, nor any Total Budget file uploaded. Proposals must instead identify the planned duration and cost cap under which the proposal is submitted as either small, medium, or large." Based on this pilot program, the Division will assess the outcome, and if successful, it will extend this simplification to technology-based solicitations like APRA and SAT and to other solicitations within the Division portfolio.

A meeting participant asked how APD planned to fund legacy missions. Dr. Clampin said that the OIRR took it under consideration, and didn't seem to want to do anything differently.

#### Discussion

Dr. Alina Kiessling asked if the Pioneers program was staying on budget. Dr. Clampin said that so far it has been doing well, with occasional schedule issues. APD has moved the management of one mission into the Balloon program. Responding to a HWO technology maturation question as to how FY25's \$50M would be distributed, Dr. Clampin said that much will default to the project office, and that a ROSES call will allow industry to start proposing for some of the major work. Asked what would inform the request for the next budget year, Dr. Clampin said that APD would focus on obtaining the best science possible for the taxpayer dollar, as informed by the DS, and the right balance. APD will work with the guidance it receives, and flow it down into programs and projects.

#### Public Comment Period

Harry Tuppets, Chair of the Hubble Committee, thanked the APAC and NASA Headquarters for taking the budget situation seriously, and was happy to hear that NASA will not cancel Hubble; in addition to its scientific capabilities, cuts to research funding for Hubble would be especially acute for students and Early Career researchers, who have relied on this funding for decades.

Dave Pooley thanked all the Chandra Users Committee for all their work. The x-ray community relies on Chandra research funding. Flat budgets have effectively eaten away basic research funding for decades. The x-ray community in particular, not on an equal footing with others, is in an extremely precarious situation. New x-ray groups will not form, and students will not join a dying field. The field may not recover.

Margaret Meixner, former director of SOFIA, said that with the mission's demise, she was concerned about sustainability of the far-infrared community. How will NASA help this community? Dr. Clampin said that APD had just completed a far-IR THz balloon mission. SMEX and MIDEX, as well as proposals

for AP Probes, all include far-infrared science. He added that APD is doing what is possible to support these communities with the resources available.

Comment: Chandra is doing its most impactful science and its efficiency is well ahead of its mission requirements, Chandra has not increased its mission costs; it will be detrimental to the field to retire Chandra. Dr. Clampin noted that NASA recognizes that difficult decisions need to be made and pointed out that NASA is seeking input from all stakeholders and is not making these decisions arbitrarily.

Question: What is NASA doing to bring TDAMM along? Dr. Clampin said that there had been some debate about the DS recommendation, but noted that the DS did not endorse an \$800M TDAMM mission. APD is putting forth UVEX as one answer, and is looking at Roman's role in TDAMM. The ACROSS Team is also working on providing TDAMM-support services to the community.

Question: Chandra is still a key part of the APD fleet: is it the intent to retire it? Dr. Clampin reiterated previous remarks.

Comment on loss of HST capabilities; commenter urged the APAC to consider the potential loss of Hubble capabilities.

Question: What procedures are in place for planetary protection from alien threats? Dr. Clampin directed this question to the Planetary Protection office at NASA.

Question: Why was the decision about Hubble/Chandra done the way it was? Dr. Clampin reiterated that NASA does not have the time to wait for the outcome of a full Senior Review.

### Discussion

Dr. Kiessling commented that the potential GO cuts, 30% for Chandra, and up to 75% for Hubble, would have a huge impact on the most vulnerable members of the community, graduate students and post-docs, particularly. Dr. Daniella Calzetti noted a disconnect between what the community has heard and what GOs have actually experienced. Cuts seem to be actually worse, anecdotally, and more like 60-75% for Chandra. Dr. Tremblay said that given the state of the Continuing Resolution (CR), it may be that current GO cuts were based on a different profile. Dr. Calzetti said she was referring to current budgets; there is no clarity and a lot of speculation. Dr. Tuttle said the community seemed to feel an undercurrent, and that funding in general has been stiff for a while. Many depend on space telescope grants. If the telescopes are working, NASA should not shut them down. The sustainability of long-term science will be affected; there won't be people to do the science. It feels like a big status change with no warning and no process. Dr. Holley-Bockelmann expressed concern about the OPCR process, as it represented another big decision being made without much input from the community, for the record.

Dr. Pascucci said she had heard similar anecdotes about Chandra cuts, and was also concerned about the time and effort put into budget planning. A participant commented that the OPCR is only reviewing an operational change, and questioned the oversight for GO and R&A. Dr. Holley-Bockelmann said the community had been told that R&A and GO would not be cut, and requested clarification on how the APAC could help APD. Dr. Tuttle said she was surprised there is not a more formal process for dealing with the current crisis: CRs and crises have become part of the norm, so there should be a process to navigate through the changes. Missions have to plan for contingencies, and so should NASA.

Dr. Shardha Jogee said she was surprised by the change from what the APAC had been told in October. The Hubble and Chandra teams are being forced into a corner (they will have to cut GO to survey). Is it possible to recommend to SMD that when the committee reaches out to the team directly to tell them to prioritize GO/R&A? Dr. Holley-Bockelmann agreed with the sentiment, but noted that the TOR for the OPCR had already been written. Dr. Tremblay felt there was no APAC recommendation that will change

the massive change about to come. As a “child” of Hubble and Spitzer grants, Dr. Tremblay said he recognized the dilemma the directors will be faced with: either layoffs or GO support. He added that NASA can’t grow the budget.

A participant commented that the prioritization must come from the Program Office; everyone knows the science and GO programs are important, it’s a complicated problem with operations needs. Dr. Holley-Bockelmann suggested looking at how the missions will be reviewed, and all the possible outcomes, and responses to each of the outcomes. Dr. Oppenheimer thought it should be the duty of the institution to fund students if they are admitted to a program; it’s not up to NASA or NSF to fund graduate students. The institution makes a commitment to PhD students, and must treat them with equity and inclusivity. It is a slightly different story for post-docs. Dr. Chen noted that the data are worthless if no one is around to analyze them. Proper personnel support is part of the “contract.” How do we balance operations and scientific impact/leadership? Dr. Holley-Bockelmann suggested, as one solution, turning the instruments more into survey mode, and letting humans reduce the data as they come. This prioritizes keeping the telescopes alive. She felt however that the APAC was being asked to weigh in on things it can’t change. Dr. Tuttle said the ground-based community faces similar struggles, and also agreed with Dr. Oppenheimer’s sentiments on graduate students. She recommended consulting with the ground-based community, thinking about NASA’s stance toward the community, and what is next.

### ExoPAG/PhysPAG/COPAG Updates

#### ExoPAG

Dr. Pascucci briefly reviewed the Exoplanet Program Analysis Group (ExoPAG) TOR statement, as well as ongoing and recent activities. ExoPAG recently put together an Operating Procedures document [[https://exoplanets.nasa.gov/internal\\_resources/2975/ExoPAG-Operating\\_Procedures.pdf](https://exoplanets.nasa.gov/internal_resources/2975/ExoPAG-Operating_Procedures.pdf)], and has been holding monthly ExoPAG Executive Committee meetings, as well as cross-PAG activities. The most recent meeting (ExoPAG29) was held in New Orleans. ExoExplorers, a program designed to enable the professional development of graduate students and/or postdocs in exoplanet research, is now in its fourth year. There is also a new 2024 Exoguides cohort, now with an international component. ExoPAG has two active Science Interest Groups (SIGs): *Exoplanets Demographics* and *Exoplanets Solar System Synergies*; and two Study Analysis Groups (SAGs): *The Impact of Exo-Zodiacal Dust on Exoplanet Direct Imaging Surveys*, and *Exploring the Complementary Science Value of Starshade Observations*.

The Executive Committee received many suggestions at ExoPAG29 on how to make the PAGs more useful to the community, and is working on these suggestions. At the last business meeting, ExoPAG discussed beginning a SAG on Reflectance Spectroscopy for HWO. Specific objectives include comparing and cross-validating the tools the community possesses. In addition, the Committee discussed standing up a SAG on Technosignatures, to identify the most promising technosignature investigations, including blind retrieval exercises to tease out hidden signatures. ExoPAG 30 will be held in conjunction with AbSciCon in May, and has already confirmed speakers, including Dr. Lori Glaze of the Planetary Science Division (PSD). The ExoPAG requested that APAC consider the two new SAGs, and to review the briefing slides containing the respective TORs. Eddie Schwieterman provided some details on the blind retrieval/hidden technosignature concept.

#### PhysPAG

Dr. Athina Meli reviewed the science objectives underlying the Physics of the Cosmos Program Analysis Group (PhysPAG). Its Executive Committee has 15 members, and recently welcomed 4 new members. There are 7 standing SIGs, and 4 SAGs active at present. The Gamma-ray Transient Network Science Analysis Group (GTN-SAG) was recently completed. PhysPAG is very active, and was present at the January AAS meeting in New Orleans. Sessions were well-attended, and there were many young participants. PhysPAG was also represented at NSBP in Tennessee, and at SACNAS.

The Gravitational Wave Science Interest Group (GW-SIG) held a splinter session at AAS, and is currently discussing topics of common interest covered by TDAMM SIG (and potentially GR-SIG), and how to structure its talk at the 2024 April APS meeting.

The Time domain and Multi-Messenger Science Interest Group (TDAMM SIG) held its first in-person meeting at the Winter AAS meeting, and its first virtual meeting in March, where discussion led to identifying the key need for NASA to build the Decadal-recommended standing committee to provide TDAMM priority recommendations this decade. TDAMM SIG is working through next steps and plans for future meetings.

The Cosmic Structure Science Interest Group (CoS SIG) held a recent virtual meeting, which featured a talk by Dr. Leonidas Moustakas entitled “A Euclid Dark Energy Mission Overview”, and held an in-person meeting at AAS, with 3 speakers. The next virtual meeting is planned for March, which will include a talk by Dr. Maria Vincenzi about the DES 5-year results.

The Gamma-ray SIG (GR SIG) continues its regular webinar series. Recent discussions included considering Fermi as a gravitational wave detector, PhysPAG science gaps, FIG SAG updates. The SIG is planning a session planned at the HEAD meeting in April, and is planning talks on magnetar flares, and the neutrino-gamma-ray connection.

The Cosmic Ray SIG (CR SIG) has just recently started to meet. Immediate plans are to collect and expand membership, and to hold more virtual meetings. The most recent meeting of the Future Innovations in Gamma-rays (FIG SAG) focused on answering the question: What science has not or cannot be done with existing or funded space-based gamma-ray instrumentation? FIG SAG held its kickoff meeting at the January 2024 AAS.

The X-Ray SIG (XR SIG) held an online Town Hall meeting for the Precursor Science Gap discussion, and was also present at the AAS meeting.

PhysPAG is concerned about the current existential threat to X-ray astronomy, given budget cuts in the Chandra GO program, after 24 years of no increases in GO funds. The X-ray community has been struggling, and now it is in danger. Chandra GO is one of the main sources of support for X-ray astronomy in the US. The proposed FY25 and beyond cuts to Chandra will reduce funding to the X-ray community to a level that will make it nearly impossible to attract new members to the field. The community feels strongly that the Chandra GO program must be restored to previous levels.

Future activities for PhysPAG include a meeting retreat later this year, and continued expansion of IDEA activities.

### CoPAG

Dr. Shouleh Nikzad presented an update, highlighting the turnover in the Executive Committee and SIGs. A CoPAG Strategic Plan is being implemented. Dr. Nikzad acknowledged great support from Stephanie Clark, Peter Kurczynski, and Patricia Knezek.

The CoPAG SIGs mirror many DS science topics. The newest SIG is the Diffuse Gas in Cosmic Ecosystem, which has undergone some changes in membership. CoPAG is trying new ways to engage the community, and hopes to continue the format that was employed at the Winter AAS in New Orleans, which featured some splinter sessions with SIGs/Science and Technology Integration (STIGs). CoPAG is trying to make booths more engaging, offering more swag and more presence. At AAS, CoPAG sponsored two Hyperwall talks, and an Astronomy on Tap event. Dr. Nikzad provided some brief updates on UVSTIG, Mind the Gap Science Interest Group, Cosmic Ecosystem SIG, Stars SIG, Galaxies SIG,

and TDAMM SIG. The Cosmic Pathfinders Program, a student-focused program, kicked off in January at the AAS winter meeting, with a splinter session on how to “Hack Your Career.”

### TDAMM ACROSS Report

Dr. Jamie Kennea provided a background on the TDAMM ACROSS pilot. NASA is now living in a golden era of time-domain facilities: Pennsylvania State University is building a TDAMM- related cube sat, and the Roman Telescope will soon launch. NASA wants to enable the science to be used efficiently, which led to the establishment of the ACROSS pilot. The pilot’s goal is to enable better coordination of NASA’s assets to perform TDAMM observations. Parameters such as slew rates, orbits, formats, etc. are spread out in a very heterogeneous manner, thus one goal of the pilot is to provide easy access to NASA missions state and status information. At present, NASA’s Neil Gehrels Swift Observatory has a system called GUANO, for example (Gamma-ray Urgent Archiver for Novel Opportunities), that can locate transients in data that otherwise would have been ignored or lost, by receiving triggers from many other sources, and ACROSS seeks to build on examples across like this to build on this. The ACROSS core team members are from PhysCOS, Goddard, Marshall and Penn State.

### *ACROSS Pilot Technical Infrastructure Development Areas*

The pilot aims to identify the location of every asset, and what it is observing. The goal is to enable researchers to access this information on the Internet, to help plan workloads. The stakeholders are not just scientists, but also teams at the observatories, all of whom need to schedule coordinated observations. NASA wants to produce a TDAMM Toolkit, a collection of generalized, modular, open-source software products that can be instantiated to streamline, standardize, and automate TDAMM workflows. In addition, NASA plans to provide TDAMM Web Services to organize and deploy status data feeds and TDAMM Toolkit products into value-added TDAMM science planning and execution. Over the course of Study Year One, the establishment of a Slack Channel service has helped greatly with planning and coordination; NASA wants to broaden access to foreign partners and ground-based observatories, as well as to develop a GUANO-like capability for BurstCube, recording events from other missions and facilities, to enable users to request that the BurstCube team generate command loads to save certain data sets/streams.

### *Study Year 2: Coordinating with US Ground Assets*

ACROSS attended the NOIRLab-hosted Windows on the Universe: Establishing the Infrastructure for a Collaborative Multi-messenger Ecosystem workshop and white paper. The team is meeting with developers of widely used ground observatory software infrastructure tools to understand workflows, options for interfacing ACROSS data streams and web services, and is meeting with observers to survey user experience.

### *TDAMM Community Grant Program and Current Status*

The TDAMM Community Grant Program completed a Phase I study that identified opportunities for community grants in 3 areas:

1. Development of tools and observing modes that enable new TDAMM science cases.
2. Funding Director’s Discretionary Time (DDT) observations made by smaller missions (analogous to flagship DDT opportunities).
3. An overarching TDAMM science call for proposals designed to streamline or fill the gaps between existing joint observing calls, remove the risk of double jeopardy, and explicitly support observing programs which require coordination between two or more observatories. NSF’s recent Windows on the Universe Workshop and subsequent white paper validated the Phase I study findings.

In summary, ACROSS seeks to develop what will become a Center of Excellence for TDAMM Science, develop expertise, tools and a grant program, subject to funding availability, to maximize the TDAMM science return of NASA missions and beyond. The program has engaged with several operating missions

to develop relationships between them and ACROSS, and will continue to engage with missions currently in development, with Flagship and Probe-class missions, and will continue to work with the community to develop a diverse set of early adopters to evaluate tools, as well as to reach out beyond NASA to US-based and foreign observatories.

### Discussion

A participant commented on how event streams are handled by onboard software: detect a gamma ray burst (GRB), here is an alert, here is light curve, here is a spectrum. A CubeSat can't get 24 hours of data to the ground. The event buffer for BurstCube is 48 hours, providing a science-vetted list of prioritized events, which allows people to fetch the information and then create the command loads for it. Dr. Holley-Bockelmann said it was good to see so much progress and organization, adding that the "Center of Excellence" described in the briefing sounds like NSF. Dr. Kennea said a discussion had inspired him to use the term "Center of Excellence" and felt the language could be easily changed; the point of the nomenclature was to indicate that the center has expertise in the field. Dr. Holley-Bockelmann wondered if in this ecosystem of effort whether interagency calls across the whole ecosystem would be valuable. Dr. Kennea said his team was surprised at how fast NSF got the Windows on the Universe call out, and noted that there can be too many calls for scientists doing similar things. NASA sees ACROSS as part of the landscape, a value-add with a NASA focus. The focus now is on low-hanging fruit, i.e. the NASA missions that are very close to the pilot's aims, and to build the capability with them as NASA goes into the future.

Dr. Kiessling praised ACROSS for its phenomenal work. Dr. Kennea said that the APAC could help by providing some advice on how to target its grant program funding. The aim is to create something lasting for the community, and maximize science with a relatively modest budget. Dr. Holley-Bockelmann said that the ability to analyze archival data is really key, and maybe not quite so event-brokered. Are these SMEs? Can you get folks talking about units? Community-building is important, as is the adaptation of common terms. Dr. Kennea agreed, and said ACROSS was just talking to mission operations centers at present, and was aware of the potential for duplicating efforts. Dr. Holley-Bockelmann recommended pairing up junior and senior folks from different fields, for a year-long fellowship.

### Wrap-up

Dr. Holley-Bockelmann opened a general discussion, noting some conversation about GO funding. Dr. Gaskin felt that GO funding was extremely important to preserve, and that APAC should discuss how to optimize GO funding as best as possible across missions, particularly as she was concerned about lack of support for pre-career/Early Career researchers. Dr. Tuttle was concerned about people leaving the field entirely, and that grad students should not be the sole focus. Dr. Joguee noted that it is inevitable that the grad student/post-doc pool will shrink, if grants are reduced. What is the role of APAC in influencing the OPCR? If the teams operating the telescopes are asked to make priorities, there will be an unconscious bias toward reduced GO funding. Is there a way to get people onto the review committee? If not, where does the APAC input come? Review criteria? Dr. Holley-Bockelmann noted that there is no plan to ask for community input. Dr. Tremblay commented that one can't overstuff the front end of a very leaky pipeline. Dr. Oppenheimer said that the JWST GO program is very healthy, but that APAC needs a broader perspective. The number of PhDs has not changed over the last two decades, but the undergrad pool is growing very quickly. More scientists are needed in Congress. The programs are not growing, and NASA can't solve that problem. Dr. Daniela Calzetti suggested a recommendation that the OPCR consider the balance between GO funding and operations funding, as it is a zero sum game. One aim should be to maintain the ability for unique operations and the ability to analyze data. Dr. Erika Hamden emphasized Dr. Oppenheimer's comments about members of Congress; NASA has had advocates in Congress in the past, and has fewer today. Dr. Tremblay said that the AAS has a great policy shop, because it has to advocate for all the discipline Decadals. A participant commented that APAC has to be very careful about the conversation, as SGEs cannot advocate. Dr. Oppenheimer said that part of the

problem with Congressional allocations is that they are very specific. She thought APAC's job is to help NASA as best it can. It was noted that the bigger question is the budget that will not be passed for another year or so. The PBR is a recommendation that NASA must plan to, but Congress may not pass any of these laws until after the election.

#### March 21, 2024

Dr. Hasan re-opened the meeting, took roll and invited the Chair to begin. Dr. Holley-Bockelmann made opening remarks and reminded APAC that they are Special Government Employees (SGEs) and are barred from lobbying Congress.

#### LISA Update

Dr. Ira Thorpe presented an update on the ESA LISA mission, first reminding APAC of the Decadal statement that has been the guiding principle for NASA as it works with ESA. ESA began planning LISA in 2013. LISA was selected as a mission concept in 2017, at which time NASA stood up a Study Team. LISA passed its ESA Adoption milestone, which is equivalent to an Agency Confirmation, and has the same sort of program-level commitment that marks the end of the mission definition study phase. NASA technology assessments went into this Adoption process, including an independent cost review. A Definition Study Report, or Redbook, contains all the details. In January 2024, when LISA was adopted by ESA, the press coverage was widespread. There is much interest in this mission.

ESA is now rapidly accelerating the LISA mission. It has a large project team in place and has put immediate focus on establishing their industrial partner. ESA's pace is putting pressure on its partners, including the US and ESA member states involved in the ground segment. A memorandum of Understanding (MOU) for ESA and NASA is nearly complete. The agencies have reached agreement on the technical side. The ESA council will review it within a week's time, and then ESA and NASA will proceed to signature.

The Science Data Policy governing the LISA mission entails the first twelve months being an early-release science phase, during which time the data is restricted. At the end of first 12 months there will be a public data release, followed by further data releases every 6 months at minimum, minus some limited intellectual property embargoes associated with hardware vendors. Science Topical Panels will be selected in advance by the joint ESA-NASA LISA Science Team. At the Study Office level, NASA is supporting ESA as it writes its Invitation to Tender process, currently being finalized. Asked whether ESA or NASA carries out the systems engineering, Dr. Thorpe noted that the spacecraft is almost subsidiary to the instrument. ESA is doing all the environmental testing, and they now have more in-house expertise on its project team. NASA and ESA engineers will collaborate to ensure that they have consistent models and requirements for their respective contracts. ESA just finished the first half of phase B. NASA is pre-Phase A, but is technically much further advanced than this would imply.

As NASA moves to formalize LISA, formulation documents are now complete, an SRB Chair and Deputy Chair have been selected, a proposal for a Lifecycle Review Strategy has been drafted. NASA is proceeding with flight procurement, targeting a first milestone review in Q3. Funding needs are currently being met. ESA will be doing an open call for the LISA Science Team, as is NASA. Dr. Thorpe encouraged people to apply quickly. Globally, LISA encompasses a broad scope of activities, with multiple international partners. Dr. Thorpe briefly reviewed the mission concept, data reduction approaches and science investigations. NASA is planning a parallel approach for data analysis in coordination with ESA and its member states, and is looking at end-to-end analysis and interpretation. A multicenter Project Team has been established, as well as plans for an Analysis Pipeline facility, and a Science Center to support the US-based science community. The "global fit," or the deliverable identified in the MOU, will require an understanding of the instrument. There will have to be at least one global fit that is fulfilling the NASA deliverable.

Current work to prepare for LISA includes mock data challenges, etc. NASA has the world leaders in global fit technology. The Science Center is less developed, but its primary goals were identified in the SIDC report. Dr. Thorpe summarized that LISA, conceived from a conversation in 1974, just happens to fit around the sun, literally.

Dr. Holley-Bockelmann recused herself from the conversation, and welcomed others to pose questions.

Asked about the LISA cost cap at ESA, Dr. Thorpe was not aware of a specific cost cap within ESA, but he did know that the ESA IG conducted a cost review as part of the mission Adoption review process. Dr. Jogee asked about funding levels for US scientists, vs. ESA funding. Dr. Thorpe said there is a LISA Preparatory Study program at HQ, accessible through ROSES, but there are no similar programs at ESA yet.

### Roman Update

Dr. Jeff Kruk presented an update on the progress of the Nancy Roman Space Telescope mission, which is still on track for an October 2026 launch, including about 100 days of funded schedule margin. Essentially every part of the spacecraft is currently in the Goddard cleanroom. The bus is in great shape and on schedule, while the telescope is being prepared for transition to vacuum for the final optical test prior to the pre-vibration measurement. On the instrument side, both (Wide Field Instrument/WFI; Coronagraph Instrument/CI) are in their final thermal vacuum tests. There are three committees, (GBTDS, HLTDS, HLWAS), which are in the process of setting up a plan to evaluate white papers, as one aspect of community input to a Survey Design draft. A separate committee concluded after feedback that an early definition of an additional survey design would be beneficial, resulting in publication of a ranked list, beginning with a galactic plane survey as their top recommendation. The main white paper came up with a sample, month-long survey design. A new committee is being established to define this survey in detail with community input, using a process similar to that for the three core community surveys.

NASA is coordinating with and engaging the science community by planning beta testing of the Roman Science Platform in Summer 2024, holding a workshop on an Astronomer Proposal Tool on 2 April, continuing monthly virtual lecture series and Roman forums, and an annual Roman Science Conference (the next one will be at IPAC in July 2024). NASA is continuing to reach out to lower barriers for access to Roman science. Soon, the Agency would like to have a community-led science collaboration, to enable people to engage with Roman independently of NASA selection. The goal is to form a quasi-independent collaboration, and let it evolve and see how it grows over time. The road ahead for Roman includes a Systems Integration Review in September, followed by the Mission Operations Review in October of this year.

Asked about the current status of ground stations. Dr. Kruk said that the White Sands antenna, part of the Near Space Network (NSN) at NASA, is planning to upgrade its receiver, and ESA is building a new ground station in Australia (capable of 500Mb/sec, with a 4-hour daily downlink), JAXA is building a station with a similar downlink rate and contact duration. There is also a DSN ground station in Canberra to be used for commanding and ranging. Dr. Holley-Bockelmann said she had heard much concern about the state of space communications, and felt Roman would be the test case for flexing the system. Dr. Kruk said he thus far saw no concern for Roman. Some work had had to be done on Ka band capabilities, as part of upgrading the existing ground stations, but he understood that most of the system was in good shape. Asked if Roman was engaging with an LSST program that does data previews to provide training on experimental data, Dr. Kruk said the program has been discussed, and that the mission team is definitely aware that this will be a different way of interacting with data. The current plan is following up with a series of workshops and training formats that are yet to be determined, and perhaps sending people



out to do demonstrations. Dr. Holley-Bockelmann felt Roman could be used to get a more diverse community involved. Asked if he had any critical path concerns, Dr. Kruk said that while there is no single technical issue that must be overcome, accidents do happen, as demonstrated by a dolly accident that set the schedule back several months.

Ms. Sandra Cauffman weighed in on space communications concerns, noting that her office was working with SCaN on White Sands One, doing assessments, working with the Lunar Reconnaissance Orbiter (LRO) folks to figure out schedule conflicts with Roman, and the issues resulting from simultaneous operations. She felt everything was going in the right direction. Margins are healthy with Roman; the biggest threat is schedule, and NASA is watching the critical path (L3Harris delivery) closely. Dr. Clampin reiterated Ms. Cauffman's remarks, stating that Roman was healthy on both budget and schedule.

### Euclid Update

Dr. Mike Seiffert presented an update on the ESA Euclid mission in tandem with Ms. Doris Daou, acknowledging the contributions of more than 2000 individuals in the US and Europe. NASA is contributing to the mission in three major areas: hardware contribution to the near-IR instrument, support for the Euclid NASA Science Center at IPAC (ENSCI), and three Science teams selected through peer review: Euclid is the first space mission dedicated to the study of dark energy. Dr. Seiffert reviewed the spacecraft's two instruments, both with a common field of view. The visible element (VIS) is a 6x6 array of silicon CCDs. The Near Infrared Spectrometer Photometer (NISIP) provides 3-band imaging and slitless spectroscopy. Euclid launched in July 2023; early observations have shown that all systems are performing well.

A few concerns emerged and have been mitigated. Euclid straylight, indicated by initial measurements that showed excessive solar straylight in VIS in some orientations, was mitigated by altering the range of solar orientations. NISIP is unaffected. Issues with solar x-ray contamination, encountered when some of the more energetic solar flares contaminated some VIS exposures, were simply accepted as a hit to overall efficiency. The root cause of intermittent loss of fine guidance tracking was traced to FGS software. The solution to this problem was effected by extending the spacecraft commissioning phase, and testing out new algorithms and software on the ground. The system is now performing well.

Euclid early release observations (EROs) are science images designed to be media-friendly. Euclid's main Science Survey started on 14 February, and is well on its way to mapping over one third of the sky. In May, there will be a public release of ERO data, initial science and instrument publications, and a media briefing at ESAC. March 2025 will mark the "Quick Release 1" data release consisting of a total of approximately 50 square degrees. June 2026 will mark the Data Release 1, composed of approximately 2500 square degrees of Wide Survey data. The Euclid NASA Science Center at IPAC (ENSCI) supports the US research community, and is dedicated to tool development and maintaining a Web presence for the mission.

Dr. Daou covered the Euclid General Investigator Program (EGIP), which is engaging the community through ROSES24. The EGIP call will be released in the next few weeks. Investigators will be required to make software or other resources that support new analysis techniques, publicly available.

Dr. Hamden asked about Euclid's issue with x-ray flare contamination. Dr. Seiffert said that gaps between cells in the solar panel caused the phenomenon. In addition, to mitigate the effects of water vapor condensing as ice, ESA created a series of 3 procedures to heat the instrumentation to deal with it. Heating two mirrors in succession, at 160K for a few hours, appears to be a successful treatment; analysis however is incomplete. Dr. Seiffert summarized by remarking that this time next year would be a good time to hear about Euclid's pipeline status. Asked roughly what percentage loss is expected due to straylight, Dr. Seiffert indicated that number was about 10%.

## XRISM

Dr. Richard Kelley briefed the APAC on the X-ray Imaging and Spectroscopy Mission (XRISM), a major collaboration between NASA and JAXA, in partnership with ESA. XRISM's two instruments are Xtend, a 38' field-of-view (FOV) soft X-ray imager, and a single-photon calorimeter (SPC). XRISM was launched in 2023, as essentially a re-build of the lost Hitomi spacecraft. The SPC absorbs each x-ray as heat, thus the sensors must be extremely cold to detect them (50 milliKelvin). These conditions provide extraordinarily high-resolution spectroscopy. An on-orbit spectrum of an onboard calibration source showed 4.5 eV energy resolution across the array. First light was released in January 2024. The SPC has demonstrated the ability to detect Si, Ca, Ar, Fe, etc. X-ray galaxy clusters are the main targets of XRISM, where spectroscopy reveals the plasma conditions (temperature, elemental abundance) within the hot gas, which constitutes the material of the universe. Dr. Kelley displayed images of XRISM's Resolve spectrum of NGC 4151, a super massive black hole, as well as Cassiopeia A, a supernova remnant. XRISM allows velocity mapping of supernova remnants and is already detecting new transients in the Xtend FOV. The mission team recently posted its first Astronomer's Telegram.

XRISM does have some issues. Resolve's aperture door has not yet opened, despite multiple attempts. Tests (on the ground) indicate that a harness is in the way of the door. Asked who finally decides on the door status, Dr. Kelley said that NASA and JAXA must be in mutual concurrence for a solution. It appears that the engineering unit (EU) was not tested ahead of time. NASA is responsible for its hardware only. Dr. Gaskin noted the importance of lessons learned and asked if this information was shared with the LISA team, for instance. Dr. Kruk noted that NASA reports lessons to HQ; it is up to HQ to apply these elsewhere.

Dr. Tremblay remarked that there is clearly stunning science to be done (Fe absorption lines, e.g.), and asked that as the mission approaches end-of-life, if there was room to really shake loose the aperture door. Dr. Kruk said that Gate Valve Operation#4 (GVO4) is planned for maximum vibration. The cryocoolers must be turned off for a GVO, so there is a severe limit as to how long one wants to turn off a cryocooler during a vibration interval. This was attempted on ISS, resulting in a situation where a cryocooler could not be re-activated. Asked how much baseline science requirement could be achieved if the gate valve remained closed, XRISM Project Scientist Dr. Brian Williams noted that the requirements will be met by making longer observations. The gate valve has no impact at all on the function of the instrument. The two baseline requirements most affected are mostly achievable, but only for photon energies above 1.7 keV.

## GUSTO Update

Dr. Christopher Walker gave an update on the Galactic/Extragalactic ULDB Spectroscopic-Stratospheric Terahertz Observatory (GUSTO) balloon mission, which required a bit of tailoring with respect to NPR 7120.5. GUSTO, a pointed telescope with gyros and reaction wheels, launched from Antarctica's McMurdo Station in December 2023. GUSTO was designed to a 75-day baseline, 55-day threshold mission, suspended from a zero pressure balloon. GUSTO weighed about two tons, a moderately-sized payload, and featured a 300 kb/sec downlink, implemented through the Starlink system mostly (but it did have Iridium and TDRSS antennas), which worked very well. Dr. Walker noted that at the time, a typhoon had disabled a TDRSS ground station. GUSTO had five science objectives: Determine the constituents and the life cycle of interstellar gas in the Milky Way; witness the formation and destruction of star-forming clouds; understand the dynamics and gas flow into and within the Galactic Center; understand the interplay among star formation, stellar winds and radiation, and the structure of the interstellar medium in the Large Magellanic Cloud (LMC); and to construct Milky Way and LMC templates for comparison to distant galaxies. The telescope is pointed through both the MW and LMC, and takes far-IR surveys.

Due to the high risk of damage to the payload during the trek to Antarctica, NASA used a large NASA C-130 aircraft instead of overland travel. Typically it takes a month or two to put components together. This time the spacecraft was flown the whole way in to allow it to come in as integrated as possible, as the number of launch opportunities are few and far between on Antarctica. Working with HQ, Wallops and Explorers program to get the integrated payload to McMurdo was key. The mission went well, with the exception of the tendency of nitrogen gas getting into the cryostat. The issue was not too significant, and there was a thin layer of N ice on the laser, which was eliminated by turning off the cryocooler. GUSTO managed to finish out the CII (ionized carbon) and N<sub>2</sub> surveys during the 55 day mission. Data products are on track to meet or exceed threshold requirements, and the data reduction process is ongoing.

For the LMC survey, the telescope was pointed at 30 Doradus, one of the brightest star formation regions in the local group. SOFIA has looked at this region too. GUSTO used the smaller SOFIA map, and mapped over it, to better understand the interstellar medium (ISM). Thermal was an issue in the end, because the balloon was launched relatively late in the season. By day 52 or so, the mission started to encounter day/night cycles, with large temperature excursions. The payload came down on 27 February; NASA hopes to recover it. Dr. Gaskin asked if the Explorer program had helped the mission tailor the process adequately, and if the Explorer Program Officer had added value. Dr. Walker replied that yes, in the decision letter, Dr. Paul Hertz had encouraged him to tailor as much as possible within the cost and schedule parameters. He thought it was overall beneficial to go through Explorers but that reviews did slow down progress (losing time to preparing presentations). Dr. Walker felt he would push a future, similar mission more toward NPR 7120.8, but overall thought the structure of the Explorer program was helpful.

#### Open Software Discussion

Drs. Rebecca Larson and Natasha Batalha led the discussion.

#### Open Software

Dr. Batalha began by addressing Community Concerns on the Adoption of Open Science in Astrophysics, reporting she had gathered the concerns from the Astrophysics and Exoplanet communities, and emphasizing that she was talking about a collection of thoughts and anecdotes. The concerns boiled down to 4 major issues that she had heard repeatedly:

1. Concern that there are no realistic avenues to support maintenance/infrastructure of open source software, open database, libraries.
2. Concern that the development of OS requirements have not been met with the development of new incentives for adoption.
3. Concern that there are no standards regarding the definition and requirements of “an open reproducible paper.”
4. Concern with open data, elimination of exclusive access periods and being scooped

Dr. Batalha offered possible solutions to all four concerns, respectively:

1. Create opportunities like a “NASA GPU Hackathon” where over the course of 3 days open science experts are paired with mentees that want to improve their open science infrastructure. The hackathon should be geared toward novices in OS. NASA could also create an option to buy an “OS expert” for certain FTE levels. In this way, the community can rely on cost-shared support and have direct access to the right kind of expertise, which could allow for more rapid progress in a one-year time frame. NASA also has to acknowledge that most codes will not have long term maintenance, and should educate the astrophysics community.
2. Add avenue for students/postdocs to articulate their commitment and contributions to OS in the NASA Postdoctoral Program & Hubble Fellowship Program (creating a model for other

postdoctoral programs); add an avenue for proposers to articulate their commitment and contributions to OS in ROSES; professional development societies (e.g. AAS, DPS) should create career awards for contributions to OS. For a top-down cultural shift we need to continue pushing the community to take training via TOPS OpenCore, especially senior leaders (initial trainees are skewed to Early Career Researchers). This will help with teaching folks how to credit contributions, when to share to ensure credit can be received, etc.

3. Through TOPS/ScienceCore or other avenues, coordinate the development of reproducibility standards that are community specific by expertise or observational or computational. These efforts should be coordinated with major publishers so that reproducibility standards can be enforced via peer review and data editors, and could also offer tiers of compliance. Creating clear hierarchies would allow non-experts and students the ability to evaluate reproducibility of papers and provide additional incentive structure for OS adoption.
4. Consider an avenue that allows for fully open data with no EAP, but still leaves “first to publishing” rights with the original proposing team within a certain period (e.g., one year). In addition, leverage OpenCore or other training materials to educate and create trust in communities, although this does not address the concern that some communities are too large to “self-police.”

Dr. Larson, based on first-hand experience with Open Data/Open Science with JWST, cited what she saw as a lack of incentive to spend time developing support for Open Science (OS). First and foremost, the community seems to feel there is a lack of a real infrastructure to support this big endeavor. The community will need to toughen up to prepare for LSST and Roman, and learn from each other so that an infrastructure can be implemented. She said that one important aspect of OS is its potential to increase access to lower income institutions, and smaller teams. Some large JWST data requires supercomputers for runs, in a data set where one color image is a 15-gigabyte PNG. The data set is public, but some people cannot deal with the size of the data sets, as they don't have the computational support. Also much funding has to go to computer time, which takes away human time for doing science and publishing papers. This means other teams can beat less-resourced community members to the science, meaning NASA needs to incentivize the back-end effort. These conversations are healthy, and NASA is in a good place to solve some of these problems. Dr. Larson said she had spoken with Dr. Clampin in an effort to diminish the negative impacts, and that a larger effort is definitely necessary going forward; everyone is going to encounter these Open Science issues. Dr. Batalha agreed that OS is the wave of the future, and the question is how to go forward in a helpful way. Other communities have solved this through building trust. Another model is to have data open but restricted for publication, which could diminish fear of scooping.

Dr. Tuttle said she could imagine instituting some sort of project priority, wherein one effectively earns status as an architecture builder, and allowing the opportunity to be acknowledged in papers. Dr. Larson said there is architect status on some papers for JWST, and architects are given authorship on some papers. This is a cultural shift. The current incentive remains being first. Citing data in the ADS is one way to architect status. Dr. Holley-Bockelmann felt the issue was much more complicated than architect status. Does one assign it to metadata or the data itself? Dr. Larson suggested citing the DOI and using it to be an author on a competing paper. While this is great in theory, DOIs need to be created early on. Dr. Joglee suggested approaching the community through AAS/NASA; people who develop the software can become authors by default, based on their contributions. Dr. Tremblay said he was excited about the idea of elevating an accepted observing proposal to a container-class object that points to all the data. Dr. Larson said she was familiar with this; those citations exist in papers, which can be turned on or off and tied to other papers. Depending on the journal, the journals need to enforce requirements for software citations. Dr. Batalha said there is still the novelty issue and the rush to publish, which are not assuaged by these citations. A researcher can cite the work and still scoop the data. Perhaps it will be necessary to establish some licensing that gives a team the rights to first-publish. Dr. Kiessling asked how long PIs

typically take to publish, and how often does the first data go out to someone who is not on the PI team. Open data helps underserved researchers; this is a larger conversation that considers the potential benefits given to the under-resourced community. The idea of citing proposals, however, still a fantastic idea. Most of Dr. Batalha's solutions are great, but they require money.

#### Public Comment Period

Question: Does NASA have its own plan to combat its own impact on climate change? Dr. Clampin said that there are some NASA websites that address this, and took an action to an answer to enter into the record.

Question: What is the path for funding Archival and Theory for HST? Dr. Clampin said he was not ready to make a statement, but that archiving would continue.

Question: Regarding HST/Chandra cuts, HST has been protected by earmarks, historically, while Chandra has not. What is the strategy to deal with this? Dr. Clampin said that NASA has no control over earmarks, and pointed out only that they make it difficult to make decisions about reductions.

Question on sustainability: Will NASA ask its centers and collaborators to establish a GHG inventory? Dr. Clampin said that recent NASA buildings have been built to LEED standards, and sustainability is certainly something the centers are looking at.

#### Discussion

Dr. Hamden, addressing the lack of exclusive access for data, commented that if one is writing the proposal for observatory time, if it doesn't come with money, the proposer is not incentivized. People who are already well resourced can just wait for the data. Dr. Oppenheimer felt it was a matter of intellectual property (IP) rights. Dr. Larson noted that these big program proposals do come with money, and felt there was an incentive, especially with JWST (which just had 3000 proposals for Cycle 3); that funding can help people do the science, but the larger grants also go to computing power and data products; the funding is often not enough to do both the data reduction and science papers. The instruments are more complicated than expected, and require patches for the software pipeline at times. In many cases, some don't feel comfortable claiming proposals as IP, with so many competing teams proposing virtually the same things. Dr. Oppenheimer said she agreed with the large program argument; and was referring more to radical ideas that lead to magical results. By federal law, a writer owns the property to everything s/he writes. It's still IP. In addition, the large programs are rarely run by junior people.

Dr. Clampin noted that the proprietary time on JWST is still one year; this has not changed. JWST still has a fully funded research program, and the PBR has fully funded JWST science in the outyears, as it has also done for Roman. There is also associated R&A funding in the outyears. Astrophysics has always been forward-leaning, with DAPR, Open Science, etc. Dr. Clampin said he was willing to start the ball rolling, such as adopting the ADS citation idea. He added that APD is very aware of the effect of Big Data, so the division is thinking very seriously about dealing with Cloud, and access to archives, and appropriate Cloud-computing facilities. Dr. Larson noted that the number of high-redshift worlds have exploded to tens of thousands, and there is no way to accommodate them right now. There needs to be an easier way to search coordinates and identities of galaxies; the catalogs are currently all over the place. It would be great to have an AI algorithm scour the database. Dr. Clampin reminded APAC that NASA will continue to direct the move to Open Science, a federally mandated direction, and asked Steve Crawford to comment.

Dr. Steven Crawford, responsible for science policy for SMD (with a background in astronomy) said the Open Science policy calls for no exclusive access, but does provide a 6-month period to carry out calibration and validation. The policy also allows variance, but it should be recognized that each division has different needs. The first variance permitted was to the APD. Variances are expected to be rare, but they can be called for any reason. The "no exclusive access" policy at NASA dates back to at least

2010/2012. The 2018 Open Data Act says that all federal government data should be open by default. Dr. Mark Mozena noted that both Congressional law and Executive Orders are equally valid, and NASA must follow them. Asked how NSF has handled the policy, Dr. Clampin said he had not discussed this with them. Dr. Holley-Bockelmann reiterated Dr. Batalha's suggestion to use supplemental funding to hire a consultant to develop software and tools. Dr. Oppenheimer said that this issue had come up on the Gemini board, and is certainly being discussed outside the space-based community. Dr. Larson felt it was important to learn how to implement the data. With regard to open software and the JWST pipeline, community members have been cooperating in developing code to help each other through some data processing issues. NASA could help this process along by creating a platform/forum/database for community code that has been developed in this way. A pipeline can't do everything. There needs to be some hive-mind energy, which would also go a long way in the personal, human aspect of the culture. Dr. Pascucci supported the idea of hiring a pool of experts, supported by NASA. Dr. Holley-Bockelmann felt NASA already possessed the needed expertise in the Data Science Institute. Dr. Larson noted that few astrophysicists have formal computer science training, and having an expert to consult would be ideal. She believes the Flatiron Institute has some resources in this area. Gordon Stacey commented that a one-year proprietary period, especially for small groups that generate unique, new instruments for future missions, would be helpful. These groups need that year to publish, to enable the group to keep going, and to enable students and post-docs to go forward into astrophysics. Immediate access is unfair to the students and post-docs.

### Discussion

A participant relayed a question from Bill Jones: given that we know we have advanced warning on solar flares, is Euclid taking advantage of this, rather than just pointing away from the sun? The question was sent to Mike Sieffert. In addition, was there an ESA press release saying the icing problem was solved? Drs. Gaskin and Joguee asked if there was any possibility of the community weighing in on the OPCR? Dr. Kiessling noted that the OPCR doesn't appear to be looking at the GO and R&A programs, and suggested putting out a question to the community as to how funding cuts will impact them. The community is also concerned about how GO and R&A will be folded into the budget going forward. Dr. Holley-Bockelmann called for more transparency. Dr. Eric Smith clarified that the projects were given the draft of the OPCR call, but unlike a Senior Review, the OPCR acknowledges the budget situation. Options are to retain capability and reduce funding for data analysis, or change operations and retain funding for scientists to do analysis and write papers. NASA wanted to give the projects the chance to explore the space, because they would know best how to deal with it. The review panel will then review the options that the projects come up with. Dr. Smith reiterated that NASA is planning to a proposed budget, which may not end up being an actual appropriated budget. Asked if NASA intends to act as if the FY25 budget plan is in place, Dr. Clampin said that if planning is from month to month, NASA will have to follow the (Operating Plan) that is put in place. Dr. Smith noted there is no easy algorithm for planning in the current atmosphere. The OPCR will give the missions the last Senior Review reports, and will also give them letters. Dr. Oppenheimer noted that Chandra is actually due for an SR in 2025, and that at some point, one must admit that things can't go on forever.

Dr. Joguee asked if the APAC community could pass a letter to SMD. Dr. Smith said that yes, he would share such letters, but APAC must keep in mind that the OPCR is being charged with producing options. Dr. Hasan added that all these recommendations must derive from a public meeting. Dr. Oppenheimer said that the OPCR panel does contain community members, and assumed they would have input.

Dr. Gaskin, commenting re: Explorers, said she'd had a follow-on conversation with Dr. Michael New, who is open to the idea of the Explorer proposal process, so the community should provide some ideas of what the first step in the right direction might be. Dr. Holley-Bockelmann said she could include in the APAC letter a suggestion that APD look at how to revamp Explorers. Dr. Joguee suggested APAC recommend ways for NASA to formally pass on lessons learned to international partners, referencing

XRISM's gate valve problem. Dr. Clampin said he understands the APAC's concerns, and noted that lessons learned from JWST are contained in one or two papers that will soon be published in peer-reviewed papers. He added that APD has learned from JAXA in carrying forward partnership models, but that the area between ground- and space-based missions is a little more complicated. Dr. Kiessling said there have been instances, or case studies, of things that would not have happened in a NASA-only mission. A case in point involved bad luck with JAXA missions in particular. Dr. Clampin thought there was an evolving thought on this problem, leading to better clarity about interfaces, for example, but he noted that NASA is working closely with LISA using a more structured systems engineering approach. Dr. Clampin was open to including in MOUs a request for joint systems engineering approaches, and he noted that recent agreements have covered these things in general.

Dr. Oppenheimer noted that HWO is being allocated \$10M, and is being ramped up in the PBR. Dr. Clampin said that while the Decadal was very clear about HWO ramp-up, the actual increase may be slower than the Decadal intended. The DS was clear about HWO: identify and mature the technologies well before formulation, so that NASA is now initially focusing on technology development, thus for now, APD will continue its investments through SAT and ISFM. APD has also started a discussion with the DS co-chairs to plan for the mid-decade review, and is continuing to follow the guidance. Asked if the community should start thinking about Probe science, Dr. Clampin said those communities are already having these discussions.

Dr. Mozena thanked Drs. Clampin and Fox for their support, and noted that as APD approaches the mid-decadal period, there is an opportunity to re-set expectations. Optimism is free, and it is incumbent upon the community to manage expectations. The community really listens to every word that NASA says, and these pronouncements filter down to all sorts of places, institutions, hiring plans. Policymakers love NASA science. Dr. Mozena cautioned the AP community against making decisions that are unrecoverable.

Dr. Holley-Bockelmann queried APAC on the content of an ACROSS findings or recommendation. Dr. Gaskin thought APAC could help ACROSS reach the community through AOs and other follow-up activities. Dr. Kiessling felt ACROSS could better coordinate with both the ground-based and space-based communities, while ACROSS continues developing infrastructure, after which time APAC should ask for an update in a year. Dr. Holley-Bockelmann worried that some efforts will get larger, and that the communities should coordinate as early as possible, and perhaps have access to the Windows on the Universe report. Dr. Clampin noted that there is plenty of work going on to make sure NASA is integrating with LSST. NASA is also working closely with NSF on this subject, and will continue these meetings. NASA will also attend a twice-yearly round table with international partners.

Dr. Mozena, noting that NASA budgets are siloed by missions, asked how much money APD spends on Artificial Intelligence/Machine Learning (AI/ML), and whether APAC should recommend more transparency on this so the public can see how much taxpayer money is being spent. Dr. Clampin said he supported showing cross-cutting funding lines, and that he knew many AP scientists using AI/ML. NASA should encourage innovation in this area.

Dr. Kiessling moved to recommend that the Technosignature SAG's TOR include start and finish dates. Dr. Holley-Bockelmann suggested that the Technosignature SAG consult with the Biological and Physical Sciences (BPS) division, and that APAC should approve both the Reflectance Spectroscopy for HWO and Technosignature SAG TORs. Dr. Kiessling reiterated thoughts on open data, and felt it would be useful to hold a data-driven study on the impact of an Open Data, to measure the positive or negative impact, with metrics such as time to publication, and impact on underserved institutions. Dr. Clampin suggested consulting with Kevin Murphy, and also NIH.

Dr. Holley-Bockelmann recommended standing up a task force that looks at Open Data recommendations, and how to enable open software to more equitably enable science. Dr. Oppenheimer felt that NASA too strictly interprets the OSTP memo on Open Science. Dr. Holley-Bockelmann thought a clearer path existed for software than for Open Data. Dr. Mozena commented that SPD-41a (Open Science) is policy at NASA, determined internally by NASA, across all divisions. Dr. Oppenheimer asked if APAC could recommend that the policy be reviewed. Dr. Hasan noted that much community input had been received on a number of iterations of SPD-41a. Pat Knezek pointed out that NASA had been working on the policy well before the OSTP memo, and reiterated that NASA had received much community input on Open Science. There is room for interpretation in implementation, however, as it has been left to the community to define what scientifically useful data is. There is also the waiver process. While APAC can't review the policy, it might be useful for the APAC to clarify the best way Astrophysics science data can be implemented under the policy. In addition, any change would have to be implemented through Kevin Murphy's office. Dr. Oppenheimer suggested NASA get some hard data on both sides, now that two years of policy has elapsed. Dr. Pascucci supported a suggestion deriving from Dr. Batalha's briefing, that there be a committee on implementing some of her briefing's solutions. The APAC concurred on putting forward this latter recommendation.

Dr. Larson commented, with respect to Open Science, that she would rather make the pipeline ready than to extend proprietary periods. Dr. Clampin said he had been discussing pipeline issues with Jane Rigby, and also with ground systems on Webb, on what additional checks and balances will be needed for Roman. Dr. Holley-Bockelmann said she was nervous about getting data down to the ground. Dr. Clampin said he would definitely welcome a letter from the APAC on space communications issue, as it is critical to everything APD does. Dr. Tremblay thought the LISA mission will be a large complicated international partnership, and asked if there was anything special APD could do to ensure more control. Dr. Clampin explained that NASA treats LISA as if it is a NASA mission; it will be managed in the Explorers office, while APD has discussions about its visibility. APD also feels that having an integrated, detailed model of the system will be key to success. Asked how much engagement NASA has had with commercial on space communications solutions, Dr. Clampin said that NASA is working with SCan in considering the use of low-Earth orbit companies as a service. While APD is not investing in optical communications, it is having discussions with SCan's Jeff Hayes on this issue. Commercial entities are already using optical communications (op comm). Dr. Gaskin noted that commercial op comm is not so evolved for science purposes. While there is a lot of interest, infrastructure still needs to be developed, and more demonstrations need to be flown on science missions. Ground-based receivers for op comm also need to be set up, a nontrivial undertaking. Dr. Clampin added that op comm also comes with additional risk.

Dr. Gaskin observed that carrying out GUSTO in the Explorers program was a big deal, and it became an expensive program that took a long time. It would be interesting to see the outcome and to hear if there was value added from both the Explorers and Balloon Program Offices. Was it a compromise? Does a GUSTO-type mission fit into Pioneers? Where does the GUSTO of the future fit? Tailoring is extremely challenging, and free flyer vs. suborbital missions are very different. Dr. Clampin noted that LISA will be managed as any other (potentially) Class C mission in Explorers, but that LISA also has a different set of challenges. APD will try to set up a NASA organization that can effectively integrate with their systems engineering. NASA and ESA have worked together quite closely for many years. Dr. Clampin agreed that treating GUSTO as an Explorer MoO didn't work well, and was very constraining.

Dr. Clampin said he had heard APAC's messages clearly. With regard to the Open Science issue, he felt there were things APD could do. There are better ways to capture work in ADS, for instance. He noted that much of this Open Science pushback is peculiar to Astrophysics, and said he could bring these concerns to the Open Science Group at SMD. Any Explorer process review must be a cross-SMD review, and Dr. Clampin said he was satisfied that Michael New is having the conversation, and that APD would



like to see any changes benefit the entire science community. He agreed there should be a data-driven study on Open Science, to provide some hard evidence, and reiterated that APD takes APAC comments very seriously. If it can find ways to mitigate the situation, it will.

Dr. Holley-Bockelmann and Dr. Hasan thanked all the meeting participants and public commenters. Dr. Holley-Bockelmann adjourned the meeting at 4:40p.

## **Appendix A** **Attendees**

### APAC Members

Kelly Holley-Bockelmann, **Chair**, Vanderbilt University  
Daniela Calzetti, University of Massachusetts, Amherst  
Regina Caputo, Goddard Space Flight Center  
Hsiao-Wen Chen, University of Chicago  
Jessica Gaskin, Marshall Space Flight Center  
Erika Hamden, University of Arizona  
Shirley Ho, Flatiron Institute  
Shardha Jogee, University of Texas, Austin  
Alina Kiessling, Jet Propulsion Laboratory  
Mark Mozena, Planet Labs Inc.  
Rebecca Oppenheimer, American Museum of Natural History  
Ilaria Pascucci, University of Arizona  
Grant Tremblay, Harvard-Smithsonian Center for Astrophysics  
Sarah Tuttle, University of Washington  
Hashima Hasan, Executive Secretary, NASA HQ

### Webex and HQ Attendees

Abdu Zoghbi	David Thilker	Jason Derleth
Aaron Tohuvavohu	Debra Wallace	Jason Martel
Adam Goldstein	Doris Daou	Jeff Filippini
Alessanda Aloisi	Drew Miles	Jeff Foust
Alise Fisher	Eddie Schwieterman	Jeff Booth
Aloke Pal	Elijah Owuor	Jennifer Wiseman
Angel Otero	Elizabeth Landau	Jianyang Fu
Amruta Jaodand	Emily Braswell	Joan Zimmermann
Amy Reis	Emma Marcucci	John Wisniewski
Andy Ptak	Eric Burns	Joshua Diaz
Arielle Moullet	Eric Miller	Julie Crooke
Athina Meli	Eric Smith	Julie McEnery
Barbara Grofic	Erik Wilkinson	Julie Stoltz
Bindu Rani	Fiona Harrison	Justin Finke
Brandon Lawton	Francesca Civano	Karlheinz Trattner
Brian Humensky	Gene Mikulka	Kartik Sheth
Brian Williams	George Helou	Keivan Stassun
Catherine Barclay	Gordon Stacey	Katherine Chavis
Chien-Ting Chen	Grace Telford	Kim Arcand
C. Michelle Hui	Grace Hu	Komera Galbraith
Chris Roberts	Greg Lee	Kirill Vorobyer
Christopher Walker	Harry Teplitz	Louis Paganini
Claude Canizares	Harvey Tananbaum	M Diaz
Dave Content	Heather Smith	Miguel Angel Vargas Cruz
Dave Leisawitz	Ingrid Farrell	Margaret Meixner
Dave Pooley	James Florance	Mario R. Perez
David Morris	James Lochner	Mark Bautz
David Huenemoerder	Jamie Kennea	Mark Elowitz
David Shoemaker	Janet Letchworth	Mark McConnell

Mark Padula  
 Marufa Bhuiyan  
 Mary Dobay  
 Matthew Zajac  
 Megan Ansdell  
 Megan Watzke  
 Melania Nynka  
 Michael Nowak  
 Michelle Hui  
 Mike Stevens  
 Miles Skow  
 Moritz Günther  
 Naseem Rangwall  
 Natasha Batalha  
 Nicolas Flagley  
 Neill Reid  
 Nicholas White  
 Nino Cucchiara  
 Paul Scowen  
 Patricia Knezek  
 Patrick Crouse  
 Pete Roming  
 Peter Edmonds  
 Peter Kurczynski  
 Peter Maksym

Pete Roming  
 Peyton Blackstock  
 Phil Kaaret  
 Quyen Hart  
 Rachel Rivera  
 Rachele Cocks  
 Raffaele D'Abrusco  
 Rhiannon Roberts  
 Richard Rogers  
 Rita Sambruna  
 Rob Petre  
 Ron Kocevski  
 Rosa Avalos-Warren  
 Sabrina Stierwalt  
 Samuel Wyatt  
 Sandra Cauffman  
 Sanaz Vahidinia  
 Santosh Yadav  
 Sasha Rahlin  
 Scott Wolk  
 Shirley Ho  
 Shouleh Nikzad  
 Steph LaMassa  
 Stephanie Clark  
 Steve Crawford

Steve Kendrick  
 Steve Thompson  
 Suvi Gezari  
 Swara Ravindranath  
 Tahani Amer  
 Terence Doiron  
 Teresa Jensen  
 Thomas Connor  
 Thomas Hams  
 Wilton Sanders  
 Zoe Wai  
 Nino Cucchiara  
 Amruta Jaodand  
 Bill Jones  
 Bill Reach  
 Carol Christian  
 Cathy Barclay  
 David Huenemoerder  
 Mark Matsumura

<b>Appendix B</b>		
<b><u>Agenda</u></b>		
<b>Astrophysics Advisory Committee</b>		
<b>March 20,21 2024</b>		
<b>Virtual (WebEx info below)</b>		
<b>Time Zone: Eastern</b>		
<b>Wednesday 20 March</b>		
10:00 a.m.	Introduction and Announcements	Hashima Hasan/Kelly Holley-Bockelmann
10:05 a.m.	SMD Associate Administrator Comments	Nicola Fox
10:30 a.m.	Astrophysics Division Update	Mark Clampin

12:30 p.m.	Public Comment Period	
12:45 p.m.	Lunch	
1:45 p.m.	Discussion	APAC members
2:15 p.m.	ExoPAG/PhysPAG/COPAG Updates	Ilaria Pascucci/Athina Meli/Shouleh Nikzad
3:00 p.m.	Break	
3:15 p.m.	TDAMM ACROSS Report	Jamie Kennea
3:45 p.m.	TDAMM ACROSS Discussion	APAC members
5:00 p.m.	Wrap up for Day 1	Kelly Holley-Bockelmann
<b>Thursday 21 March</b>		
9:00 a.m.	Opening Remarks	Hashima Hasan/Kelly Holley-Bockelmann
9:05 a.m.	LISA Update	Ira Thorpe
9:30 a.m.	Roman Update	Jeff Kruk
10:00 a.m.	Euclid Update	Mike Seiffert
10:20 a.m.	Break	
10:40 a.m.	XRISM Update	Richard Kelly
11:00 a.m.	GUSTO Update	Chris Walker
11:30 a.m.	Open Software Discussion	Rebecca Larson/Natasha Batalha/Kelle Cruz
12:00 p.m.	Lunch - UVEX Explorer	Fiona Harrison
1:00 p.m.	Discussion of Open Software	APAC members
1:30 p.m.	Public Comment Period	
1:40 p.m.	Discussion of APAC topics from the community	APAC members
2:10 p.m.	Break	
2:30 p.m.	Discussion	APAC members
3:30 p.m.	Formulate Recommendations	APAC members
4:00 p.m.	Debrief Division Director	APAC members
5:00 p.m.	Adjourn	

***Instructions for WebEx access on March 20, 2024***

<https://nasaenterprise.webex.com/nasaenterprise/j.php?MTID=mc1f44fac9dc4ce77af2322c57b0f99d7>

Meeting number is: 2763 710 0487

Meeting password is: Apac032024#

To join by telephone the numbers are: 1-929-251-9612 or 1-415-527-5035. (Access Code: 2763 710 0487)

***Instructions for WebEx access on March 21, 2024***

<https://nasaenterprise.webex.com/nasaenterprise/j.php?MTID=m6a50aa286a1ef9beacb18c8092f540be>

Meeting number is: 2763 710 0487

Meeting password is: Apac032124#

To join by telephone the numbers are: 1-929-251-9612 or 1-415-527-5035 (Access code: Access code 2823 194 9794)

NASA Astrophysics Advisory Committee's website:

<https://science.nasa.gov/researchers/nac/science-advisory-committees/apac>

The public may submit and upvote comments/questions ahead of the meeting through the website

<https://nasa.cnf.io/sessions/dxmy#!/dashboard> which will be opened for input on March 10, 2024

## **Appendix C** **APAC Membership**

Kelly Holley-Bockelmann, **Chair**  
Vanderbilt University

Daniela Calzetti  
University of Massachusetts, Amherst

Regina Caputo  
NASA Goddard Space Flight Center

Hsiao-Wen Chen  
University of Chicago

Jessica Gaskin  
NASA Marshall Space Flight Center

Erika Hamden  
University of Arizona

Shirley Ho  
Flatiron Institute

Shardha Jogee  
University of Texas, Austin

Alina Kiessling  
Jet Propulsion Laboratory

Mark Mozena  
Planet Labs Inc.

Rebecca Oppenheimer  
American Museum of Natural History

Ilaria Pascucci  
University of Arizona

Grant Tremblay  
Harvard-Smithsonian Center for Astrophysics

Sarah Tuttle  
University of Washington

Hashima Hasan  
**Executive Secretary**, NASA HQ

## **Appendix D** **Presentations**

1. Astrophysics Division Update; *Mark Clampin*
2. Community Concerns on the Adoption of Open Science; *Natasha Batalha; Rebecca Larson*
3. COPAG Update; *Shouleh Nikzad*
4. Euclid Update; *Mike Seiffert; Doris Daou*
5. ExoPAG Update; *Ilaria Pascucci*
6. GUSTO Update; *Christopher Walker*
7. Laser Interferometer Space Antenna (LISA); *Ira Thorpe*
8. PhysPAG Update; *Athina Meli*
9. Roman Update; *Jeff Kruk*
10. TDAMM Update; *Jamie Kennea*
11. UVEX Update; *Fiona Harrison*
12. XRISM Update; *Richard Kelley; Brian Williams*