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Dr. Mark Clampin
Astrophysics Director
Science Missions Directorate
National Aeronautics and Space Administration (NASA)

Dear Mark,

The NASA Astrophysics Advisory Committee (APAC) had its Fall meeting on 2022 Oct 17 and 18th. The entire two-day meeting was conducted in a hybrid mode, with many APAC members being present with Senior Division management at NASA HQ, aided using WebEx™ video conferencing technology accompanied by a digital portal and a chat-window to assist in exchanging APAC, invited speakers, and community comments. The following members of the APAC attended the meeting: Kelly Holley-Bockelmann (APAC Vice Chair), Jessica Gaskin, Hashima Hasan (APAC Executive Secretary), Erika Hamden, Ryan Hickox, Shirley Ho, Alina Kiessling, Grant Tremblay, Ilaria Pascucci, Rita Sambruna, and Chick Woodward (APAC Chair).

Each day, Dr. Hasan began the meeting by welcoming all the APAC members and explaining the committee's purpose. Dr. Hasan reminded the APAC members who had conflicts of interest with specific topics on the agenda that they were allowed to listen to the presentation but could not participate in the committee's discussion as they are conflicted. Dr. Hasan then read aloud the Federal Advisory Committee Act (FACA) rules. Dr. Woodward then welcomed the members to the meeting, outlined the agenda, and reiterated some of the FACA and conflict of interest rules.

The APAC thanks all the presenters for their time and efforts to provide crisp and informative presentations. In addition to the agenda, the presentations for the meeting are posted at https://science.nasa.gov/researchers/nac/science-advisory-committees/apac

The APAC has the following specific findings and recommendations in response to the presentations and subsequent discussions. Additional detailed contextual narratives are found in the 2022 October APAC meeting notes which is a transcription of the recorded proceedings.

2022 GOVERNMENT PERFORMANCE AND RESULTS MODERNIZATION ACT (GPRAMA) -- ASTROPHYSICS DIVISION

The APAC expended a considerable fraction of its efforts discussing representative science highlights that demonstrated the Astrophysics Division's (APD) continued progress towards division science goals, including Strategic Objective 1.1: Understand the Sun, Earth, Solar System, and Universe, and advance the state of knowledge during fiscal year (FY) 2022. In addition, colleagues Dr. Tyler Robinson (Planetary Science Division Advisory Committee [PSD]) and Dr. Kristen Simunac (Heliophysics Science Advisory Committee [HSD]) joined the committee's deliberations for assessment of a set of interdisciplinary performance goals for the NASA Science Mission Directorate (SMD) science program that seeks to "advance discovery in emerging fields by identifying and exploiting interdisciplinary opportunities between traditional science disciplines SMD has traditionally operated." The APAC thanks our colleagues in HSD and PSD for providing their insight. After discussions, the APAC members were polled on their assessment by individual vote and a progress color code was assigned. The complete 2022 GPRAMA document, as edited by the APAC, was provided to APD and Dr. Jennifer Kearns.

Findings

The APAC judged that progress towards meeting Multiyear Performance Goal 1.2.2: *NASA shall demonstrate progress in exploring and probing the origin, evolution, and destiny of the galaxies, stars, and planets that make up the Universe,* was GREEN (10 affirmative individual votes).

The APAC judged that progress towards meeting Multiyear Performance Goal 1.2.4: *NASA shall demonstrate progress in discovering and studying planets around other stars, was* GREEN (10 affirmative individual votes).

Recommendations

The APAC recommends that the illustrative science highlights contributed as examples of APD's contribution to PSD goal 1.2.5 (Multiyear Performance Goal: 1.2.5: *NASA shall demonstrate progress in improving understanding of the origin and evolution of life on Earth to guide the search for life elsewhere, exploring and finding locations where life could have existed or could exist today, and exploring whether planets around other stars could harbor life)* be considered for incorporation in the PSD 2022 GPRAMA document.

ASTROPHYSICS DIVISION (APD) UPDATE

Dr. Mark Clampin gave a summary of the state of the APD covering the initial few-month period of their new duty assignment as division Director.

The APD Director remarked to the committee that the FY2025 budget will be the first full opportunity for them to substantively be involved in prioritization of Division portfolio activities. The APAC reflected that this juncture was already mid-decade and discussed that the initiation and timing of the next Decadal Survey process may require strategic scrutiny.

The APAC was apprised that APD continues to meet internal performance metrics of delivering selection decisions within an approximately 150-day window to investigators. The APAC recognizes the effort of APD personnel in achieving this goal and commends their commitment. Recent outcomes from the latest aggregate announcement of opportunities indicate that the selection rates are improving for research and analysis proposals, while the overall proposal pressure for the Astrophysics Research and Analysis (APRA) Program and the Astrophysics Data Analysis Program (ADAP) seemed to have modestly declined.

The APD Director discussed with the committee the current commitment constraints the division maintains to support US involvement with the European-led Athena mission. The APAC was apprised that APD does not intend to move additional NASA resources to the mission beyond those currently committed, but the reconfiguration may require NASA to review its contributions. The APAC awaits the outcomes of the Athena mission science review and anticipates their recommendations will guide the committee's future advice to the Division, in concert with reflections from the US Athena community.

The APAC and the APD Director also had a lengthy conversation about the progress to resolving issues associated with the Webb memorization process and controversy. The APAC expressed dissatisfaction with the "slow-walk" to date.

Findings

Failure to produce a formal, publicly released document regarding the Webb memorialization decision and associated findings from an investigation of Webb-related materials at the Truman Library related to community concerns is both exasperating and a source of dismay for the community. This finding is supported by the number of upvotes received during the 2022 October meeting of the APAC for the related community-posed question for a progress report.

Despite continual assurances from APD management and its Directorate leadership, working in consultation with the NASA historian and their team, for a crisp and timely exercise, resolution of the Webb memorization controversy remains elusive.

The APAC fully endorses the APD decision to provide a full year of funding in FY2023 to support early-career scientists associated with the NASA SOFIA mission, as well as resources to ensure that all pipeline-processed data products (including those of the GREAT instrument,

slated for the end of 2024) are successfully delivered to the NASA/IPAC Infrared Science Archive (IRSA) as close-out activities bring the project to completion.

The APAC commends APD for continuing to plan and implement a balanced approach to the Astronomy and Astrophysics 2020 Decadal Survey recommendations, particularly the Time Domain and Multi-Messenger Astrophysics (TDAMM) and State of the Profession set of activities. Continued and timely progress is urged.

Development of a formal written APD memorialization policy and process associated with naming Flagship and Great Observatory missions is welcomed.

The NASA Postdoctoral Program (NPP) is a high-value program within the Science Mission Directorate (SMD) portfolio, contributing to NASA workforce development and innovation to the NASA science and technology portfolio. The NPP should continue to be resourced adequately to fully achieve its mission.

APD's continued intent to pursue and fulfill the ambitions articulated in SMD's 5th pillar of excellence is laudatory.

Recommendations

The APAC requests a full briefing regarding the Webb investigation and record of decision at its next meeting.

The APAC requests a presentation on the new, pending (currently in the process of Agency approval) mission naming and memorialization policy and guidelines-of-practice and its implementation in APD at its next meeting.

The APAC recommends APD initiate coordinated inter-agency activities, including the possibility of a community stand-up of a TDAMM-related Science Interest Group (SIG) / Science Advisory Group (SAG), that also is international in scope to identify actionable and timely paths to effect TDAMM science as outlined in the Astronomy and Astrophysics 2020 Decadal Survey.

The APAC suggests APD consider if there are workable industry-agency-center partnerships enabling workforce development and retention opportunities within the scope of the NPP fellow program.

The APAC acknowledges the Galactic/Extragalactic ULDB Spectroscopic Terahertz Observatory (GUSTO) Project successfully met their thermal-vacuum (TVAC) test milestone and advises APD to consider the science return on investment if there are further issues as GUSTO marches towards their launch in 2023.

The APAC requests at its next meeting a thorough discussion by APD leadership of a Great Observatories Mission and Technology Maturation Program (GOMAP) implementation roadmap

commensurate with the prioritization of this activity over the next decade dictated within the 2020 Decadal Survey recommendations.

The APAC recommends APD continually assess the balance in technology funding opportunities in the Strategic Astrophysics Technology (SAT) and APRA to assure that a range of opportunities are available to diverse scientific communities developing mission concepts.

The APAC recommends APD promptly develop a mission and vision statement for the NASA Hubble Fellowship Program (NHFP) that align with the SMD six core values as recommended by the 2022 Fellowship Review Committee.

The APAC recommends continued implementation of the NHFP Review's recommendations, particularly the evaluation criteria of candidates based on inclusive leadership requirements.

The APAC requests APD initiate a review of whether the community research and analysis funding profiles and formulae used in pointed mission models is applicable to survey missions to maximize the scientific return.

The APAC supports the APD decision to de-link tight complimentary requirements of future Probe call architectures to Athena.

The APAC advises APD to understand what new opportunities may be available to future astrophysics payloads upon retirement of access to the International Space Station (ISS), including commercial Low-Earth Orbit (LEO) or Gateway, among others.

The APAC recommends APD assess the long-term impacts on the Balloon Program flight opportunities and payload architectures as the domestic helium supply availability becomes more acute.

The APAC requests a complete briefing at its next meeting of the overall mission feasibility assessment of NASA's Athena and Large Interferometer Space Antenna (LISA) posture based on development commitments within the European Space Agency (ESA).

The APAC requests a brief on the Ultraviolet Transient Astronomy Satellite (ULTRASAT) mission (funded by the Israel Space Agency) mission science objectives and the management structure of the data products and analysis tools curated at NASA hosted archives facilitating community access.

PAG UPDATES

Dr. Ilaria Pascucci presented the ExoPAG report. They highlighted the ExoPAG's growing connections with planetary scientists and NASA's Planetary Science Division (PSD), as exoplanet science is cross-disciplinary in reach. The expansion of the ExoExploers Program to include international participants in the third cohort also was discussed. Dr. Pascucci summarized ExoPAG's planned activities for the American Astronomical Society's (AAS) 2023

winter meeting, where concerted efforts were being made to establish guidelines of practice for the ExoPAG's sponsored activities that seeks to create conversations in an environment free of acronyms, sessions with more background in presentations, and focused topical orientation and emphasis to be more inclusive and inviting to community at all stages of the careers and scientific interests. The APAC was intrigued by these activities, including the speaker coaching techniques, and reflected that these strategies might be useful to other PAGs.

Dr. Grant Tremblay presented the PhysPAG report, updating the APAC on recent PAG activities including planning sessions for the upcoming SACNAS, NSBP, and AAS 241 meetings. Dr. Tremblay also reminded the APAC of the terms of reference and plans for the cross-PAG New Great Observatories and AWESOM Science Analysis Groups (SAGs), as well as the PhysPAG-sponsored Gamma-ray Transient Network SAG. All three of these SAGs have now been approved by APD. The PAGs will be meeting shortly to finalize the forthcoming calls for membership. Dr. Tremblay also discussed still-notional PAG-wide planning for a potential TDAMM SIG or SAG, as well as the *potential* for cross-PAG SIGs associated with each of the three GOMAP entrants (IR/O/UV, X-ray, and FIR Great Observatories). Dr. Tremblay summarized recent cross-PAG discussions of how the community might maximally interface with the GOMAP Process, not only by SIGs and SAGs but also via formal structures that NASA might soon be establishing. Dr. Tremblay remarked that, although the PAGs (and community at large) have great energy and enthusiasm for all three notional entrants to the GOMAP, it was important that NASA soon establish formal GOMAP teams, sponsored and directed by NASA, *in addition* to PAG-led community efforts like mission-specific SIGs. Dr. Tremblay and the APAC also discussed the ways in which SAG and SIG membership can be more broadly valued.

Dr. Rachael Beaton presented the COPAG report. The APAC was updated on the membership of the COPAG, as 4 members finish their terms, and 3 new members join the PAG. The COPAG reported the creation of a new SIG focused on Active Galactic Nuclei (AGN). All four SIGS (IR, UV, AGN, stars) have been active, hosting webinar, seminar series, and planning AAS special sessions. The APAC had requested a technical workforce study from the COPAG which was presented at this meeting. A takeaway from the report was that hiring challenges for technical staff were becoming a risk for large science programs. The contrast between salary, timescales, and demand between academia and industry were highlighted. In addition, while there are many reasons for technical staff to leave an academic environment, one of the most important was salary differentials. There are limited salary benefits to receiving a PhD (vs. a bachelor's in physics, from statistics gathered by the American Institute of Physics [AIP]), which are only realized for industry jobs. In addition, the increase in postdoctoral fellowship salaries has failed to match the increased cost of living, resulting in lowered real buying power over time. These salaries are an inclusion issue since they are a critical step in the pipeline to faculty appointments but may not be high enough to provide financial stability for someone without access to other resources.

Findings

The PAGs are fostering community input by creating cross-PAG initiatives like SAGs and SIGs, including the recently approved cross-PAG New Great Observatories SAG, the AWESOM SAG

on broadening participation in NASA Astrophysics, and the Gamma-ray Transient Network SAG. These, alongside in-development structures such as a TDAMM SIG/SAG and potential SIGs for the IR/O/UV, X-ray, and FIR New Great Observatories, can create lasting community interfaces between APD and the community as we collectively work to enact the Astronomy and Astrophysics 2020 Decadal Survey's priorities, including building a more inclusive future as these ambitious space missions develop.

Recommendations

The APAC advises that the PAGs elicit feedback from their respective communities of practice on the impacts of minimal exclusive use periods associated with APD mission data, especially on early-career scientists.

The APAC advises that APD not only support cross-PAG SAGs and SIGs as community interfaces to the GOMAP process, but to explore the efficacy of establishing formal GOMAP structures operated by the Division for all three Great Observatories simultaneously.

The APAC advises APD to consider formal stewardship of early GOMAP Integration/Strategy teams for the X-ray and FIR concept missions envisaged withing the Astronomy and Astrophysics 2020 Decadal Survey that can interface with community-led initiatives such as SAGs and SIGs.

The APAC encourages all three PAGs to develop terms of reference for a cross-PAG TDAMM SAG or SIG.

LISA UPDATE

Dr. Ira Thorpe graciously provided the APAC with an overview of the LISA mission and science and discussed the implementation of a data center. A study, chaired by Feryal Ozel, of the LISA ground segment - Science Data Implementation Center - was made to discuss NASA's potential role in terms of architecture, concept of operations, requirements, and interface definition, to develop NASA approach (budget and schedule) to contributions, and to define possible alternative approaches. Recommendations to NASA included investing "...early in the development of global fit algorithms as a necessary step in developing an independent NASA global fit pipeline…"; "provide as soon as possible opportunities and funding to groups and individuals within the scientific community to become engaged…"; and that "…NASA should also encourage coordination with the National Science Foundation [NSF] for mutual support for gravity wave [GW] science and proposals."

Findings

APD has an ongoing preparatory LISA science program within Research Opportunities in Space and Earth Sciences (ROSES), has begun discussions with ESA and the LISA consortium on data policy and publication rights, and is working with the NASA LISA Study Team to grow the LISA community.

Several open questions remain regarding the NASA interface with the European LISA ground segment, the development of data products, as well as the approach to science investigations.

LISA mission adoption is anticipated to be in November 2023, and the coming year is an opportunity to solidify NASA's role in the mission beyond hardware contributions.

Recommendations

The APAC recommends that APD adopt a US stance on data access, data release policy, and publication rights that support the Astronomy and Astrophysics 2020 Decadal Survey recommendations to ensure the LISA achieves the full scientific scope of its capabilities as a flagship mission as envisioned by the Astronomy and Astrophysics 2010 Decadal Survey.

The APAC fully endorses the conclusions in the LISA Science Ground Segment study for NASA to invest in a substantial US role in LISA data analysis, interpretation, and science. The report is consistent with the Astronomy and Astrophysics 2020 Decadal Survey recommendation that NASA should establish funding for a LISA science ground segment at an aggressive level to ensure that US scientists can fully participate in LISA analysis, interpretation, and theory.

The APAC requests frequent updates on the roles NASA is taking in the LISA mission, particularly in terms of the APD response to the recommendations from the LISA Science Ground Segment study.

The APAC recommends that NASA should continue calls for the LISA Preparatory Science Program with a yearly cadence to maximize the US participation in LISA science and to explore synergies with TDAMM.

JAMES WEBB SPACE TELESCOPE UPDATE

Dr. Eric Smith summarized the current operational and scientific status of Webb. The on-station performance of the Observatory has exceeded many mission requirements, including photometric sensitivity, tracking and guiding, and optical performance. Further, Dr. Smith informed the APAC that mission life-time estimates have been markedly extended from the original nominal expectations based on launch performance. The risk associated with micrometeoroid strikes was discussed at length. Current risk mitigation strategies, based on impact rate modeling and other sources, are in place to alleviate potential impact events on critical surfaces during high flux rate events such as know meteor showers, that shift the

observatory point. Although such events are rare, the APAC was apprised that the mission is looking to enable the broadest flexibility in scheduling rather than impose additional constraints.

The APAC also was informed of the challenges to the MIRI MRS operations (a report of a friction issue with the MRS grating wheel affecting one of MIRI's four observing modes) which have been in safe-hold since 2022 August. The recommendations from the Webb Accident Review Board (ARB) have not been released, although Dr. Smith conveyed assurances that all contingencies were being examined to mitigate scientific and operational impacts. The APAC noted that the release of the Cycle 2 call for proposals is imminent, and therefore a prudent resolution to this instrumental issue is of necessity to guide the community's scientific utilization of Webb.

The rapid publication of initial science results highlighted by Dr. Smith suggests that Webb is demonstrating its potential to transform our understandings of the cosmos.

Findings

JWST is now delivering an impressive array of new science results and stunning imagery that is captivating the science community, the public, and other stakeholders.

Recommendations

The APAC advises the Webb Project to provide timely and well-publicized community updates and alerts on the performance status of the Observatory and mission.

The APAC advises APD to understand whether the demands on the telecom infrastructure and the data downlink bandwidth environment and access is sufficiently robust for Webb alongside simultaneous operations of pending missions such as Euclid and Roman, and those envisioned in the GOMAP vision, in concert with the broader portfolio of mission operations conducted by NASA.

ROMAN UPDATE

The APAC appreciates the overview and status presentation on Roman by Dr. Jamie Dunn and Dr. Julie McEnery. The peak in the procurement delivery schedule of most all supply-chain items on the assembly critical path has passed. The few remaining machining and manufacturing of subsystem is on schedule for close out and progress at the L3 Harris remains commensurate with the schedule replan. The Roman project is in the process of releasing test detector data as well as mock galaxy catalogs and has begun a monthly Roman Community Forum to provide input on progress and opportunities within the Roman project.

Findings

Development of Roman flight hardware is proceeding well, and the redesign of the Relative Calibration System is providing valuable schedule margin as well as improved capabilities.

The Roman Community Forum and Roman Science Interest Group provide mechanisms for the community to be informed and engaged with regards to the development of the Roman mission. However, the current gap in Roman funding going to the science community may have a significant impact in community involvement in pipeline development and calibration.

Recommendations

The APAC requests regular updates on the cost and schedule of the Roman Observatory.

The APAC requests an update at the next meeting regarding the Roman project's response to the Committee on Astronomy and Astrophysics (CAA) recommendations about approaches to designing the Roman survey program.

The APAC requests additional conversations with Roman regarding the stand-up of infrastructure teams, especially those with focus on pipeline and user-tool software architectures.

Sincerely,

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