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TO: Wes Huntress, Chair, NASA Advisory Council Science Committee
RE: Report from the Astrophysics Subcommittee (APS)
FROM: Alan Boss, Chair, APS

This letter report summarizes the APS meeting held on July 13-14, 2011 at NASA HQ in Washington, D.C. All of the members of the APS participated in the meeting, either in person or through Webex and telephones.

The Subcommittee is grateful for presentations from Adam Greenstone, Jon Morse, Jay Gallagher, Linda Sparke, James Green (with Paul Schechter), Rick Howard, Nicholas White, Robin Stebbins, Tod Strohmayer, Gerry Skinner, David Schiminovich, Rob Petre, and the chance for a long discussion with Ed Weiler and Rick Howard. We are also thankful for the ongoing NASA staff support, in particular the work by Rita Sambruna, Marian Norris, and Jennifer Kearns, as well as by Ana Wilson of Zantech.

Division Update: Following the Ethics Briefing by Adam Greenstone, Jon Morse presented the status of the Astrophysics Division (APD), beginning with several examples of the exciting science results being returned by operating APD missions. Morse noted the ongoing plans of the European Space Agency (ESA) to select two M-class missions in October 2011, and to down-select L-class mission concepts in February 2012. APD is trying to keep open the option of NASA participation in some of these ESA-led missions, and will task the Committee on Astronomy and Astrophysics (CAA) to begin to review NASA's options in Spring 2012. The CAA is in the process of being re-constituted, and will function effectively as the Decadal Survey Implementation Advisory Committee (DSIAC) called for in the Astro2010 Decadal Survey. An Explorer-class mission competition is currently underway. **The APS concurs with APD's efforts in meeting Astro2010's call for a sustained Explorer Program, as well as keeping open the option of possible future joint missions with international partners, and the plan to consult with the CAA about the future mission portfolio for APD.**

Morse also described the APD plans to release a NASA Research Announcement (NRA) in Fall 2011 calling for mission concept studies for possible US-led medium-class X-ray and gravitational wave missions that are distinct from ESA's Athena and NGO missions (described below). These studies would occur in early 2012, in order to provide input to the CAA review in Spring 2012. **The APS requests that the NASA Advisory Council**

(NAC) Science Committee (SC) reconsider at its upcoming August 2-3 meeting the timing of this proposed Fall 2011 NRA release, as opposed to a release after the announcement of ESA's L-class mission selection(s) in February 2012.

R&A Senior Review Results: Jay Gallagher presented the final report of the Senior Review (SR) of APD's Research & Analysis (R&A) Programs. **The APS thanks Jay Gallagher and his team for assembling a very thorough report on APD R&A in near-record time, and for making a number of sensible suggestions for improving the R&A program,** in line with the recommendations made in the Astro2010 Decadal Survey. Linda Sparke then presented the status of APD's R&A Programs, noting that APD was planning on adopting the recommendations made by the R&A SR in the next year's budget. **The APS concurs with this plan to make the recommended R&A Program changes.**

The APS also recommends the continued use by APD of external reviews to maintain and facilitate a balanced, productive, and innovative R&A program. Two methods for achieving these goals were discussed: 1) establishment of a standing group similar to NASA's Management Operations Working Groups (MOWGs), and 2) continued Senior Reviews, to be conducted every few years. The APS saw merits in both of these methods and did not advocate a particular review strategy.

WFIRST SDT Initial Report: James Green, assisted by Paul Schechter, presented the Science Definition Team's (SDT) Initial Design Reference Mission (IDRM) for the WFIRST Mission. The IDRM plan calls for a 1.3-m telescope with an off-axis secondary and a five-year prime mission that comes close to meeting the multiple goals (dark energy, exoplanet microlensing, and infrared survey science) outlined for WFIRST in Astro2010. The SDT also stated that planning for WFIRST should proceed, regardless of the upcoming ESA decision regarding Euclid, which shares several science goals with WFIRST. **The APS thanks the WFIRST SDT for producing a highly detailed, well-developed IDRM in a relatively short period of time.**

The SDT has been successful in defining quantitative science requirements for the exoplanet microlensing and near-infrared imaging surveys recommended for WFIRST by the Astro2010 Decadal Survey, and their IDRM attains significant performance gains over previous mission concepts in these metrics. This is excellent progress toward an important mission. The APS notes, however, that the IDRM facility would require over 7 years to achieve the science goals recommended by Astro2010's Electromagnetic Observations from Space (EOS) panel for WFIRST's primary (5-year) mission. The APS also notes with concern the SDT's calculation (page D-4) that, under their dark energy metric, the nominal IDRM matches the performance of an aggressive ground-based program (or ESA's Euclid) only under the assumption that high-precision supernova cosmology is possible without obtaining high-quality spectra. **The APS encourages the SDT to continue the trade studies discussed in the report, and further recommends that changes in the field of view and/or nominal mission duration be added to the list of future SDT studies.**

JWST Update: Rick Howard presented the status of the James Webb Space Telescope (JWST) re-plan effort directed toward solving JWST's severe cost and schedule overrun problems. The re-plan effort is on schedule to deliver a new plan in time for the start of FY13 negotiations with Congress around 1 September 2011. **The APS thanks Rick Howard for his vigorous efforts in accomplishing this timely re-plan.**

The re-plan calls for a launch of JWST in October 2018, but meeting even this launch date will require a higher annual spending level than the notional \$375M in the President's FY12 budget. JWST will have cost \$3.5B by the end of FY11, and considerably more will be required to launch in 2018. Without spending more than \$375M per year, JWST would not be able to launch until some time in the 2020s. It is unclear at present what the sources might be of this desired increased funding for JWST, but APD can be expected to share this burden.

There is no question that JWST will be a giant leap forward in our quest to understand the Universe and our origins. JWST will examine every phase of cosmic history, from the first luminous glows after the Big Bang to the formation of galaxies, stars, and planets, to the evolution of our own Solar System. JWST will have an enormous educational and cultural impact in the US, and around the world, equal to that of the Hubble Space Telescope. NASA is striving hard to find solutions to the current crisis and to define a viable path forward for JWST. The APS commends the JWST project for meeting all of its cost and schedule milestones in FY11. **At the same time, it is of grave concern to the APS that cost and schedule problems generated in the past continue to threaten the mission. The APS is equally concerned about the overall health and funding of NASA's Astrophysics Division.**

The APS requests a lengthy briefing on the JWST re-plan status at its next face-to-face meeting in Fall 2011. The future of JWST, the top-ranked mission in the 2001 Decadal Survey, is an important agenda item for the APS to consider. **The APS also requests that Rick Howard provide the APS at that time, or before, with the following:** 1) documentation about recent (within the past three years) studies of de-scope/re-scope options for JWST, 2) documentation about studies of alternative means of achieving the scientific goals of JWST, 3) the history of JWST project status reports (green/yellow/red) for the last three years, and 4) estimates of what percentage by cost (not mass) of JWST's parts have already been fabricated or are in the process of being fabricated.

The APS regrets the recent action by the House of Representatives Appropriations Committee to eliminate funding for JWST from the FY12 budget mark-up. Such an action, if sustained by the Senate, would effectively mean the end of flagship-class missions by APD, not only JWST, but future APD flagships as well, as the action would remove \$375M from the SMD budget that would be expected to be used to build future flagships. While such budgetary matters are strictly beyond the purview of NASA, the severity of this proposed budget action requires the APS to oppose this action, which is disproportionately harsh compared to the House's otherwise worthy goal of setting a cost discipline example for NASA.

Athena/NGO Update: Nicholas White and Robin Stebbins discussed the current status of ESA efforts to develop mission concepts for future L-class missions for detecting X-rays (Athena) and gravitational waves (NGO), respectively. These missions show great promise for meeting several of the scientific objectives envisioned for previous mission concepts in the same areas, namely IXO and LISA, respectively.

Operating Missions Accomplishments: Tod Strohmayer, Gerry Skinner, David Schiminovich, and Rob Petre presented the current status of four operating missions, RXTE, Integral, GALEX, and Suzaku, respectively. NASA is in the process of ceasing its funding for all four of these missions, as a result of the 2010 Senior Review of operating missions, coupled with an acute shortage of funds Division-wide. All four missions continue to produce excellent science, and as a result the speakers made eloquent pleas for varying levels of continued NASA support. **The APS, however, cannot override the rankings established by the 2010 Senior Review**, as painful as they may be in a fiscally constrained environment, as only the Senior Review had a global picture of the status and value of all of APD's operating missions.

Program Analysis Groups (PAGs): Jim Kasting, Steve Ritz, and Chris Martin reported on the status of the ExoPAG, PhysPAG, and COPAG groups, representing respectively the Exoplanet Exploration, Physics of the Cosmos, and Cosmic Origins themes of APD.

The APS considered the ExoPAG's request to form a new Science Analysis Group, or SAG, to consider the question of how much technology funding is needed and how it should be allocated to pursue the New Worlds Technology Development Program advocated by the Astro2010 decadal survey. The APS agrees that it is appropriate for the ExoPAG to consider technical aspects of this question, such as whether better ground-based testing facilities and/or precursor space missions are needed. However, **the APS did not approve the request to create a SAG to address the programmatic question of how technology development money should be spent.** That function is already handled by ongoing roadmap activities within APD. That said, the ExoPAG can and should play a role in developing a future roadmap leading to a plan to verify (by ground-based, suborbital, or orbital tests) the performance of a major exoplanet mission. Planning activities of this nature are both permitted and encouraged.

The PhysPAG noted that after decades of investment, the X-ray and gravitational wave communities in the US have a strong interest in finding a minor, but significant, hardware role in the emerging European-led missions in these two areas, as well as a continued and deep involvement in the science to be pursued. The opportunity costs and priorities for such a possible NASA role should be understood in a timely manner, given ESA's progress in defining future L-class missions. Regardless of the outcome of the ESA selection process, the X-ray and gravitational wave communities see as vital the continued support of technology to enable possible future NASA-led missions in these science areas, as highlighted in the Astro2010 Decadal Survey.

The APS approves the COPAG request to expand its Executive Committee (EC) by three new members. However, the APS also urges the COPAG to expand its EC

membership in ways that reflect a broader community representation, and suggests that a request for further EC members be presented at the next APS meeting. **The APS concurs with the COPAG request to revise the tasks of the existing three SAGs and to add a fourth SAG, tasked with setting science objectives for the PAG.**

Government Performance and Results Act (GPRA) Reports: The APS reviewed the many fine examples of success in meeting the three Performance Goals outlined for APD in the 2010 NASA Strategic Plan, and **unanimously voted a “Green” Science Rating for all three goals**, i.e., that the expectations for the research program were fully met in the context of the resources invested. The draft GPRA report was discussed, and assignments made for APS members to draft or polish text about a number of major discoveries made in the last year by NASA APD missions.

APD FY2012 Budget: **The APS supports the intention of SMD to task the relevant NAC Subcommittees with evaluating possible Division-level budget options this fall, once the FY12 budget (or a Continuing Resolution) results in an SMD appropriation.** Given the harsh fiscal constraints on the federal budget, it is only prudent to expect that the FY12 SMD budget appropriation will fail to meet any optimistic expectations, and that APD in turn will be forced to make hard choices between many otherwise valuable APD activities.

Best wishes,



Alan Boss, Chair, APS