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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 October 19-20, 2011 at NASA HQ in Washington, D.C. With two exceptions, all of the members of the APS participated in this meeting, either in person or through Webex and telephones.

The Subcommittee is grateful for presentations from Jens Feeley, Geoff Yoder, Rick Howard, Eric Smith, Linda Sparke, Jaya Bajpayee, Neil Gehrels, Michael Devirian, Mansoor Ahmed, Jim Kasting, Steve Ritz, Chris Martin, Richard Kelley, Fiona Harrison, Claudia Meyer, and Jason Kalirai. We appreciated the opportunity to speak briefly with Chuck Gay, and to learn about the challenges he is facing as Acting Associate Administrator (AA) for the Science Mission Directorate (SMD). **We wish that we could have had the chance to thank Ed Weiler, the outgoing AA for SMD, for his three decades of dedicated service to NASA.** We are thankful for the ongoing NASA staff support, in particular the work by Rita Sambruna and Marian Norris.

Division Update: Geoff Yoder, Acting Division Director (DD), discussed the status of the efforts to find the new AA for SMD and the new DD for the Astrophysics Division (APD). Both searches are underway and the results should be announced in the next month or so. Yoder pointed out that he is continuing to move forward with APD's agenda, as the current rapidly evolving situation with regard to overall NASA funding and future APD mission planning does not allow stalling APD's planning efforts. **The APS fully supports Yoder's efforts to continue to maintain APD's forward momentum in these troublesome times.**

The most important element of Yoder's presentation was the question of possible NASA involvement in the European Space Agency's (ESA) Euclid mission, recently chosen by ESA as its second M-class mission (M2) and scheduled for launch in 2018. Yoder will be having meetings with ESA's Fabio Favata and others in Paris the week of October 24, with the intention of learning more about a possible NASA collaboration on Euclid. ESA is willing to consider a 20% share by NASA in Euclid, provided that the mission design is not significantly changed from that already approved, and provided that NASA can commit to a share of Euclid in the next few months, as ESA is ready to proceed with

negotiations this winter and the release of industrial contracts by July 2012. Hence a timely response by NASA is required if this opportunity is not to be missed. The APS previously considered such a collaborative effort during its September 2010 meeting, and voted at that time to support a 20% NASA share in Euclid. Much has happened since that time, and as a result the APS again spent considerable time discussing the wisdom of such collaboration.

Given the highly constrained budgetary conditions that NASA faces during upcoming fiscal years, and recognizing the importance of making progress on the main scientific areas highlighted by the Astro2010 Decadal Survey (New Worlds, New Horizons; NWNH), the APS encourages NASA to find novel, cost-effective, and timely ways of attaining these science goals in the coming decade. In this spirit, and as one example, the APS would like to encourage NASA to investigate ways of partnering with ESA on the Euclid mission. Euclid's main scientific goal, to characterize the nature of dark energy using the techniques of weak lensing and baryonic acoustic oscillations, is well aligned with one of the three scientific goals of the top-ranked WFIRST mission concept defined by NWNH. In seeking NASA involvement in this mission, **the APS encourages NASA to explore with ESA any possible way of enhancing the scientific yield of the Euclid mission through US participation, at a level allowable by ESA and consistent with NASA's available resources.**

The APS also heard a summary of the Explorer Program plans for this decade and is appreciative of the effort by NASA to implement the strengthening of the program recommended in NWNH. The APS notes, however that the GEMS mission has been forced to descope, and that mission proposals were cost-capped at $200M (plus launch costs) in the most recent Explorer missions competition. **The APS would like to have a presentation at its next face-to-face meeting on the question of possibly raising the maximum cost limit for Explorer missions**, depending on the status of NASA's efforts to decide upon a suitable replacement launch vehicle for the Delta II.

JWST Update: Rick Howard and Eric Smith presented the status of the James Webb Space Telescope (JWST). The JWST re-plan effort, which is of critical importance for this flagship mission, has been largely finished and the efforts to implement the many changes specified in the re-plan are well underway. JWST has been declared by the Administrator to be one of NASA's top three Agency-wide goals, and as a result the additional funds needed in FY12 ($156M) to complete and launch JWST in 2018 have been apportioned to both the Agency's institutional support budget (50%) and to SMD (50%, with no funds from Earth Science). While the apportionment within SMD is still in discussion, **the plan to share the additional costs associated with JWST was appreciated by the APS as a necessary step for accomplishing NASA's top science goal without eviscerating the APD.** The source of the additional funds ($1,052M) required for JWST's re-plan budget in FY2013-2016, remain to be identified, however, and these future costs remain as a major concern for both APD and SMD.

Howard and Smith provided the APS with three of the four specific JWST items requested at the last APS meeting, dealing with descope options, status reports history,

and percentage completed by cost. The fourth item, a summary of the alternative means of achieving JWST's science goals, has been prepared, but is embargoed until submission of the report containing this information to Congress in the near future. **The APS thanks Howard and Smith for their past and ongoing JWST re-plan efforts, which appear likely to preserve the status of JWST as the top science goal of NASA.**

Senior Review of Operating Missions: Jaya Bajpayee presented the status of the plan for the next Senior Review (SR) of the APD's operating missions, to be held in February 2012. The Hubble Space Telescope (HST) will be subject to this SR for the first time, along with Chandra, Fermi, Kepler, Planck, Spitzer, Suzaku, Swift, and XMM. The total of the FY11 budgets for these nine missions is $232.8M, with the largest share ($91.6M) supporting HST. **The APS supports the intention of the SR to help APD achieve the highest return of science per dollar that can be achieved from these operating missions.**

Exoplanet Exploration Program (ExEP): Michael Devirian presented a draft set of tasks for the Exoplanet Exploration Program Analysis Group (ExoPAG), given that the previous intention to downselect to a single mission concept for a Terrestrial Planet Finder (TPF) mission for presentation to the 2020 Decadal Survey has been overtaken by other events. Instead, Devirian requested that the ExoPAG approve a sixth Study Analysis Group (SAG), tasked with considering concepts for a possible non-flagship class mission, in either the $350M to $1B or $1B to $2B range. Such a "probe-class" mission could attempt direct exoplanet detection or characterization, astrometric exoplanet detection, exozodi characterization, or other exoplanetary science goals. **The APS approves the creation of ExoPAG's sixth SAG, to study such possible probe-class exoplanet missions.**

The APS further recommends that ExEP planning be broadened to include all aspects of exoplanet exploration, such as the diversity of exoplanets and comparative planetology, and that it be broadened to include near-to-intermediate term goals, such as scientific follow-up on exoplanet candidates identified by NASA's Kepler Mission. [As a Kepler Science Team member, chair Alan Boss recused himself from this particular APS recommendation.]

Physics of the Cosmos and Cosmic Origins Programs: Mansoor Ahmed summarized the status of the two other Programs in APD, and in particular how these programs are responding to the science goals outlined for them in NWNH. Ahmed also pointed out the need to develop a mission that will de-orbit HST, which is expected to re-enter the Earth's atmosphere in 2025 in the absence of further orbit boosts. APD is expected to pay for the costs of developing and launching the HST de-orbit mission, and the current estimates are that such a mission will cost at least $500M. While 2025 may seem remote in time, APD needs to consider how such a mission will impact any plans for new missions in the next decade, after JWST has launched. In these constrained fiscal times, **the APS fears that the HST de-orbit mission may constitute APD's "flagship" mission for the decade 2020-2030, especially if the costs of this mission grow significantly beyond $500M**.

Program Analysis Groups (PAGs): Jim Kasting, Steve Ritz, and Chris Martin presented the status of their groups, the ExoPAG, PhysPAG, and COPAG groups, representing respectively the Exoplanet Exploration, Physics of the Cosmos (PCOS), and Cosmic Origins (CO) themes of APD. Steve Ritz requested the approval of the APS to submit their detailed report on plans for an Inflation Probe to the PCOS office for posting on the PCOS web site, and **the APS approved this action**. Similarly, Chris Martin requested APS approval of the CO ranking of technologies to be developed in support of future CO missions, in conjunction with the ExoPAG's consideration of future exoplanet imaging mission concepts, and again **the APS approved this request**. The APS thanks the three PAG chairs and all the members of their PAGs and SAGs for their fine efforts over the last several years in helping to define the path forward for APD's future mission efforts.

Best wishes,

Alan Boss, Chair, APS