

**Minutes of the Meeting of the
Astronomy and Astrophysics Advisory Committee
6 November 2018
Teleconference**

Members attending:

John O'Meara (Chair)	Dieter Hartmann
Andrew Connolly	Mansi Kasliwal
Ian Dell'Antonio	Shane Larson
Scott Dodelson	

Agency personnel:

Richard Green, NSF-AST	R. Chris Smith, NSF-MPS OAD
Chris Davis, NSF-AST	Swati Sureka, NSF-MPS-OAD
Elizabeth Pentecost, NSF-AST	Kathy Turner, DOE

Others:

Klaus Honscheid, OSU	John Blakeslee, Gemini Obs.
Steve Heathcote, CTIO	Andy Adamson, Gemini Obs.
Philip Puxley, AURA	Ashlee Wilkins, AAS
Adam Bolton, NOAO	Rachel Osten, STScI
Jennifer Lotz, Gemini Obs.	Dan Clery, <i>Science</i>
Henry Roe, Gemini Obs.	

MEETING CONVENED 1:00 PM, 6 NOVEMBER 2018

The AAAC Chair called the meeting to order.

The purpose of the teleconference meeting is to receive a preliminary report from the *Gemini-Blanco-SOAR in the Era of Multi-Messenger Astronomy Assessment Group* (GBS-MMA-AG) on the evolving roles of the Gemini, Blanco, and SOAR telescopes. Dr. Klaus Honscheid chaired the GBS Subcommittee and spoke with the AAAC about the process and preliminary findings.

The GBS Subcommittee was requested to develop an assessment of the scientific utility and priorities for the US community for the Gemini Telescopes and the complementary Blanco and SOAR 4-meter telescopes for the first half of the upcoming decade. The purpose is to provide NSF timely advice on the renewal of agreements for two of the facilities and DOE on whether there is need and priority for use of these facilities to enhance dark energy science investigations.

Specifically, the ad hoc subcommittee was asked to deliver:

- An assessment of the degree to which each of the telescopes provides critical complementary data for the Large Synoptic Survey Telescope (LSST), multi-messenger/time domain science, and dark energy science.
- A short list with description and evaluation of the highest impact science in other areas enabled for US observers by the facilities (separately or in combination), given the planned instrument complements.
- An assessment of whether the current share is adequate to accomplish the highest impact scientific programs identified in the two activities above.
- Identification of modes of multi-facility use that could be further enhanced or have competitive access streamlines (e.g., GRB follow-up).
- Aspirations for improved instrumental or adaptive optics capabilities critical for the highest

priority programs.

As emphasis on time domain, multi-wavelength, and multi-messenger science increases and as the LSST comes on line, the role and utility of the Gemini Telescopes and the complement of Southern Hemisphere moderate aperture ground-based optical/IR telescopes, i.e., Blanco and SOAR, will be evolving. Although the upcoming Decadal Survey will define the scientific priorities for the field for the next ten-year timescale, processes internal to the Gemini and SOAR partnerships dictate the need for advice on a shorter timescale. The partners must express their intentions with regard to renewing the Gemini International Agreement in November 2018, so that they are in a position to negotiate a new agreement for operations and development of both Gemini-North and Gemini-South telescopes post-2021. Also, by late 2019 the NSF will need to determine its position on supporting the operation of SOAR beyond 2020.

The Subcommittee's charge was received in mid-August and their first committee meeting was held at the end of August. An in-person meeting was held on October 9 in Tucson, where the subcommittee met with the directors of Gemini and CTIO and several others who were in Tucson for a National Center for Optical-Infrared Astronomy (NCOA) meeting. The subcommittee were provided with valuable information to include in their deliberations. The subcommittee were divided into several sub-groups to address science cases that included small bodies, exoplanets, star formation, stellar astrophysics, supernovae and variables, galaxies, dark energy, dark matter, and multi-messenger astrophysics.

Dr. Honscheid provided an example of the multi-messenger science that could be done with the GBS system. The advanced detectors on the Laser Interferometer Gravitational-Wave Observatory (LIGO) and on Virgo will start their next run in February 2019 with increased sensitivity. Both instruments will be observing/detecting numerous binary black hole, neutron star-neutron star, and neutron star-black hole mergers. However, localization is uncertain on the sky over 10-100 deg². Follow-up requires same night optical and near-IR imaging and high cadence spectroscopy. DECam on Blanco is unsurpassed for localization, while Flamingos-2 on Gemini can be used to characterize pure red kilonovae. Overall, Gemini is well set up for optical and near-IR imaging and spectroscopy at high cadence; SOAR can do the same for brighter objects.

Dr. Honscheid continued the presentation with the subcommittee's preliminary findings:

First, the subcommittee finds the science opportunities for Gemini, Blanco, and SOAR for the first half of the next decade to be compelling; all three telescopes are great assets for the US optical-infrared (OIR) program; their operations should continue. Time domain science will be supported in the LSST era by these three telescopes and the GBS system will provide strong support for multi-messenger astronomy. All of the science areas that the subcommittee reviewed could be done with the GBS system, but there needed to be a balance between small and large PI-driven programs and the ToO programs. NSF was encouraged to extend the Gemini international agreement.

Second, multi-messenger astronomy and time domain science is supported by all three telescopes. The subcommittee suggests several ways to strengthen this effort. For example, queue observing is available at SOAR and Gemini and could be made available at Blanco if desired; a telescope time exchange program for the US community that included both public and private US facilities would be a first step toward better collaboration; and there is an opportunity now to evolve the TAC process as well as address proprietary data issues and develop schemes to coordinate competing proposals for the same alerts.

Third, the DOE's focus on dark energy science is supported by all three telescopes; the Alert Broker is critical for this. GBS spectroscopy supports probes of dark matter physics using dwarf galaxies and stellar streams. Spectroscopy of cluster galaxies provides critical calibration of photo-z's to enable cluster cosmology. Gemini Adaptive Optics (AO)-assisted imaging and spectroscopy will be needed so

that hundreds of LSST time delay gravitational lenses can be used for cosmology. Missing from the GBS portfolio is a multi-object spectrograph like the Dark Energy Spectroscopy Instrument (DESI – on the Mayall telescope) or the Prime Focus Spectrograph (PSF – on Subaru) in the southern hemisphere, ideally on an 8 m class telescope. This is needed for photometric redshift training and possibly calibration.

Fourth, the subcommittee encourages continuing support for the development of software infrastructure and tools for time domain science in the LSST and LIGO era. Community input and contributions should be encouraged and solicited as the development of alert brokers, target and observation management platforms and dynamic scheduling systems continues. The different components of such an observation network should have standard interfaces that can accept streams from other alert producers or external observation requests. Issues regarding proprietary data need to be addressed and balanced against efficient use of resources; in some cases public follow-up campaigns could be appropriate.

Fifth, the subcommittee commented on the instrumentation that would be needed. Gemini instrumentation continues to improve; the continuation of this program and expeditious commissioning of new facility instruments has to remain a high priority. A recent NSF award to Gemini will help improve AO capabilities at both sites, which is of great importance to many science programs; the continuing development of AO-assisted imaging and spectroscopy has to remain a high priority. The sub-committee supports the planned move of the Gemini Planet Imager (GPI) to Gemini North and suggests that Gemini finds a way to strengthen support for its Visitor Instrument program. By the middle of the next decade, DECam will be 13 years old; the sub-committee suggests that NOAO/NCOA starts to develop a plan for future instrumentation for the Blanco and SOAR telescopes. A capable NIR imager on a 4-m telescope is missing from the GBS portfolio as well as a high throughput, wide wavelength (0.3 – 2.4 micron), low resolution ($R \sim 50-100$) spectrograph on a 4-8 m telescope; a wide field, multi-object spectrograph on an 8-10 m class telescope in the southern hemisphere is also still missing from the US OIR portfolio. Efforts should continue to explore options for such a facility for the second half of the next decade.

John O'Meara thanked Klaus Honscheid and the subcommittee for all of their hard work. He also wanted to know what the subcommittee's thinking was with regard to the low resolution spectrograph on a 4-8 m telescope; what was the driving need for that particular type of instrument. Dr. Honscheid replied that the subcommittee members who were looking at small body and small system objects thought this type of instrument would be important to their science cases, although Gemini will have Scorpio to do these types of studies on some objects.

Mansi Kasliwal commented that the subcommittee should take into account the work that is being done internationally; take into account the broader context to optimize and get the most out of the GBS system. Klaus Honscheid responded that this was discussed in the subcommittee but the charge to the subcommittee was to focus on US capabilities, in particular, the US public telescopes.

Andrew Connolly asked about the broker/alert system. Has the subcommittee been thinking about this issue in terms of creating a new infrastructure in order to be able to take multiple streams and distribute these alerts out to the different resources available, and is the subcommittee thinking about this as being developed through the GBS or as a more global system? Klaus Honscheid replied that the subcommittee discussed this with Adam Bolton. For example, for LSST, there will need to be some coordination of these alert streams. Also, there will need to be an organization and coordination of resources across the system; this will be important to get the science out. The subcommittee is not planning to engage in details of technical or implementation questions but reviews aspects of an OIR system at a high(er) level.

Dieter Hartmann noted that he could not find any reference to the input the subcommittee received for their discussions. How did the subcommittee reach out to the community? Klaus Honscheid replied that it was decided early on in the process that the subcommittee would be short lived, fast paced, and would

not repeat previous studies that were done, such as the Elmegreen study/report. The only external input the subcommittee received, besides the expertise of the committee members who were selected to cover the science areas, was at a meeting with the observatory directors and NOAO staff, who had a chance to talk with the subcommittee at their October meeting, through various reports (Kavli and Elmegreen for example), and through a presentation by Debra Elmegreen on the state of the OIR system five years after the report was released. Dieter commented that there might be an opportunity for further commentary after the report has been released so that nothing is missed. Klaus noted that it would be up to the AAAC to consider any further commentary. John O'Meara agreed that it could be discussed later.

Mansi Kasliwal suggested the community think about more than one data management system for the alert streaming; there may be more than one management platform that could be used. Klaus indicated whether there is one broker or multiple brokers or whether they are specialized or not is a question of resources and how much LSST can provide; this needs to be figured out in a collaborative way.

Richard Green thanked the subcommittee for their hard work in a short timeframe. This provides him and Chris Davis some guidance to go to the Gemini Board next week as NSF gives a preliminary indication of intentions about future participation in Gemini; the science case will be important as NSF goes forward to advocate for Gemini.

Kathy Turner also thanked the subcommittee for their hard work. DOE/HEP is happy with the process and how this has fed into the report so far. She is looking forward to the final report.

MEETING ADJOURNED AT 12:50 PM, 6 NOVEMBER 2018