

# AS4: Call for Proposals

The AS4 ("After Sloan IV") Steering Committee (SC) invites proposals for scientific projects to be carried out by a future AS4 Collaboration in the time period 2020-2026. Proposals are due September 23, 2016, but some components of the proposal may be submitted up to one week later as described below. After review, the AS4 SC will select elements from some or all of these proposals to formulate an AS4 program, which (like SDSS-II, III, and IV) will likely consist of a small number of large survey projects using common hardware assets. This program will be presented to the Board of Governors (BoG) of the Astrophysical Research Consortium (ARC), and to the owners of any other assets (such as the 2.5-m du Pont Telescope at Las Campanas Observatory) that are essential to the proposed program. If the program is approved by these governing bodies, then a Director, Project Scientist, Program Manager, and a new Steering Committee will be appointed to build the AS4 Collaboration and develop funding proposals.

The eventual decision on whether to proceed with AS4 will be made by the participating institutions based on fund-raising sufficient to enable a viable program; based on previous cycles, the time required to reach this decision point following formulation of the program is 1-2 years with the recognition that the use of additional telescopes will increase the project cost.

## ***Evaluation Criteria and Process***

Preliminary proposals and the Letters of Intent (LOIs) received earlier this year demonstrate an abundance of compelling scientific ideas that can take advantage of the remarkable hardware systems, pipeline and database infrastructure, and collaborative culture that the SDSS has built over the past 25 years. Assets currently owned by ARC and used in SDSS-IV include the 2.5-m Sloan Foundation Telescope at Apache Point Observatory, the two BOSS spectrographs (both located at APO), and the two APOGEE spectrographs (one at APO and the second at LCO). In addition, the LCO du Pont Telescope plays a major role in SDSS-IV. For the sake of uniformity, proposals should assume that AS4 observations will be carried out from summer 2020 through summer 2026, though the actual dates will ultimately depend on funding considerations.

AS4 is likely to use a robotic fiber positioner in place of the plug-plate system adopted in previous generations of the SDSS, and this should be assumed in proposals. We are **not** currently soliciting proposals for the fiber positioner itself, as the requirements for such a positioner will depend on the selected science program. AS4 could also employ new spectrographs or other instruments if needed for the scientific program and if sufficient funds for hardware development can be raised. Proposals may also include the use observing time on the ARC 3.5-m or NMSU 1-m telescope at APO or on other telescopes (even new ones built

for AS4). The criteria and process for project selection and formulation of the AS4 program will be similar to those used previously for SDSS-III and SDSS-IV.

The key criteria for evaluation of proposals will be:

- Compelling nature of the proposed scientific investigation
- Competitiveness of the proposed observations relative to other capabilities expected in the 2020-2026 timeframe, and synergy with other ground- or space-based projects
- Technical feasibility
- Strength and commitment of the science team
- Ability to mesh with other AS4 projects
- Potential for fundraising as part of the overall AS4 program

For reference, it is useful to note that the total budget of the 6-year SDSS-IV program, excluding the cost of building the APOGEE-South spectrograph, is approximately \$57M. The majority of this budget is funded by Participating Institutions -- a full participating institution contributes \$1.05M, while associate member institutions contribute \$0.21M per senior participant. The Sloan Foundation has provided \$10M of support for SDSS-IV, plus \$3.5M toward the construction of the APOGEE-South spectrograph. The viability of AS4 will depend on its ability to attract many participating institutions and external funding from foundations and government agencies.

Proposals will be sent for one or more written external reviews at the discretion of the SC. Where relevant, concerns raised in written reviews or in the SC's discussions will be communicated to proposal teams with a request for brief written responses. Teams are encouraged to propose for the full resources (instrumentation, observing time) needed to achieve their scientific goals. However, the SC reserves the right to rescope, merge, or modify proposed projects when developing the unified AS4 program for presentation to the ARC BoG and other bodies. PIs of all proposals will be notified before the presentation of this unified plan.

The SC encourages groups with similar interests to join forces and develop proposals that address broad scientific themes within a coherent observing program, which may include optical and infrared and northern and southern components.

To facilitate this process, the majority of the LOIs submitted in April 2016 are available at

<http://www.sdss.org/future>

Most of the LOIs received fall into one of four broad science themes:

1. Stellar astrophysics
2. Galactic archeology and chemical evolution
3. Extragalactic science enabled by IFU observations of galaxies
4. Black hole accretion investigated through quasar variability

The AS4 program may encompass all four of these themes, or a subset.

Each proposal should identify a PI who is prepared to lead the project through at least the first AS4 public data release (approximately 2022) if the project is selected as part of the AS4 program. Proposals are also encouraged to identify other key members of the science team who are prepared to make major commitments of time and effort to the project.

However, we anticipate that all positions, **including that of PI**, will be filled through an open application process, as is now the common practice in SDSS-IV in order to ensure diverse representation in project management. In particular, because proposed investigations may be merged, rescoped, or reorganized in the process of formulating the unified AS4 program, being PI of a proposal does not, in itself, guarantee being selected as PI of the most closely related AS4 survey.

### ***Hardware Assumptions***

Based on feedback from LOI teams, the SC has envisioned hardware and operations concepts that can address the observing needs of many though not all of the projects described in the LOIs. While we remain open to additional hardware concepts, we ask the proposal teams to consider the following assumed hardware capabilities:

- \* Availability of all dark and bright time on the Sloan 2.5-m and the du Pont 2.5-m over 6 years.
- \* One APOGEE spectrograph at each telescope.
- \* Two BOSS spectrographs at APO.
- \* On each telescope, a robotic fiber positioner with 300 zonal positioners (7 or 10 arcmin diameter zones, for the du Pont and Sloan telescopes respectively), each of which can feed either a BOSS or APOGEE spectrograph, and which are rapidly reconfigurable (~ 2 minutes).
- \* Observations arranged in tiers that range from deep drilling fields visited many times to an all-sky tier visited approximately four times.
- \* Potentially additional optical spectrographs with BOSS-like capability.

A specific program "AS4 Beta" was distributed earlier and comprises a specific observational program. It also provides some tools for proposers to evaluate trades in designing a robotic fiber based observational program. It should be viewed purely as a starting point. This concept is available at <http://www.sdss.org/future>

This configuration leaves fibers available to feed IFU units. The "AS4 Beta" concept specifically proposed a 400-fiber IFU at a fixed field position. We recognize the IFU capability in AS4 Beta is not adequate for the extragalactic investigations proposed in some LOIs, and that this may lead to further developing the case for additional optical spectrographs. However, we note this does not preclude additional science cases that take advantage of IFU(s) using only the existing spectrographs.

Teams whose science program relies on multi-object spectroscopy that is well matched to this configuration are encouraged to adopt these hardware and operations assumptions and detail how their observing program would fit within it. They are also encouraged to suggest modifications that would improve the performance for their project, including changes to or expansion of individual tiers and alternative or additional hardware. If the above configuration cannot achieve the team's science goals (e.g., because a patrol-region fiber robot is too restrictive or because different spectroscopic capabilities or observing strategy are required), they should explain why not.

Teams whose science program relies on IFU spectroscopy are encouraged to propose whatever hardware configuration and observing strategies are needed to achieve their science objectives and to present plans and cost estimates for developing this hardware.

### ***Proposal Elements***

Proposals should contain the following elements:

1. A Cover Page that includes title, PI contact information, and the names and institutions of all members of the proposal team. The team can include members who were not involved in writing the proposal but would be interested in participating in the project if it becomes part of AS4. In practical terms, "interested in" translates to, at minimum, "prepared to encourage their institution to join AS4."
2. A one-page summary that describes the science questions the project is designed to address and explains why the proposed project will have a transformative impact. Successful proposals must have a science case that is matched to the \$50M+ scale of AS4.
3. A description of the assumptions about hardware adopted for the proposal, especially any hardware beyond that in the AS4 Beta concept. This description should be limited to two pages, with more detailed discussions of new instrumentation presented in an appendix.
4. A project description, limited to 8 pages including figures, that explains the scientific motivation for the project, target selection, observing strategy, software needs for data reduction and analysis, anticipated outcomes, and competitiveness of the project in the expected landscape of the 2020s. (Descriptions shorter than 8 pages are welcome.)
5. A trade and scope discussion, limited to 2 pages. This section should explain how the scientific return of the project could be improved by changes to the observing allocation or hardware relative to the baseline assumptions used in the project description. Recognizing that the sum of observing time requests from the selected projects may well exceed the total available, this section should also describe descope options that would still leave a scientifically compelling project.

6. A budget and personnel description that presents project-specific needs, i.e., those not connected to standard observatory operations, central management of AS4, or AS4 data management and distribution. Budgets and personnel for hardware development should be separated from those required for management and execution of the project. The personnel description should identify the roles and FTE-number of senior investigators, postdocs, students, and other staff who will require AS4 financial support in each calendar year from 2018 through 2026, including personnel needed for target selection, pipeline development, and survey operation. Personnel should be identified by role in the project, not by name. The budget description should identify financial needs of the project beyond these identified personnel, e.g., for hardware or computing.
7. A description of key personnel, limited to two pages. Most importantly, this should include a description of the experience and qualifications of the PI and a frank discussion of her/his ability to commit to the necessary level of effort if the project is selected. Other key personnel may also be described, up to a maximum of ten.
8. A discussion of fund-raising potential, limited to one page. This should explain why the proposed project is likely to be effective in attracting institutional partners and external funding, including specific opportunities. It should identify any unusual opportunities specific to the project, such as synergy with space projects (at a level that could attract space agency funding) or possibilities for large in-kind contributions.
9. A list of references cited.
10. **Optional:** One or more appendices presenting technical details beyond those in the main proposal. Any proposal involving hardware development beyond that in AS4 Beta should include an appendix that presents a detailed description of the proposed hardware and a plan and schedule for development.
11. **Optional but strongly encouraged:** Institutional letters of endorsement, from department chairs or equivalent. Sample wording:

The University of XXX Department of YYY endorses the project described in the proposal "\_\_\_\_\_" submitted to the AS4 Steering Committee. Interest in this project within our department is sufficiently strong that we would likely pursue options for institutional membership in AS4 if this project is selected as an element of the AS4 program.

Recognizing the compressed time-frame for writing proposals, items 10 and 11 may be submitted up to one week after submission of the main proposals, i.e., by September 30, 2016.

### ***Submitting your Proposal***

Proposals must be emailed as a single PDF document to [as4-sc.at.sdss.org](mailto:as4-sc.at.sdss.org). Review of proposals will begin after September 23, 2016. This will allow the SC to formulate a recommendation to the ARC BoG at its November 2016 meeting.

### ***Proposer Resources***

Information for proposal writers will be made available at [www.sdss.org/future](http://www.sdss.org/future)

The SC has funds to defray the costs of proposal writing workshops. We envision a workshop on each of the themes and we encourage the proposers to organize themselves to request funds. LOIs whose authors have agreed to make their documents public can be found at [www.sdss.org/future](http://www.sdss.org/future) to facilitate organization among proposal writers. These funds should be requested by email to [as4-sc.at.sdss.org](mailto:as4-sc.at.sdss.org) no later than August 23.

Teams are welcome and encouraged to consult with members of the AS4 Steering Committee with questions regarding the scope and content of the proposal.

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