

## **UNIVERSITY REORGANIZATION: THE VIEW FROM STEWARD OBSERVATORY AND THE DEPARTMENT OF ASTRONOMY (SO/DA)**

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**Overview.** SO/DA is one of the most internationally prestigious entities on campus, routinely generating the highest level of research funding (and hence ICR) in the UA, contributing high-profile economic activity for the State, housing one of the most highly ranked academic programs, and teaching more students in General Education science than any other department but one.

While the basic motivation for the current transformation studies arose from cuts in state funding, SO/DA approaches the reorganization process with the intent of improving the quality of UA programs, increasing its income and achieving the "top 10 publics" (TTP) goal set by President Shelton. We respond to the call for reorganization with robust plans for tighter collaboration and greater efficiencies of operation between SO/DA and its most closely aligned research units/ departments. We propose that this can occur within a tiered framework of larger academic structures that could eliminate redundancies in courses and enhance the quality of General Education in science. At each tier the approach seeks to maintain the strength of the strong research units, to facilitate selective development of new enterprises (failure in either would doom the TTP goal), while providing an enhanced education product.

The first draft of this White Paper was fully discussed at an SO/DA faculty meeting on October 1, having been circulated beforehand. The faculty approved it in an anonymous vote by 35 to 1 (4 of the 5 who did not vote are emeriti). Thus it is presented to the Dean, the Provost, and SPBAC with a strong prior endorsement from the overwhelming majority of the SO/DA faculty.

**SO/DA.** Steward Observatory runs mountaintop observatories, builds large telescopes and astronomical instruments, and is involved in multiple international partnerships (e.g. Germany, Italy, Japan, Taiwan) that bring major financial resources to UA. It provides astronomical research facilities to scientists at UA, ASU and NAU operating, among other facilities, the Large Binocular Telescope, the largest and most powerful optical telescope in the world. SO/DA also operates several unique facilities such as the UA Mirror Lab and the Imaging Technology Lab, and is a major participant (as well as providing the mirrors for) the MMT and Magellan facilities. SO/DA conducts a vigorous research program in space astrophysics and is involved in instrument/detector development for a number of present and future space missions. The average grant/contract income per year per SO/DA faculty member has exceeded \$1M over the last several years and the ratio of grant/contract to state income has exceeded 5:1 for this time. A rigorous streamlining of SO/DA was undertaken during the last several months, resulting in a staff reduction of more than 30 people. SO/DA is now down three faculty members, with further losses anticipated unless we can fend off outside offers and recover our full strength. Further reduction, especially in faculty members, would clearly result in reduced net income, contrary to the TTP goal.

SO/DA operates a highly selective graduate program that places over two-thirds of its graduates in long-term jobs in the profession; by the simple metric of graduates who receive the premier Hubble Fellowship, our program is second only to Caltech, and ahead of Princeton, Harvard, Berkeley and MIT. SO/DA also has 100 undergraduate majors, 70% of whom get hands-on research experience, and the Department contributes extensively to the CoS teaching program, especially through General Education for non-science majors. Our NATS instructors have among the highest student evaluations in the college and they are pioneers in the use of technology and learner-centered methods. We could potentially add seats or expand the number of sections to satisfy demand and generate net additional funds to the University if overall UA enrollment increases.

**Collaborative Institutes/Departments.** SO/DA has strong synergy and collaborates extensively with LPL and OSC, two comparably strong research units within the CoS/UA. Several SO/DA faculty members have joint appointments with these research organizations. The three institutes already cooperate by exchanging certain financial, management and technical resources as needs/opportunities arise. For example, there is strong interaction between OSC and the SO/DA Mirror Lab on large optics and between

SO/DA and LPL on observational and astrobiological research and in managing large space projects. A full merger of these research units is unwise because they have each attained international prominence and a unique identity (brand) over decades, and they compete in largely separate funding arenas. Similarly, using a centralized “Business Center” to replace financial functions currently located in these units would be very unproductive and potentially disastrous; the requisite detailed knowledge and expertise in grants, contracts, and the needs of the sponsors do not exist centrally. (We do, however, suggest that business overhead costs can be reduced significantly by streamlining central administrative demands on the departments.) We emphasize that any weakening of high return sponsored research units such as OSC, LPL and SO/DA would result in losses in grant/contract funding and hence be a false economy. Indeed to maintain the strength of these institutes and enable them to compete for large projects, it will be necessary to make available additional funds from the Research Development Fund.

SO/DA also has strong ties to both the Physics and Chemistry Departments, again with several joint faculty appointments. Astronomy and Physics have long had a close linkage for many of our courses and degree programs; two-thirds of Astronomy majors graduate with a double major in Physics. In our view, a strong physics component of the undergraduate Astronomy major curriculum is essential to the success of our own academic program. The two departments have had good cooperation and coordination with respect to undergraduate courses. Some have been cross-listed and co-taught for years – for example, Computational Physics – while in others, Astronomy faculty have taught sections of Physics courses (e.g., Optics, Thermodynamics, Mechanics, Electricity & Magnetism) which are part of our core undergraduate requirements. We plan to enhance this linkage and thereby improve the quality of the majors' programs in both departments while at the same time making best use of the pedagogical skills and expertise within the two departments. We believe that this would best be accomplished within the framework of a School of Physical Sciences (see below).

A full merger of the Astronomy and Physics departments has been considered carefully but was unanimously rejected by the Astronomy faculty on October 1, by a vote of 36 to 0. The current SO/DA structure — plus the excellence of our faculty — has resulted in a top-ranked department with the ability to build, maintain and utilize major facilities and compete for major space projects. An overwhelming majority of our direct peers and rivals have separate Physics and Astronomy departments while, in the remainder that are merged, the Astronomy represents a relatively minor component. If the geographical separation could be overcome with a future building closer to SO, LPL, and OSC, tighter collaboration and cost savings on both teaching and research would be enabled. In the meantime, we have studied a preliminary version of the Physics Department white paper and agree with the general direction outlined there, finding it a fruitful basis for a continuing dialog and closer collaboration.

As noted above, DA has natural linkages with both Planetary Science and Optical Sciences and has developed informal agreements with both regarding our undergraduate major and minor programs. DA/OSC faculty have outlined plans for a double major in Astronomy and Optical Science; DA and Planetary Science, which has no undergraduate major, have a major/minor plan which lets students pursue planetary studies with a strong foundation in astrophysics. It is noted that theoretical astrophysics remains a critical aspect of SO/DA's program and strength, and it is also an example of interdisciplinary excellence. Theory provides the required context for observational work and is crucial for maximizing the returns from UA telescope facilities. The Theoretical Astrophysics Program (which is a joint program with Planetary Science/LPL and Physics) remains a high priority for SO/DA to maintain a strong theory group and provide a vehicle for national recognition and recruitment of students and postdoctoral fellows. The SO/DA faculty is willing to contribute to joint academic activities, preferably in the context of a School of Physical Sciences in which much greater benefits could be realized.

**School of Physical Sciences.** This concept, which involves close integration of the teaching of physical sciences, is a natural way to serve the needs of science majors, General Education, Multidisciplinary students, and students in the pre-professional programs. A larger envelope for teaching physical science makes sense because there are at least as many physicists in SO/DA, LPL and OSC as there are in the Physics Department — currently with only 25 faculty members. Within an appropriate framework these physicists could teach physics courses within the School while continuing their research in their highly

successful research institutes. The new landscape would thus include a series of research Institutes whose faculty would share in physics instruction within a School of Physical Sciences which, once established, would immediately have national credibility and help greatly in hiring faculty and recruiting students. Graduate and undergraduate degrees could be administered by the Institutes/Departments, which would retain their individual identities for the purpose of hiring, governing individual teaching loads, operating graduate programs, and conducting research.

Faculty (and some research staff) associated with SO/DA would thus be responsible for maintaining the required undergraduate majors courses and the core courses, electives and seminars of the Astronomy graduate program. All would contribute to the General Education, service, lower division and some of the upper division courses of wider applicability; this undergraduate teaching would be unified and organized under the oversight of a college-level academic administrator. The source of potential cost savings and/or new revenue generation would be the consolidation of redundant courses at all levels, expansion of the student enrollment especially in the General Education and in future Multidisciplinary programs, and the use of teaching specialists or “master teachers” for General Education and Multidisciplinary courses.

Moving forward within a School of Physical Sciences would provide a framework within which to strengthen our mutual academic programs (graduate and undergraduate) and offer new courses and programs that served student needs and went beyond traditional disciplinary boundaries. Examples we have discussed with our peers include a minor for non-science majors in Astronomy and Space Science, a graduate minor in Astrobiology, and graduate degrees in Optical and Astronomical Technology and in Science Education. The School of Physical Sciences framework would also benefit non-science majors, allowing the General Education program to include interdisciplinary or “Great Ideas” courses rather than the current patchwork quilt of courses with no prerequisites and no articulation between Tier 1 and Tier 2.

**College of Science and Technology.** This concept has been raised in the final few days of the transformation discussion and has not therefore received the same level of review within SO/DA as the options listed above. Essentially all of the efficiencies and cost savings for instruction that could be realized in a School of Physical Sciences could potentially be achieved in a larger structure that spanned the Colleges of Science, Engineering and Optical Sciences. It would also recognize the fact that research in physics has moved inexorably in the direction of applied physics, in subjects as wide ranging as astronomy, global climate change, nanotechnology and energy generation. However, one would want to be assured that the price was not another layer of administrative superstructure but rather one that supported a collection of highly-effective, specialized independent research institutes – an approach that seems to work so well for our peers (much as proposed in association with the School of Physical Sciences). With an appropriate structure, such a College could potentially remove artificial barriers to research endeavors between the current colleges and better enable students to tailor their science and technology programs to their career goals. It could also facilitate the development of new research programs, for example in solar energy generation and storage, an area in which the UA lags due to the fragmentation of its efforts.

As of this writing, no consensus has been reached within SO/DA on the College of Science and Technology concept. Some SO/DA faculty members see potential advantages in such a structure, while others are troubled by the potential risk of unnecessary administrative overhead. Given the short time available and the magnitude of the proposed change, it has not been possible to provide meaningful estimates of the likely academic or financial consequences of this proposal. While it has sufficient potential to be given serious consideration, we believe that the most practical next step would be to implement the School of Physical Sciences concept

In terms of process and consultation, the first draft of this document was fully discussed (and voted on) at a faculty meeting, and was made available to all faculty, staff and students in SO/DA. A special meeting was held specifically to listen to staff concerns. The second and final draft was similarly made available to all faculty, staff and students, with an invitation for feedback and comments. Right up to the time of final submission, the white paper was the subject of discussions with the Dean and several representatives of the Physics Department.