

women & philanthropy

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The Ohio State University Women & Philanthropy Grant Proposal

Generously Funded By The Members Of The Ohio State University Women & Philanthropy Program

Grant Proposal

Title: *ASAS-SN: The All-Sky Automated Survey for Supernovae*

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The Department of Astronomy

Program Abstract

ASAS-SN is an international project led by OSU Astronomy faculty to rapidly identify, characterize and study the brightest transient sources our Universe. Our small robotic telescopes are discovery machines, and we rely on other, larger telescopes to do the follow-up studies. Few telescope systems are operated in the manner needed for these follow-up studies, and we request support from Women & Philanthropy to obtain 150 hours of telescope use from the best source for such observations, the network of larger robotic telescopes run by the Las Cumbres Observatory Global Telescope Network (LCOGT). This will significantly enhance our ability to use our discoveries as tools to better understand our Universe.

Program Narrative

Humanity should have a continuous record of the sky. The ultimate goal of the ASAS-SN project is to observe the entire visible sky every night, providing real-time public alerts of new astronomical transients of all types to the professional and amateur community, and producing a publicly available data base of extraordinary value. We will produce the first time-lapse "movie of the universe" -- the first continuous, all-sky monitoring of the heavens ever undertaken.

ASAS-SN presently has two fully operational sites in Chile and Hawaii. Each site has 4 telescopes in a common mount, allowing us to cover about half the visible sky every clear night to a depth 25,000 times fainter than visible to the human eye. Observations are scheduled, executed and processed automatically, returning a list of candidate events and images after each night. These are then vetted and followed up by an international network of amateur and professional astronomers. New discoveries are made public as soon as possible.

At OSU, we currently have three graduate students deeply involved in the project, and three former OSU graduate students continue to play critical roles. These ex-students are now at the Kavli Institute for Astronomy and Astrophysics in Beijing, Diego Portales University in Chile, and the Carnegie Observatories in Pasadena. We also have team members elsewhere in the US, Denmark, Poland and the UK. A remarkable aspect of our collaboration is that we work closely with a group of amateur astronomers interested in supernovae -- ASAS-SN finds candidate supernovae, the amateurs confirm them, and then we study them in detail to do new science.



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Among many recent successes, ASAS-SN has discovered the most powerful supernova found to date. This discovery made international headlines, and members of our team were interviewed by NPR, the BBC, the Wall Street Journal, Scientific American and many other media outlets. ASAS-SN leads the world in the discovery of bright supernovae, finding roughly 180 per year. We have also discovered 3 rarely-seen tidal disruption events, where a star is torn apart by the tides of a black hole millions of times more massive than our Sun. ASAS-SN finds the closest, brightest and most easily studied sources, which makes them especially valuable because they can be studied in detail with modest size telescopes for long periods of time.

ASAS-SN presently has funding from the National Science Foundation and roughly \$100,000 membership contributions (each) from groups at Catolica University in Chile and the Kavli Institute for Astronomy and Astrophysics in Beijing. These funds are used to support the operations of the existing ASAS-SN telescopes -- this includes paying LCOGT to host the telescopes, the necessary computers/storage, and supporting graduate students. We are in the process of adding a group from Michigan State University and expect to do the same with North Carolina State University in the fall. We are also in discussions with a large private national foundation.

The focus of these efforts is to collect sufficient funds to expand ASAS-SN to four sites, with the new sites likely being at MacDonald Observatory in Texas and the Sutherland Observatory in South Africa. This will bring us to our goal of observing the entire visible sky every night and greatly increase our protection against bad weather. We are roughly half way to funding one new site, and the expansion would be fully funded if our discussions with the foundation are successful. The roughly \$450,000 for each new site (plus operations costs) appears to be beyond the scope of projects supported by Women & Philanthropy.

We do, however, have an important, near term need for support, which we have been neglecting in favor of building the funds needed for the expansion. Our small survey telescopes are tools for discovery, not for detailed studies. For detailed studies, we must obtain observations from other, larger telescopes. The most valuable resource for this aspect of the project is a system of nine 1 meter telescopes also run by LCOGT and spread across seven sites around the world. Almost all telescopes are scheduled for use by a particular team on a particular night, but to monitor and study the time evolution of the transient sources we discover, ASAS-SN needs a little bit of time every night. This crucial capability can be supplied by LCOGT, but not for free. We obtain about half of the time we need to maximize our science through our collaborators in Chile and China, but we desperately need more, and a grant of \$45,000 from Women & Philanthropy would meet this need for the next year. Data obtained with LCOGT telescopes will be used in at least a dozen scientific publications, with full credit to support from Women & Philanthropy. We credit all of our supporters on our web site. They are also included in our announcements of new discoveries, and in our published papers whenever it is feasible, and this would also hold for any support from Women & Philanthropy.

How does this proposal meet the mission and/or objectives of Women & Philanthropy?

Project ASAS-SN represents an area of extraordinary excellence in cutting-edge scientific research at Ohio State.

Total Requested.....\$45,000

Budget

The cost of time on the LCOGT 1 meter network is \$350/hour of time plus a \$3000 administrative fee for 20-99 hours in a year, \$300/hour with no administrative fee for 100-500 hours, \$250/hour for 500 or more hours, again with no fee. With this cost structure, \$30,000 buys 100 hours of time while \$29,000 (\$20,000) only buys 74 (49) hours of time. We request your support to obtain 150 hours of time from LCOGT, which corresponds to \$45,000.

