

Introduction to the Joint AAS-AAVSO Scientific Paper Sessions

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Preparations for the joint AAS-AAVSO meeting (May 2011) were well underway in 2010 when I began planning the joint sessions that would bring the AAS and AAVSO together. As someone with roots in both organizations, I wanted to plan science sessions that would bring the Amateur and Professional researchers and observers into the same room and provide an opportunity for each to learn about new science and new initiatives by the other. I worked closely with AAS Vice Presidents Lee Anne Willson and Christine Jones-Forman to schedule a day's worth of sessions that would interest both of our communities. We settled on two special sessions that would highlight both the field of amateur observing and the astrophysics that we hope to gain from studying variable stars.

On the observing side, we chose "Astrophysics with Small Telescopes" to give a forum to researchers using small telescopes to do big things. There are two parallel trends operating in research astronomy today. On one hand, astronomical researchers face smaller budgets and more competitive access to astronomical facilities, and those professional facilities that exist increasingly consist of very large telescopes not necessarily appropriate for doing astrophysics on bright variables. On the other hand, we are seeing increasingly sophisticated detectors and telescopes of high quality but low cost available through the consumer market. Given the technology that's currently available, the number of projects available to researchers with modest equipment is growing rapidly, and we wanted to highlight some recent novel uses of small telescopes that have brought us new and valuable astronomical and astrophysical knowledge. Ultimately, the goal of the session was to highlight the fact that there remains a great deal of astrophysics left to be learned at brighter magnitude limits, exactly where the amateur observer community can make its greatest contributions to science.

AAVSO Director Arne Henden led the session with an overview of how observers with very modest telescopic resources can and do make observations of remarkable quality, opening new opportunities for astrophysical research. This was followed by a talk by Michael Simonsen, who led the AAVSO's "Z-CamPaign," a wholly-amateur effort to characterize a large number of candidate Z Camelopardalis variables, yielding light curves of superb quality along with some surprising astrophysical results, chief among them that many "Z Cam" stars are not Z Cam stars at all! Long-time Pro-Am leader Joseph Patterson then gave a review of the Center for Backyard Astrophysics research program on cataclysmic variables, which has not only produced great new astrophysics but

also serves as a model for how Pro-Am collaborations among geographically distributed, dedicated researchers can work. Gaspar Bakos presented a talk on HATNet, a novel robotic observatory using small telescopes to search for transiting exoplanets. The fact that HATNet can produce such great science on exoplanets highlights the fact that small-telescope observers can and do make great contributions to this new field of stellar astrophysics, but HATNet also highlights a growing trend of using very small telescopes to survey bright nearby variables that are being left behind by ever-larger professional facilities. Robert Stencel provided a review of the recent multi-year campaign on ϵ Aurigae, with extensive participation in observations by the amateur community. Stencel highlighted the enormous contributions that the amateur community has made via the most recent and historic eclipses, as well as new tools—like digital photography and amateur spectroscopy—that provided novel astrophysical information about ϵ Aurigae’s once-in-a-generation eclipse. To end the session, John Percy highlighted one of the AAVSO’s greatest treasures—our long-term data archives. Data archives such as those held by the AAVSO and other amateur Variable Star Organizations provide astrophysicists with one of their only views of variable star behavior on long timescales. Such data archives are a rich mine of data for variable star researchers—amateur, professional, and student alike.

For the afternoon session on astrophysics, we chose “Variable Stars in the Imaging Era” as the unifying theme. We are moving forward into a new era where we see stars not as astrophysical point sources but as resolved objects with detectable structure using technology like optical interferometers and space-based observatories operating at all wavelengths of the electromagnetic spectrum. Variable stars are of particular interest in this field because we can then gain deeper understanding by coupling knowledge of their spatial structure with knowledge gained from studying their variability. By combining the new information from imaging with additional photometry by the amateur community, we can improve our understanding the underlying astrophysics.

Margarita Karovska led the session with a discussion of direct imaging of stars and systems with space-based telescopes like the Hubble Space Telescope and Chandra X-ray observatory, and how these observations expand our understanding of stars and stellar systems across the Hertzsprung-Russell diagram. This was followed by a talk by Thomas Barnes on the use of interferometric measurement of Cepheid diameters as an important direct check on the Cepheid distance measure calibration so critical in modern cosmology. Brian Kloppenborg presented a talk on the use of interferometric imaging in the optical and infrared, and how such measurements complement photometric measurements obtained by more traditional variable star observation. We note especially that Brian was a member of the team that made interferometric observations of the ϵ Aurigae system that proved so strikingly the eclipse of the primary star by a large disk around the secondary. Angela Speck gave a talk on the critically important role that stars play in the evolution of the interstellar

medium. She highlighted recent results on mass loss from AGB stars and the properties of interstellar medium surrounding them, gained from observations with new and greatly-improved infrared instrumentation on the ground and in space. Finally, Sam Ragland ended the session with a talk on how optical and near-infrared interferometry are allowing us to probe structure in AGB star atmospheres. Ragland and collaborators have made a number of fascinating discoveries in recent years, including the remarkable one that most if not all Miras show asymmetries suggestive of large-scale photometric variations in their photospheres. New techniques in imaging these stars will provide new insight in this important phase of stellar evolution.

I hope that attendees took at least two things away from these sessions beyond the specific projects outlined here. First, there is an enormous amount of astrophysics left to be learned “at the bright end.” While the technological capabilities of astrophysics continue to expand, there remains a great deal of extraordinary science to be done with “ordinary” instrumentation that is within the means of a far larger pool of researchers than major research facilities can serve. Second, the professional and amateur research communities can and do complement one another in the modern era, just as they always have. Fundamentally the amateur community continues to provide support to the professional research community by providing things like long-term observations of variable stars. However, what has changed more recently is the capability of the amateur community to innovate and become more directly involved in specific research projects, either in collaboration with individual professionals or through novel research programs of their own. There remains a great deal of room for observers at all levels—from casual amateurs enjoying an evening outside under the stars to dedicated amateur researchers pursuing their own astrophysical questions—to contribute to variable star astrophysics in the modern era. The community of variable star astronomers remains a diverse and thriving one.

I would like to extend my thanks to all of the speakers who were willing to contribute to these sessions and present their work and ideas to a diverse audience. I would also like to thank the two people who assisted with the planning and scheduling of these sessions, Dr. Lee Anne Willson of Iowa State University, and Dr. Christine Jones-Forman of the Harvard-Smithsonian Center for Astrophysics. I am greatly indebted to all of you.