Abstracts of Papers and Posters Presented at the AAVSO Symposium on Mira Stars, Held in Cambridge, Massachusetts, April 26, 2004

The Mira Imaging Project: Near-IR VLBA, and Thermal-IR (paper)

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Abstract Interferometer observations in three wavelength regions can tell us about out flow from Mira stars as ejected material moves farther and farther from the star, and changes its state. In the near-infrared we see the photosphere, in radio we see SiO masers in a surrounding shell, and in the thermal-infrared we see dust condensations in an even-larger shell. Three interferometers, IOTA, VLA, and ISI, can now give us imaging information on Miras, using closure-phase methods. The Mira Imaging Project is a cooperative observational program which promises to combine the results from these interferometers to give us a new picture of how mass is ejected from Mira stars.

Miras and Their Companions (paper)

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Abstract I present recent results from multi-wavelength studies of Miras and their companions. These include the prototype of the Mira-type variables—Mira A (o Cet, Mira)—and its accreting companion Mira B (V2 Cet). The Mira AB interacting binary provides an ideal laboratory for studying mass loss and accretion processes in systems containing an AGB star and a compact accretor, because it is one of the few wind accreting systems in which the components have been resolved and can be studied individually. I highlight here results fromour long term study of accretion processes in this system including recent surprises. I also discuss future prospects of resolving and studying Mira-type stars and their companions using ultra-high resolution at UV wavelengths.

Planets in the Winds of Dying Stars: Detection by Photometry and the Fates of the Planets in Our Solar System (paper)

Lee Anne Willson
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Abstract From models for mass loss from pulsating Mira variables we know quite a bit about the conditions that planets will encounter when their stars reach the end of the AGB and the final mass loss epoch. I present some calculations and some speculations about the fates of planets like those in our solar system and discuss the conditions needed to detect the presence of planets at that stage of stellar evolution by photometric means.

Mira Data in the AAVSO International Database (paper)

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Abstract The AAVSO International Database contains observations of several thousand variable stars, with light curves spanning over a century for some objects. Among these are many Mira variables, one of the most popular types of variable star in the AAVSO observing program. Over 1,500 Miras are officially in our program, and several hundred of these are well-observed. As a result of the AAVSO Validation Project, most of these data are validated and available from our website by the astronomical community.

The AAVSO International Database continues to grow on a daily basis. Our observer community also continues to grow, as do the number of stars observed and the sophistication and power of the equipment available to our observers. Many of our observers can now perform calibrated, multiwavelength photometry, and the AAVSO has begun a pilot program to distribute near-infrared photometers to our observers, adding J- and H-band photometry to our menu of available data for some stars. Our ability to study the Mira variables will only improve as light curves grow longer and increase in photometric precision, depth, and spectral coverage.

Long-term light curves have many applications in the study of Mira variables, from the refinement of periods and detection of multiperiodicity, to the measurement of real-time evolution. Because they lie on the asymptotic giant branch, Mira stars are believed to occasionally undergo significant evolutionary events such as thermal pulses on timescales of hundreds or thousands of years. Light curves that span several decades to over a century now enable us to detect and measure these events. We have observed large, long-term period changes in a small percentage of stars in the AAVSO International Database. Some of these changes are likely due to thermal pulses, and we speculate on other possible causes of this interesting behavior.

Secular Evolution in Mira and Semiregular Variable Pulsations (poster)

Matthew Templeton
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Abstract The Mira and semiregular variables are pulsating stars in very advanced stages of evolution, and they exhibit a wide variety of pulsation behavior. It is suspected that a small fraction of these variables (including R Aql, R Hya, T UMi, and LX Cyg) exhibit large secular period changes because of structural readjustments from recent thermal pulses. Analysis of secular period changes and other changes in pulsation behavior may therefore be useful in studies of the evolution of these stars. The American Association of Variable Star Observers (AAVSO) International Database (ID) contains data on over 1,500 Mira and semiregular variables. Data for these stars span nearly a century in some cases, making it possible to study the evolution of the pulsation behavior over time. We present preliminary results of a study of period change in these stars using data from the AAVSO ID, and discuss the consequences of our results on models of Mira and semiregular variable star evolution.

X-Ray Jets in R Aquarii (poster)

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Abstract R Aquarii is a binary with a Mira variable star and a compact companion that is accreting material from the Mira's wind. We present x-ray and radio observations of the jets in R Aqr from ROSAT, Chandra, and the VLA, showing dynamic changes in their structure over several years. The x-ray spectra of these jets also tell an interesting story about the nature of the excited regions where the x-ray emission originates as well.

9.5 Million Variable Star Observations Coming to You by 2005! (poster)

Elizabeth O. Waagen
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Abstract The AAVSO International Database contains over 11 million mostly visual observations of over 5,000 known and suspected variable stars contributed by over 6,000 observers worldwide since 1911 (the data for some stars go back earlier, even to the late 1800s).

Late AAVSO Director Janet Mattei liked to describe the AAVSO International Database as a treasure chest just waiting to be opened and explored. Not having the data validated (checked for transcription and digitization errors and quality-control checked) made accessing the "treasure" slow—and sometimes very slow—for researchers, despite our best efforts to provide the data quickly.

Of the 11+ million observations, 9.5 million are being validated by AAVSO Headquarters technical staff and released for downloading from the AAVSO website, thanks to Janet's planning and a 2-year grant from NASA. When the project (presently over 81% completed) is finished in the fall of 2004, the data will be placed on Caltech's NASA/IPAC-IRSA site and in other NASA databases so that the data are publicly available and may be used for astronomical research, education, and public outreach.

This paper addresses the questions: what is validation? why is it necessary? how is it done? and shows several examples of the "treasure" becoming available to everyone.

Abstracts of Papers and Posters Presented at the 93rd Spring Meeting of the AAVSO, Held in Berkeley, California, July 22–23, 2004

Secular Evolution in Mira Variables (paper)

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Abstract Stellar evolution theory predicts that stars on the asymptotic giant branch (AGB) undergo a series of short thermal pulses that significantly change the luminosities and masses of these stars on timescales of a few thousand years. These changes may be observable as changes in period for pulsating AGB stars such as the Mira and semiregular variables. It is known that a small fraction of these stars exhibit secular period change. In our project, we examined the light curves of 547 Mira variables from the AAVSO International Database to search for and quantify these secular changes. Approximately 10 percent of stars showed evidence of secular period change at the two-sigma level, and eight stars showed large period changes at the six-sigma level or greater. The largest measured values of dlnP/dt are consistent with those predicted to occur during thermal pulses on the AGB. A number of other stars exhibit non-monotonic period change on long timescales, the cause of which is not yet understood. In the overwhelming majority of cases, the period variations appear to be small and essentially random.

[Ed. note: The complete version of this paper has been published in the Astronomical Journal *(Vol. 130, p. 776, 2005), and is available from the author upon request.]*

BZ UMa and Var Her 04: Keeping Us Up At Night (paper)

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In 2004 the AAVSO conducted two intensive observing campaigns of peculiar cataclysmic variables. BZ UMa was observed for four nights in outburst in February and again for two nights during quiescence in April. Results (lack of superhumps) do not support its official classification as a UGSU star. Var Her 04 was discovered in late June and observed for about a month. Originally suggested as a rare UGWZ type star, its classification is also in doubt. We present early results from and lessons learned during these two campaigns.

Observing Cataclysmic Variables (paper)

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Observing techniques for cataclysmic variables (getting alerts of outbursts, performing time-series CCD observations, and measuring photometry) are discussed and several light curves are presented.

Unexpected Benefits (Preliminary Research Results From the AAVSO Chart and Sequence Teams) (paper)

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In the course of checking existing and new AAVSO charts since 2002, many questions and discrepancies have come to light regarding the basic information pertaining to many known and suspected variables.

Amateurs with training and access to publicly available databases on the Internet have been able to resolve unanswered questions as basic as the identity, position, variability, range and type of numerous variables and suspected variables.

Presented here are three interesting cases. EV Aqr, TY Sge and suspected variables in the field of U Geminorum.

The AAVSO Data Validation Project: Opening the Treasure Chest (paper)

Elizabeth O. Waagen
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The AAVSO Validation Project is a 2-year project funded by NASA to validate (check for transcription and digitization errors and perform quality-control checks) over 9.5 million variable star observations made between 1911 and 2001 by over 6,000 observers worldwide and contributed to the AAVSO International Database. When the project is completed in the fall of 2004, the data, already available on the AAVSO website, will be placed on Caltech's NASA IPAC-IRSA site and in other NASA databases so that the data are publicly available for astronomical research, education, and public outreach.

The AAVSO International Database, with its 11+ million observations going back to 1911 or earlier, was described by the late AAVSO Director Janet Mattei as

a treasure chest waiting to be opened and explored. Validation makes this exploration possible. This paper addresses the questions: what is validation? why is it necessary? how is it done? and shows several examples of the "treasure" becoming available to everyone.

William Tyler, Meet Janet: How Two Extraordinary People Made Variable Stars Accessible to the Rest of Us (paper)

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The idea of watching a point of light brighten and fade over a specific period of time is not always an "easy sell"— there are some very good amateur astronomers who have embraced the planets, comets, and deep sky observing while leaving variables alone. Like fine wines, variable star observing can be an acquired taste.

Fortunately, over the decades, some people have dedicated their careers and lives to making the field accessible to the larger community of lovers of the stars.

This presentation celebrates the work of two of these champions—William Tyler Olcott and Janet Mattei, two mentors who transformed variable star observing into a field that touches the hearts of their generations. They both combined knowledge and enthusiasm for variables with an uncanny way of reaching out to people. Variable stars would not be the field it is today were it not for the efforts of these very special astronomers.

Gamma-ray Burst Optical Afterglow Observations at Nyrölä Observatory (poster)

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The GRB team of Nyrölä Observatory has been involved with gamma-ray bursts since 1999, when the observatory joined the GRB Coordinates Network. Since then twenty GRB fields have been imaged, four of them showing optical afterglows and sixteen upper-limit observations. The observers also joined the AAVSO International High Energy Network in 2000.

The optical afterglows of GRB 000926, GRB 010222, GRB 021004, and GRB

030329 have been successfully observed. A table of all observations with delay from the burst and the magnitude or optical upper limit is presented. Fourteen GCN Circulars have been issued by the authors.

The Rice University CCD Imager for the AEOS Telescope (poster)

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We describe the details of our new versatile CCD imager (RUCCD) that has recently been constructed for use on the AEOS telescope. It is a flexible instrument capable of performing imaging photometry, spectroscopy, and polarimetry of both bright and faint sources. It will be in a permanent state of readiness for making observations. Its primary objective will be performing comprehensive studies of the early emission from gamma-ray burst counterparts. However, it will be made available to the United States Air Force and other visiting scientists. The RUCCD was successfully installed and aligned in Coudé room 6 of the AEOS 3.63m telescope at Haleakala, Maui, Hawaii on 2004 February 3-4 and several test images of astronomical objects made. Examples of two of the objects observed (Saturn and the planetary nebula NGC 2392) are presented here.

Deep Impact Mission (poster)

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The NASA Discovery mission, Deep Impact (DI), has the task of launching a 370-kg copper impactor in December, 2004, which will arrive at comet 9P/Tempel 1 in July 2005. The mission goals are to have the probe intercept the comet to create an impact crater and to dig below the evolved surface materials of this comet. Scientists will study the physics of the crater formation and the composition of the pristine interior of the comet. The comet orbit, the probe trajectory, and other details are featured to demonstrate the scientific challenges of this mission. Comet nuclei plus gas and dust tail images from past missions provide some background information.

Professionals, amateurs, and students are being encouraged to participate in the observing campaign before, during, and after the impact to support the DI scientific team. Telescope sizes, sample images for data analysis needed, and the process for participation are described. A table of visibility dates of comet 9P/Tempel 1 is shown. One example given focuses on Hawaii's students' use of Faulkes Telescope North at Haleakala Observatory on the island of Maui during the months that the comet is visible. The dynamic nature of the Deep Impact Mission will instill the excitement of 21st Century astronomy in observers worldwide.