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)

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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)

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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)

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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.