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Scientists Look at 2012: Carrying on Margaret Mayall's Legacy of Debunking Pseudoscience

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Abstract In 1941 Margaret Mayall, the future director of the AAVSO, and Harvard colleague Bart Bok authored a critical study of astrology and its impact on society entitled "Scientists Look at Astrology." They chastised the scientific community for thinking the debunking of astrology to be "below the dignity of scientists." In contrast, they opined that it is one of the duties of scientists to "inform the public about the nature and background of a current fad, such as astrology, even though to do so may be unpleasant." Fast-forward 68 years in the future, and the astronomical community now faces a pseudoscientific enemy just as insidious as astrology, yet just as ignored by the general professional and amateur community as astrology had been when Mayall and Bok took up the charge in 1941. The pseudoscience in question is the well-publicized "prediction" that the Mayan calendar will end on December 21, 2012, causing the end of civilization in concert with one of a number of possible astronomical calamities, including (but not limited to) the gravitational pull of the center of the Milky Way (somehow enhanced by an "alignment" with our solar system), the near-approach by a mythical 10th planet (often named Nibiru), large-scale damage to the planet by solar flares larger than those ever recorded, or the shifting of the earth's axis of rotation (often confused with a proposed sudden and catastrophic reversal of the earth's magnetic polarity). As a scientific and educational organization, the AAVSO and its members have a responsibility to follow in Mayall's footsteps, shining the light of reason and knowledge on the dark corners of ignorance which far too often permeate the Internet, radio and television programming, and recent films, most notably 2012. This talk will highlight some of the basic premises of the 2012 hysteria and suggest ways that the AAVSO and its members can use variable stars and the history of the AAVSO to counteract some of the astronomical misinformation which is increasingly promulgated by proponents of the 2012 pseudoscience.

The Z CamPaign

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Abstract Z Cam type dwarf novae are described as being those CVs that sometimes after an outburst do not return to their original brightness, but instead, get hung up on the way to quiescence in what is called a "standstill." If it doesn't exhibit standstills it isn't a Z Cam star. There is no strong agreement between the various CV catalogs as to which few dozen or so stars are actually Z Cam type systems. If any significant percentage of the number of Z Cams eventually proves not to be Z Cam, the remaining few represent a fairly rare and unique class of stars worthy of further investigation. We will describe a campaign to observe many of the known and suspected Z Cam stars and the science goals we hope to achieve through this campaign.

T Ursae Minoris: From Mira to ???

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Abstract T UMi is known to have decreased its period and amplitude dramatically, perhaps due to a helium shell flash. Most recently, its amplitude has dropped below the limit defining the class of Mira-type variables, and it now shows signs of multimode pulsation, the two modes having the period ratio observed in many semiregular variables. We suggest that T UMi is no longer a Mira-type variable, instead it is presently behaving like a member of the SRb class.

Variability "Profiles" for T Tauri Variables and Related Objects From AAVSO Visual Observations

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Abstract T Tauri variables are young sun-like stars in various stages of their birth. The AAVSO has accumulated observations of T Tauri variables and related objects for several decades, but only recently have some of the observations been

validated and analyzed (Percy and Palaniappan 2006 JAAVSO 35, 290). Here, we report the analysis of many additional variables, using Fourier and self-correlation analysis. A few variables showed periodic behavior, but self-correlation analysis makes it possible to construct a "variability profile"—amount of variability versus time scale—for all the stars, not just the periodic ones. We will show several examples, and discuss the significance of the results. We will discuss an interesting but spurious low-amplitude one-year periodicity which occurs in a few of the stars, and a possible spurious low-amplitude one-month periodicity.

We thank the AAVSO observers who made the measurements, the AAVSO Headquarters staff—especially Elizabeth Waagen—who validated them, and the Natural Sciences and Engineering Research Council of Canada for support.

GALEX and Optical Light Curves of LARPs

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Abstract Low Accretion Rate Polars are expected to have little to no accretion and therefore flat light curves. But GALEX and ground-based data show otherwise. I will present our UV and optical light curves of three systems (WX LMi, SDSS1031+20 and SDSS1212+01) and the results of our modeling efforts for WX LMi.

Kepler Observations of Variable Stars

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Abstract The NASA Kepler mission was launched in March 2009 and has begun science operations. While its primary goal is to detect exo-planets—particularly Earth-like planets—light curves of variable stars will be a great by-product. Kepler exo-planet target stars as well as guest observer targets are already showing a wide variety of variability from classical types to new and bizarre variables. This talk will highlight light curves of some variables already observed, focusing on a few spectacular examples, as well as discussing ways in which AAVSO members can get Kepler light curves of their very own.

Rapid Cadence Monitoring of ε Aurigae

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Abstract Rapid cadence (every 42 seconds) photometry of ε Aur in September 2009, using a V-filtered 50 mm *f*/2.8 camera lens and an SBIG ST-7E camera, does not show short period brightness variations significantly different from those of the comparison star η Aurigae. On a scale of minutes to hours, the only variations detected are attributable to scintillation and differences in atmospheric extinction.

BVRI Photometry of W Ursae Majoris Binary Systems and Lessons Learned

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Abstract Six years ago, a multi-color *BVRI* survey of W UMa binary systems was begun. This was the first time the author undertook multi-color photometry. Although he had done *V*-band photometry in the past, there were many new things he had to learn. Data of thirty-five W UMa binaries was collected on nine nights during Nov/Dec 2003 when the sky was suitable for all-sky photometry. The equipment used was an 11-inch Schmidt-Cassegrain with ST-9E camera and *BVRI* filters. Approximately 1,520 CCD images were obtained. The data then waited six years to be reduced. A major reason for the delay was overcoming procrastination in reducing this rather large data set. An efficient, accurate process had to be developed. First, Mira AL was used to extract the instrumental magnitudes. Then, the data were entered into a filemaker pro relational database where air mass values were obtained from the AAVSO web site. The final step in the reduction process was to use Minitab statistical software to transform instrumental magnitudes into standard magnitudes. Publication of the scientific results is forthcoming. This work was partially supported by a grant from NASA administered by the American Astronomical Society.

Debris Disks in the AB Doradus Moving Group

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Abstract The field of planetary science is quickly developing due to our appetite to learn more about the formation of our solar system and about planets

around other stars. After the Jovian planets formed in our own solar system, it is believed that our solar system underwent a period of high dust production. For example, our terrestrial planets are thought to have formed from collisions between planetary embryos which includes the large collision that formed our moon when our solar system was ~50 Myr. These collisions formed more dust which swirled around our sun to become a debris disk. We can apply the model here to other star systems. Collisions between planetary embryos of other star systems must also produce high dust production and the dust grains are warmed by stellar light. These dust grains emit thermal infrared radiation which can be detected using space-based infrared telescopes such as the Spitzer Space Telescope (SST). However, it is important to note that the majority of these debris disks are not spatially resolved with current telescopes.

The goal of this project was to figure out if there were any debris disks around the stars in the AB Dor moving group. In this project, the moving group AB Doradus was chosen because at 50 Myr and only 20 pc away from Earth, the stars in this association make for an extraordinary laboratory for inquiry of the end-stages of planetary formation. Data was obtained from the Spitzer Space Telescope's FEPS Legacy MIPS observations. The approach was to: 1) reduce Spitzer data to measure the brightness of the stars at 24 and 70 microns, 2) estimate the brightness of the stellar photosphere at those wavelengths and finally, 3) to look for an excess in the infrared emission which would indicate thermal radiation from dust grains. The study revealed that about 21% of the stars measured in AB Dor have debris disks. However, only the star system of HIP 18859 had an excess at both 24 and 70 microns. Therefore, only HIP 18859 is guaranteed to have a debris disk based on the result of this study.

Hawaii Student/Teacher Astronomy Research (HI STAR) Outcomes

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Abstract Outcomes of Hawaii Student/Teacher Research (HI STAR) program are: 1. Support grade 7–11 students in Hawaii to conduct authentic astronomy research projects worthy of Science Fair entry. 2. Provide HI STAR alumni pursuing science and mathematics majors in college with summer research opportunities. 3. Establish an astronomy mentoring program to support the students undertaking Science Fair projects. We will discuss how we have been able to realize these goals due to having passionate, motivated 12–16 year old students, dedicated astronomer mentors, committed parents and teachers and other supporters for our program. Our major grant funding is over, but we will continue HI STAR. We continue to expand our program. We will have our HI STAR alumnus, Mimi

Hang, now a sophomore at Mt. Holyoke College, discuss her research on Debris Disks in the AB Doradus Moving Group. She was fortunate enough to work at the Space Telescope Science Institute operated for AURA for NASA as an undergraduate researcher this past summer.

Estimate of the Limiting Magnitudes of the Harvard College Observatory Plate Collection

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Abstract This paper provides estimates of the number of plates in the Harvard College Observatory plate collection which show a given object. The estimate is a function of magnitude and sky location and is based on the analysis of 6,041 plates scanned under the "Digital Access to a Sky Century @ Harvard" program and transcriptions of 199,921 plate centers of the approximately 530,000 plates in the HCO collection. We find that the deepest plates are in the region of the Milky Way and the Magellanic Clouds.

Intrinsic Variability of Eclipsing Variable β Lyrae Measured With a Digital SLR Camera

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Abstract Continued observations of β Lyr with a DSLR camera with a standard-issue zoom lens (focal length: 55 mm; *f*/5.6) on an unguided tripod clearly show the well-known eclipse light curve where the magnitude drops about 0.6 magnitude every 12.94 days. After the eclipse light curve is subtracted the data show a definite intrinsic variability with a cycle time ~280 days. These observations were begun in June 2008 and are continuing through the present. The portability of the equipment and quick observation time should encourage many observers to make these observations while reserving telescopes for observing fainter objects. It is desired to obtain several years of similar observations of β Lyr in order to understand the cause of the intrinsic variability. The wide field of view using photographic lenses as opposed to telescopes, while advantageous for bright stars, presents special problems in obtaining suitable flat fields and measuring for atmospheric extinction. The use of electroluminescent film as a source for flat fields will be evaluated. Problems correcting for atmospheric extinction will also be discussed.

Making Good Plots With EXCEL

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Abstract Microsoft EXCEL is used by many amateur and professional astronomers for data analysis. EXCEL also has plotting capabilities which are often used in their default settings, which create plots that are hard to read and contain many violations of good style. Based on the work of Edward Tufte, I will present examples of good plots and bad plots and demonstrate how to make a good plot with Microsoft EXCEL.

Mrs. Fleming's "Q" Stars

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Abstract At Harvard in the 1890s, Williamina Fleming developed an alphabetical classification system for the photographic spectra of "normal" stars. In her system she used the letter "Q" for stars whose line patterns didn't resemble the prototypes. After she published a preliminary catalog of spectral types for more than 10,000 stars, she studied the "peculiar" stars and published several papers on them in The Harvard Circulars. This paper will present the development of her classification system and her discovery of many variable stars and novae by the peculiarities in their photographic spectra.

The Park in the Sky

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Abstract Parks in towns are favorite spots for stargazing. They commonly have open sky exposure, quiet surrounds, trees to block local lights, proximity to conveniences and transport. In New York City the prime park for astronomy is Central Park through the Top of the Lawn clear sky star viewing sessions on weekends. When a new park opens, astronomers inquire after its utility for stargazing. This was the case on Manhattan when the new High Line opened in June of 2009. But this park is a bit different than the typical center-city park. It's a park in the sky, built on an abandoned elevated railway. The slides shows High Line by day and evening to illustrate its history and features. These demonstrate how the High Line in its few months of its operation became a new habitat for stargazers on each clear evening.

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