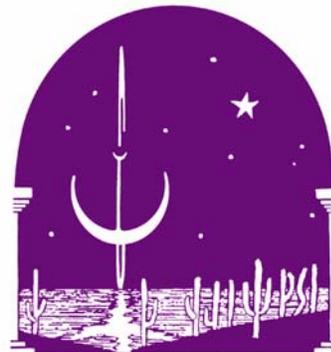

PSI NEWSLETTER

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Planetary Science Institute

PSI IS DEVELOPING A NEW COMET SURVEY

Carol Neese



From left to right: Carol Neese, Gil Esquerdo, David Levy, Carolyn Shoemaker, and Wendee Wallach-Levy

PSI will soon be surveying for and discovering comets in the inner solar system, if all goes well for the comet survey project currently under development by myself, Gil Esquerdo, and Bill Hartmann. Our project has recently joined forces with the Shoemaker-Levy Cometograph project, a comet survey being carried out by comet researchers David Levy, Carolyn Shoemaker, and Wendee Wallach-Levy at Jarnac Observatory near Vail, Arizona. Levy and Shoemaker are both members of PSI's Board of Trustees.

The PSI comet survey will use an automated 18-inch telescope and CCD to survey the area of the sky within 90 degrees of the sun. Most existing survey programs, concentrating primarily on asteroids, search the area of the sky opposite the sun, the opposition region. This is optimal for discovering asteroids but not for comets, which are brighter near the sun. The Shoemaker-Levy comet survey, which also searches the near-sun region using a 12-inch Schmidt telescope and film, searches for brighter comets over a larger area. The PSI survey covers a smaller area but is able to find fainter comets. Thus the two approaches are complementary and will benefit greatly from collaboration. The combined project is now called the Jarnac Comet Survey.

Recently, we have obtained a small grant from the Fund for Astrophysical Research for equipment to develop the project by searching for sungrazer comets. We have also submitted a proposal to the National Science Foundation for funding for the first year of the survey, including obtaining the 18-inch telescope needed. Until this telescope is acquired, we have been using PSI's 8-inch telescope and CCD as a testbed to implement all the techniques needed for the survey. We have completed automation of the telescope, data reduction, and computerized moving object detection to find comets in the data. We have also been able to make test observations with the 18-inch telescope which will eventually be acquired for the survey to characterize the expected performance of the survey system. Currently we are working with David, Carolyn, and Wendee to move our operations to Jarnac Observatory and to carry out a search for sungrazer comets as a demonstration of the capabilities of the system. Stay tuned to hear more news of the Jarnac Comet Survey as it becomes operational and begins discovering comets.

PSI SOON TO HAVE NEW DOCTOR

Steve Howell

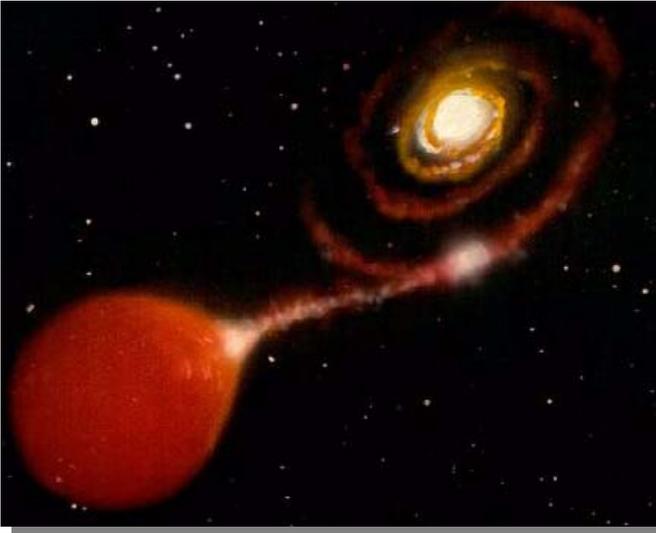
Elena Mason, a graduate student working at PSI/Tucson, will defend her Ph.D. thesis research in early April. Elena, a native of Italy, has spent the last two years working with Steve Howell on the details of accretion processes within interacting binaries. Mason has recently published two major works in the area with a third submitted for publication. These milestone papers provide a new view of accretion disk physics and will set the standard for both observation and theory to comply with for the next 5-10 years. In addition, Elena has worked on spectral modeling using ultra-violet, optical and infrared data, and methods of 2-D reconstruction of accretion disk mapping techniques, allowing detailed physics within accretion disks to be calculated.

Upon graduation in May 2001, Elena will take a well deserved vacation in Italy for a month or so before she starts her already acquired two-year fellowship position with the European Southern Observatory (ESO) in Chile. ESO is the premier observatory in the world and Elena will be performing research activities in Santiago and functional work at the Very-Large Telescope project (VLT). The VLT is a set of four, 8-m optical/IR telescopes located high in the dry, clear mountains of Chile. Elena hopes to spend many nights observing and we all hope to spend many nights visiting her. Her smile and scientific energy will be missed at PSI.



NEW TYPE OF STAR DISCOVERED

Steve Howell, Head of the Astrophysics Group at PSI/Tucson, is using the UK Infrared Telescope (UKIRT) in Hawaii to discover two examples of a kind of star never previously observed. These small, cool stars look superficially like brown dwarfs but are actually the remnants of ordinary stars that have been whittled down to cool Jupiter-sized bodies over billions of years by spilling material over to a white dwarf companion star.



An artist's conception of a very old cataclysmic variable containing a brown dwarf-like secondary star (left) and a white dwarf (right). In the case described here, the two stars orbit each other every 80 minutes or so and are only about as far apart as the Earth and Moon.

Howell led a team of astronomers that three years ago theoretically predicted that stars of this kind would exist in such binary star systems. Now, working with Dr. David Ciardi of the University of Florida and UKIRT staff scientists Chris Davis and Paul Hirst, Howell has secured the first direct observational evidence of such stars using infrared spectroscopy.

The brown dwarf-like stars residing in LL Andromedae and EF Eridani are very cool, only 1650K (1350 degrees C) and about 1300K (1000 degrees C), respectively. According to the theory which predicted them, the estimated mass of these cool stars is near .04 the mass of the Sun, or 40 times the mass of the planet Jupiter. Assuming that they give out about the same amount of radiation as more familiar young brown dwarfs, Howell estimates that both LL Andromedae and EF Eridani are between about 100 and 130 light years away - - virtually neighbors of the solar system. These newly discovered stars are probably about 8 billion years old, as old as the galaxy itself.



NEAR- Shoemaker's descent to the surface of Mars.

PSI'S INVOLVEMENT IN THE NEAR MISSION: THE ALPHA AND THE OMEGA

Don Davis

The grand finale of the Near Earth Asteroid Rendezvous-Shoemaker (NEAR-Shoemaker) mission was scheduled to be the "landing" (at the speed of about 5 ft/sec) of the spacecraft on the surface of the asteroid Eros, a Manhattan-sized chunk of rock. Surprisingly, there was an encore to the mission: the spacecraft, designed purely as orbiting platform, survived the impact and happily continued to transmit data. NEAR-Shoemaker thus gave the U.S. a first in planetary exploration, the first landed spacecraft on an asteroid. NEAR-Shoemaker had spent the previous 13 months orbiting Eros, returning a wealth of data on this body.

So, what was PSI's role in this project? Davis co-authored the first study for an asteroid orbiting mission and Eros was the Earth approaching asteroid considered by this study (Asteroid Mission Study 1979, SAIC Report 1-120-839-M11); this study even proposed the same initial orbit that was ultimately selected by the mission.

Though it took another 15 years before this paper study became reality, the scientific legacy from this mission is enormous and will greatly expand our understanding of these small asteroids. PSI scientists Neese and Davis are leading the team of scientists responsible for archiving the NEAR-Shoemaker data trove into NASA's Planetary Data System (PDS). Through the PDS, all mission data will be made available to the scientific community for study and analysis in future years. Planetary scientists will comb through this information to better understand the geology, mineralogy, and structure of the near-Earth asteroids, some of which will impact Earth in the future (distant future, we hope). Because of our space program, humanity has the opportunity to escape the fate of the dinosaurs. Hopefully, we will be wise enough to take advantage of this option.

MEET SOME OF THE VOLUNTEERS FROM OUR SAN JUAN CAPISTRANO, CA OFFICE



Peggy & Dick Kenealy. Dick is our field trip director and Peggy assists with field trips.



Connie Christensen assists with activities on the field trips.



Muriel Gustin assists with activities on the field trips.



Rochelle Whitener helps with clerical duties.



Johanna Rath assists with activities on the field trips.

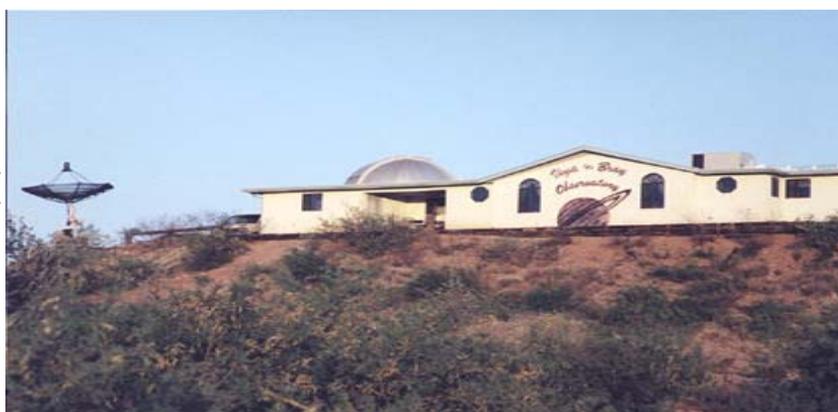


Curtis Asplund student intern.

BOARD OF TRUSTEES FIELD TRIPS

PSI hosted its 29th anniversary party in conjunction with the Board of Trustees meeting on February 16. As part of that meeting, the Board and friends were given a tour of Vega-Bray Observatory/Skywatcher's Inn in Benson, AZ. The Inn facilities are adjacent to the Vega-Bray Observatory, a privately owned amateur astronomical observatory that also houses a small science museum, classroom, and a planetarium.

This annual "Ground Hog Day" event is our favorite opportunity to greet old and new friends. The festivities started at 5:00 p.m. with food and drink from Govinda's; they boast that they are the "finest pure vegetarian restaurant" in Tucson, and as far as we are concerned, they're right! The open house was scheduled to start at 5:00 p.m. and run until 7:00 p.m. as usual; however, the revelry continued well past 9:00 p.m. because we were all having such a good time. We were fortunate to have seven out of our ten board members present at this meeting, but Bill Hartmann, Alex Berman and Wes Huntress were greatly missed this year. If you haven't been to a PSI open house, you are missing out and are hereby cordially invited. We hope to see you next year! Get on our mailing list! Contact us in CA at 949-240-2010 or in AZ at 520-622-6300 (or <http://www.psi.edu>).



Vega-Bray Observatory/Skywatcher's Inn in Benson, AZ, is owned & operated by Eduardo and Patricia Vega.

A GRAD STUDENT MINING THE SKY AT THE PLANETARY SCIENCE INSTITUTE

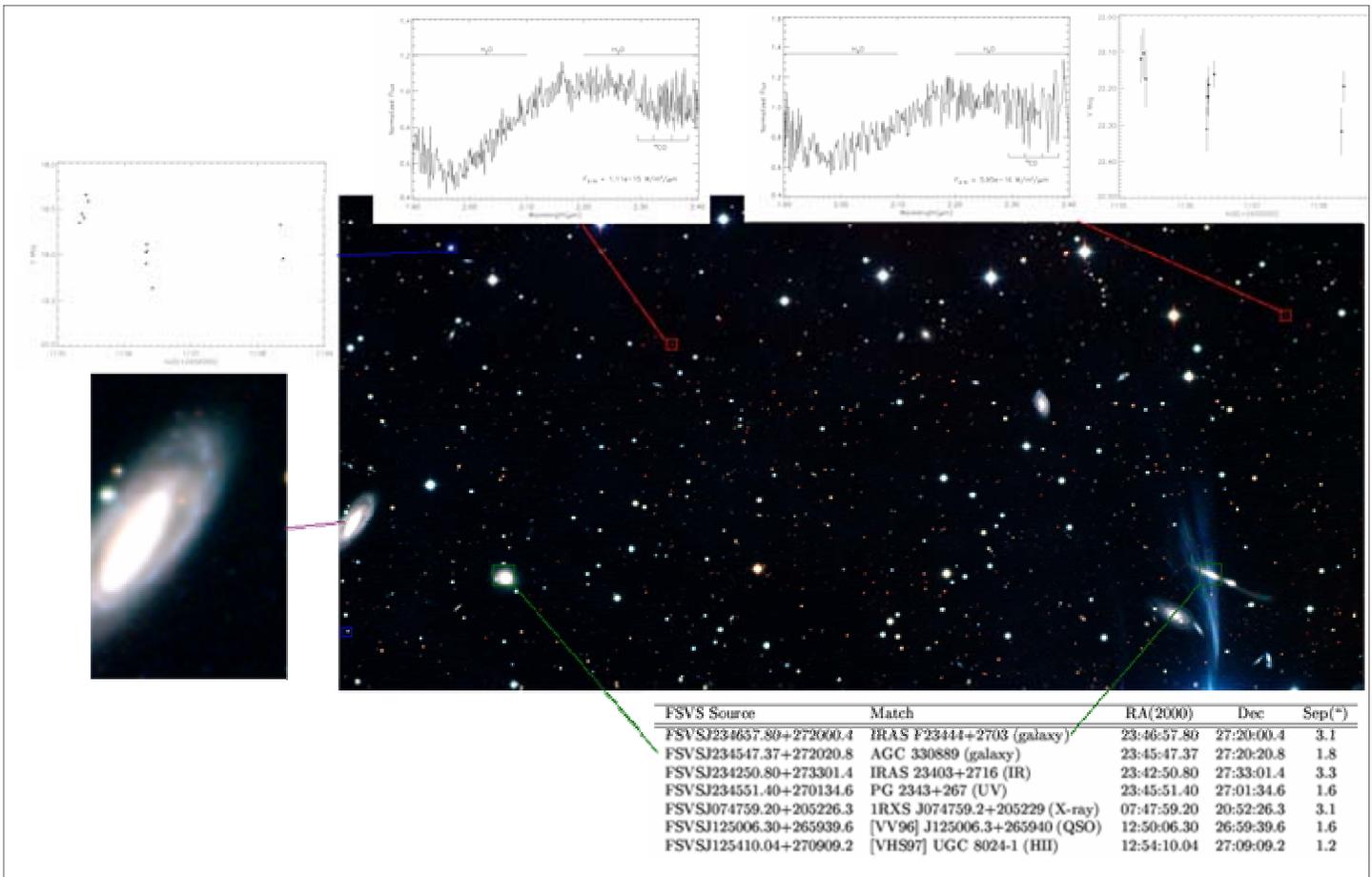
Mark Huber

In September 1999 I came to the Planetary Science Institute to continue my Ph.D. research with Steve Howell. To explain why, I need to start at the beginning of my graduate career. In the fall of 1996, I entered the graduate program at the University of Wyoming. There were several good reasons for attending the UW, principally to continue my pursuit in astronomy and physics, but warnings of certain disaster for the department were looming. I was fortunate though; I entered just before the fall, and enjoyed learning astronomy and physics from some great minds in the field.

Not more than a few hours after I had shown up at the department did I meet Steve Howell who has contagious enthusiasm. He had some data for a project to study the cataclysmic variable V592 Cas, aka Fred. Even though the project was a small one and it took me some time to publish the results, I found that I wanted to continue doing research in the field of cataclysmic variables with Howell. Then a “can of worms” was opened when Howell introduced me to an ambitious group starting the Faint Sky Variability Survey (visit the homepage at <http://www.astro.uva.nl/~fsvs/>). The primary goal of the survey is to explore the variability of faint sources to new levels using the Wide-Field Camera on the Issac Newton Telescope on La Palma. With the group literally taking the phrase “the sky’s the limit”, objects in the solar system, the solar neighborhood, the galactic disk, the galactic halo, and out to distant quasars are being studied. Since I began mining the survey, I have explored new areas of research including the search for the “missing” group of old, low-luminosity cataclysmic variables, the study of very low-mass stars/brown dwarfs and their variability, and identification of objects with just plain wacky colors.

So when Steve Howell returned to head up the Astrophysics Group at PSI/Tucson, I followed him to finish my Ph.D. research. Maybe I am a bit twisted, but I actually enjoy graduate school. For instance, having to travel to exotic mountain locations to do observations like to La Palma in the Canary Islands to use the Issac Newton Telescope for the survey and to Hawaii to use the UK Infrared Telescope to obtain spectra of very low-mass dwarf candidates is not all that bad. There are the many long days at PSI, processing, categorizing, and sifting through the gigabytes of data obtained, trying to understand what the data say about some little piece of the universe being studied, but that can be just as much fun. Of course I do want to finish my Ph.D., but is tough living as a graduate student and having all this fun.

This image is one of four CCDs from the Wide-Field Camera used for the Faint Sky Variability Survey and illustrates just a piece of the survey's potential. The



spectra on top are of two possible brown dwarfs, one showing variability in the light curve on the far upper right. In the upper left is the light curve of a faint cataclysmic variable candidate. The listing at the bottom is a sample of the type of objects that are currently being matched in the survey to other surveys.

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 Dr. Carol Neese, Staff Scientist
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Enclosed is my membership donation of \$ _____

In addition, I am making a special gift of \$ _____

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\$ 5,000.00 Supporting Member	\$200.00 Asteroid Member
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We welcome New Friends to PSI

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 Tim Hunter
 William & Carol Ellis
 William Hartmann
 Janet Whitener

Please visit our website for information on our current research projects & PSI Education Program (SJC)

www.psi.edu

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