

# starry nights



January, February, March 2003

Volume 22, Issue 1

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## The Wait is Over: We are Tax Exempt

The task of converting our club to what is known as 501(c)(3) status or tax exempt status started about two years ago when David Beine decided to break the ice with the idea of changing our status as a club. The job was a huge undertaking. It required reading through tough legal statements and filling out information about our club over its history, so research had to be done also. Later on, Jackie Mau (Secretary) took over the stack of papers. Eventually she turned to the board for assistance, which made the job slightly less cumbersome. The sheets required lists of volunteer work among other things we did as a club in the past.

By the middle of November the IRS was teasing us when they contacted Joe Carlone (President) and Sandy Dombeck (Treasurer) just to ask a few more questions, and announcing we could have the status. It took until the middle of December to get the official letter, but there in black and white, "we have determined you are exempt from federal income tax under section 501(a) on the Internal Revenue Code as an organization described in section 501(c)(3)." Now as a club we are able to receive donations and the donor can write it off on their taxes.

There is much thanks to be given to the board members Joe Carlone, Sandy Dombeck, Jackie Mau, and Tim Grunewald for their added time put toward this project. Also, we would like to thank Norman Fons for his added legal assistance. Great job guys!



# W.A.S. News and Information

## New Members

Sorry, I did not get these out sooner, when you really were new, but I had some trouble getting your names. The board appreciates your membership and we hope you will consider becoming an active member of the club, welcome aboard.

### Single Memberships

Robert Stutzer	May 2002
Aaron Ranney	May 2002
Kim Krause	May 2002
Jim Glocka	November 2002
Tristan Kloss	November 2002
Venkatesan Tangarajan	September 2002
Dan Raasch	October 2002

### Family Memberships

Marshall Teschner	May 2002
Cathy, Cynthia	
Brian Manske	November 2002
Kathy, Brandon	

## New Vice-President

The board would like to welcome Mike Nugent to the board. Mike has accepted an invitation to be the Vice-President. Thanks Mike.

### W.A.S Board of Directors and Officers

President:	Joe Carlone
Vice-President:	Mike Nugent
Secretary:	Jackie Mau
Treasurer:	Sandy Dombeck
Observatory Director:	Tim Grunewald
Newsletter Editor:	Adam Machajewski
Membership:	Greg Zuchowski
Proofreading:	Donna Grunewald
Duplication:	Greg Zuchowski
Distribution:	Charlotte & Gene DuPree

Wehr Astronomical Society  
Phone: (414) 425-8550  
<http://www.wehrastro.org>

## Thank You

This past quarter we received a club donations and the Wehr Astronomical Society would like to give thanks to the following:

Paul Richard Eells

-Mr. Eells donated a heavy duty tripod to the club.

Tom McMann

-Donated an 8 inch tube, an Equatorial Mount, and other parts

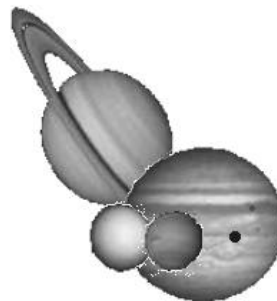


We would like to thank WITI FOX 6 Milwaukee for their support of our club over this past year. On two occasions this summer Chief Meteorologist Vince Condella had announced our observing sessions at our observatory at Froemming Park. On these two occasions we had huge turnouts of people, between 80 and 100. Also, just last November, Mr. Condella had announced our regular meeting at the Wehr Nature Center for Tim Grunewald's telescope talk, which was also received with an impressive turnout.

## Odds and Ends

Our library is missing its copy of *Starry Skies*. If you have this book we would appreciate if it was returned.

Our 6 inch telescope construction project is planned to begin in January. If you have any experience with telescope building or are interested in joining us, contact Tim Grunewald.



# Solar System News Roundup

**PLUTO (and beyond):** Pluto's status as the outermost and ninth planet is being challenged almost weekly as new Kuiper-Belt Objects (KBO) are discovered. Already an astonishing 400-plus KBOs have been identified and tracked, but it is

assumed that there are billions of planet or moon-sized KBOs out in the Belt. The latest discovery, named Quaoar, is half Pluto's diameter, and displaces the previous next-in-size holder, Varuna, which was two-fifths Pluto's diameter. In fact, none of the KBOs found yet exceed the size of even Pluto's moon Charon. Pluto is still the closest-in body, all the others being more than 4.5 billion miles away. Pluto is also the brightest, since its now-condensing atmosphere of nitrogen gas is forming a layer of ice on its surface, whereas the KBOs are as dark as charcoal with an albedo of only 4 to 7%

**NEPTUNE:** Thirteen years after Voyager 2 discovered the rings of Neptune, the singular peculiarity of these rings--that they are actually arcs and not complete rings--still has yet to be explained. All the other gas giants have full circular rings, but Neptune's arcs defy the commonly-held expectation that dust and debris circling a large planet gets spread out eventually into a complete ring. Initially it was thought that the close-in moon Galatea was responsible for the interruptions, but recent observations of the planet and the arcs by the Hubble telescope have revealed that the arc openings are not where Galatea could have caused them all. Speculation remains that there are still smaller undiscovered "shepherd" moonlets confining the dust--which would make the arcs actually curved "dumbbells."

**URANUS:** Yet still another moonlet of Uranus has been discovered: the planet's 21st. It is only between 6 and 12 miles in diameter, and has a highly elliptical and eccentric orbit, making it most likely an asteroid or KBO remnant captured by the gas giant. In keeping with the Uranian convention, the new moon will most probably be given a Shakespearean character's name.

**SATURN:** Similar to Hubble's findings about Neptune's arcs and moonlets, the space telescope has also discovered that the two shepherd moonlets in Saturn's F-Ring, Pandora and Prometheus, are not in the positions predicated for them as a result of calculations made after their discovery by Voyager 2 two decades ago. In fact they are over 100,000 miles farther along in their orbits than expected. The only explanation offered so far is that uncalculated consequences of line-ups by other close-orbiting moons, plus unforeseen effects that occur when the two shepherds exchange orbits upon overtaking each other alongside the ring, have created a "gravitic kick" that propelled them farther along.

**JUPITER:** The monarch of the planets turns out to have the same ozone-depletion problems above its North polar region that Earth suffers at its South Pole. A gigantic multiple-Earth-sized hole that is actually hexagon-shaped has been discovered by hard-working Hubble's instruments. Earth scientists studying it are actually finding useful information from it to program models for predicting our South Pole's ozone gains and losses, since Jupiter revolves so much faster than Earth, it gives them a speeded-up "video" to observe.

On another note, the Galileo spacecraft, in orbit inside the Jovian system since 1995, has finished its last task, a closeup survey of the inner satellite Amalthea on Nov. 5, when it also passed its closest to the cloudtops of Jupiter itself, skimming past only 90,000 miles away, and receiving a near-lethal dose of radiation as a reward. With its extended seven-year-long task of mapping the Jovian system now finally finished, Galileo is poised to plunge into Jupiter's atmosphere in September of 2003, a maneuver planned to prevent any possible contamination with its radioactive components of Jupiter's moons--especially potential life-bearing Europa and its shelled ocean.

#### **ASTEROIDS & COMETS:**

**EROS:** One of the mysteries of this probed asteroid was why the thousands of photos taken by the NEAR-Shoemaker probe revealed almost no small craters--unlike our Moon where crater sizes continue on down to the microscopic. Now a new analysis of the photo data reveals a possible answer: seismic shaking. When large impacts were made on Eros, the shock waves reverberated back and forth throughout the small 21-mile-long body, causing the tiny crater walls to crumble and settle--like flour in a bowl would do upon shaking. This also probably accounted for another phenomenon: the flat "silted-up" floors of the larger craters, wherein the same seismic shaking caused crater-wall debris to sift on down to their floors.

**ANNEFRANK:** On its way to visit the Comet Wild-2 in 2004, (to collect comet dust to return to Earth,) the Stardust deep-space probe on Nov. 4 sailed past this tiny (2.5-mile diameter) asteroid and snapped a few pictures; nothing new or unusual was revealed of a typical asteroid's surface, however.

**BORRELLY:** Yet still another deep-space probe, this one the Deep-Space-1 mission, (which tested

ion-engine drive in deep space,) has added to its unplanned achievements by photographing the 5-mile-long Comet Borrelly with the closest-ever pictures taken of a cometary surface. The stunning photos reveal a combination of rolling, pitted terrain, giant mesas, and dark, smooth plains, while emerging from the later were seen jets of dust and gas, shooting dozens of miles out into space. These jets are not the usual cometary tails--which point away from the Sun--but rather the opposite, pointing towards the Sun; undoubtedly they are caused by sunlight heating up fragile frozen surface areas and causing the gases thus sublimated to expand and gush forth. The conclusion by astronomers viewing the pictures and the data is that comets--and by inference other Kuiper-Belt Objects--should no longer be considered "dirty iceballs," but rather "icy dirtballs," since their extremely dark surfaces (less than 4% albedo,) contain less frozen water than originally thought.

**MARS:** The first mass amount of data from the Mars Odyssey spacecraft's first six weeks in orbit has now been released, showing among other discoveries, the huge amounts of water contained just under the surface in many parts of the Red Planet, radiation amounts and temperatures gradients across the surface, amongst other data. Meanwhile, future exploration of the surface has been given a boost with the successful testing of two important devices: the new improved Rover's instruments and cameras, scheduled to be landed on Mars in 2004, and the MarsFlyer. The latter is a half-scale version of a future aircraft that will be sent into Mars' atmosphere for close-in surveying and photographing. In the MarsFlyer test, a high-altitude balloon took the model up to a 19-mile height, (in order to test its operation in the same thin atmosphere that exists on Mars,) released the aircraft from an aeroshell, whereupon the flyer unfolded and spread its wings and tail, then proceeded to coast back to Earth in a 90-minute pre-programmed sequence of events. The MarsFlyer model was unpowered, but its full-scale progeny will be powered across Martian skies by a hydrazine rocket engine.

**EARTH:** In an amusing note--to Western minds, but not to its Korean creators--Korea Telecom has named its fourth communications satellite Koreasat 5, skipping the number 4. This is because in oriental languages employing the Chinese pronunciation of numbers, 4 is pronounced "shih" which is also the sound for the word "death." But

before we snigger too much at this, it should be pointed out that GE Americom went from GE-12 to GE-14 for its satellites--thus avoiding the use of the number 13 . . .

Jay E. Wichmann



## Review of ST-237A CCD camera

### INTRODUCTION

I have recently started doing CCD imaging with my 6" Maksutov-Newtonian telescope. In addition to it being an exciting new field to learn, astrophotography has allowed me to "observe" objects that are barely visible through the telescope from my light polluted backyard. Here's why I chose the SBIG ST-237A camera:

- ★ Good for both deep sky objects and planetary imaging.
- ★ Short back focus. Needed for my telescope.
- ★ Reasonable price for an astronomical CCD camera(\$1300)
- ★ Good company reputation
- ★ Light weight
- ★ Fairly fast computer interface
- ★ Good resolution: 657x495 pixels
- ★ Color capable with optional color wheel
- ★ High sensitivity

This camera has, so far, fulfilled my expectations.

Astronomical imaging can be done with a bewildering array of equipment. This includes film photography, conventional digital cameras, digital video cameras, and dedicated CCD cameras. I've seen extremely good planetary images taken with video cameras by stacking hundreds of individual images, but video cameras are not very good for imaging the dim deep sky objects (DSO's) such as nebulae and galaxies. Conventional digital cameras have similar limitations.

Film photography has been the amateur's option of choice until about 10 years ago, when the CCD camera became readily available. Film can capture remarkable DSO and planetary images, but it has significant drawbacks. These include low sensitivity requiring long exposures, delayed

feedback due to the development process, recurring costs for film and processing, high sensitivity to light pollution, and non-linear response to light.

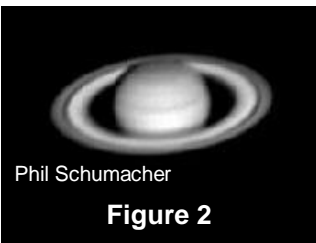
The CCD camera overcomes all of these limitations, but, of course, it has some of its own. The main advantage is the near instantaneous feedback. It's easy to see if the exposure is correct, if the focus is good, and if the telescope is aimed at the object. The CCD camera is also up to 100 times more sensitive than film, so that a galaxy, for instance, may need a few minutes of exposure instead of an hour or more. This demands less of the mount, and my patience.



Phil Schumacher  
**Figure 1- ST237A Camera (Left)**

**SETUP AND USE**

The camera consists of a head unit and an interface box. The head unit is shown in Figure 1 attached to a Nikon camera lens. The head unit attaches to the interface box, which connects to the parallel port of the computer. The camera is useless without a computer. There are no controls or setting on the camera or interface box; everything is set though the computer. The head unit comes with a 1-1/4" nosepiece which inserts into the telescope's focuser. The head unit weights about 1 pound, which should not be a problem for most telescopes.



Phil Schumacher  
**Figure 2**

The scope should be rebalance for most accurate tracking.

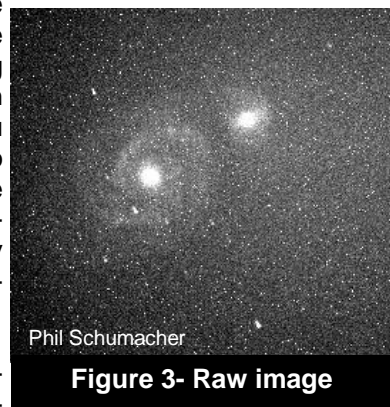
The camera comes with several camera control and image processing programs. The main program is called CCDSOFT by SBIG and Software Bisque. It operates the camera, regulates the CCD chip temperature, exposes and saves a series of images, does dark frame subtraction (to reduce noise speckles), aligns and combines images, and a lot more. It comes with a 300+ page manual on disk. Also included is PlanetMaster, which takes repeated images of the planet showing the current image on the left and the sharpest image on the right, using a split screen. This allows getting the best image when the sky is unsteady. I took the image of Saturn in Figure 2

with the aid of this program.

**DEEP SKY IMAGING**

Imaging dim deep sky objects has several challenges. The object must be found, and positioned on the small CCD chip, even though the object may not be visible through the telescope with the naked eye. The camera must be accurately focused, and the telescope's mount must track the object through the sky during the exposure. *The Handbook of Astronomical Image Processing* calls these the 3 F's: Finding, Focusing, and Following.

The camera's imaging area is 4.7 x 3.6 mm. With my telescope this gives a 18 arc-minute field of view, less than 1/3 the width of the Moon. The object you are imaging needs to be centered in this area, even if you can't see it. An ability to read star charts, or have an accurate GOTO system is needed to easily locate, and center the object.



Phil Schumacher  
**Figure 3- Raw image**

This camera does a surprisingly good job of capturing dim DSO's even in my light polluted backyard. After locating the galaxy M51 (with considerable effort), I took a 15-second exposure, and saw the spiral arms! I've never seen them through even a large telescope at a dark site. I then took ten 30-second exposures. One of the raw exposures can be seen in Figure 3.

This image has a lot of speckles of thermal noise. These are removed by taking an equal length exposure with the shutter closed. This is called a *dark frame*, and is subtracted from the raw image. Ten sets of these were combined to make the final image in Figure 4. Doing a long exposure requires cooling the CCD chip down to low temperature to reduce the thermally generated noise. The camera does this with an electronic cooler. For these images of M51, I had it set to -15°C. Without cooling the CCD, the image would be much grainier.

Achieving good focus can be difficult. The software has a special mode for focusing, where a small area of the image is updated rapidly while you adjust the focus. This is best done on a

not-too-bright star. The program also displays a sharpness value, and a graph of how it has been changing.

During the 30-second exposure the mount must keep the image very accurately on the CCD chip while the earth rotates. An image pixel is 0.0074 mm across, and you don't want the image to drift more than about twice this amount, ideally less than 1 pixel. This requires a very accurate mount that is very well polar aligned. The telescope also needs to be properly balanced, a little heavy to the East. With my mount (a Losmandy German equatorial mount), I can do about 60 seconds at full resolution. Even then I will throw away a number of raw images due to stars streaking. It's best to take twice as many as you think you need. A longer exposure can be taken, but the telescope would need to be guided, either manually or by use of an autoguider. Guiding is the process of minutely adjusting the telescope's position to keep a guide star in a fixed location. This can be tedious, and requires special equipment. Autoguiding uses a CCD chip to automatically control the mount to keep the

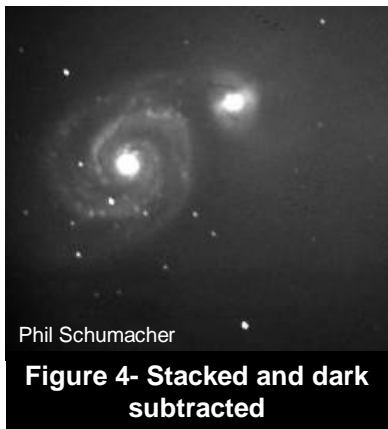
guide star fixed. More about this later. *The Handbook of Astronomical Image Processing* is a very good source for all of these concepts and much more. It also comes with a CD-ROM containing quite good image processing software.

**IMAGE PROCESSING**

The look of the final image depends ultimately on how it is processed.

The computer monitor cannot display all of the information contained in the image. The image needs to be adjusted to match the capabilities of the display device. This is done by adjusting the contrast, brightness, black level and white level. Adjusting the black level sets all of the light pollution and other sky glow to black, thus eliminating it.

The image can also be enhanced by increasing the sharpness, or filtering out noise and graininess. Planetary images normally need to have the sharpness and contrast increased. With deep sky images, usually the midlevel tones are enhanced to show nebulosity, or galaxy detail, while letting the brighter stars become overexposed.



Phil Schumacher

**Figure 4- Stacked and dark subtracted**

**AUTOGUIDING**

In addition to taking photos, the ST-237A CCD camera can act as an autoguider. In this mode, the telescope is aimed at a suitable star near the object of interest, then the CCD is commanded to keep the telescope locked on this star for the duration of the exposure. It does so by taking an image every second or so and telling the telescope mount to move a small amount to correct for any movement. Unfortunately, this camera cannot take an exposure and autoguide at the same time. Another camera, either film or CCD, will be needed. The more expensive SBIG cameras have 2 CCD chips to allow them to do both autoguiding

and imaging. I did try this feature out, and it worked quite well. It held the guide star centered to within a fraction of a pixel for the several minutes that I tried it. It also generated a report of the corrections that it made. I then disconnected the command cable to the mount to prevent it from correcting the drift. The data from this can be used to graph how good the mount can track on its own.

**CONCLUSIONS**

The ST-237A CCD camera is a good compromise in features and abilities for my needs. It works pretty well with my 6" Mak-Newton telescope for both planetary and deep sky photography. In the future I expect to get the optional color wheel and attempt color imaging. This is more time consuming, but should be worth the effort. The supplied software can automate the color imaging process.

Phil Schumacher



**REFERENCES**

**Books:**

- ★ *\*The Handbook of Astronomical Image Processing* by Richard Berry and James Burnell
- ★ *CCD Astronomy*, by Christian Buil
- ★ *The CCD Camera Cookbook*, by R. Berry, V. Kanto, and J. Munger

**Web Sites:**

- ★ CCD camera manufacturer [www.sbig.com](http://www.sbig.com)
- ★ Telescope and CCD dealer [www.buytelescopes.com](http://www.buytelescopes.com)
- ★ Internet discussion group [sci.astro.amatuer](http://sci.astro.amatuer)
- ★ Internet discussion group [sci.astro.ccd-imaging](http://sci.astro.ccd-imaging)
- ★ Yahoo group for camera maker [groups.yahoo.com/sbig](http://groups.yahoo.com/sbig)



# SCHEDULED ACTIVITIES

FOR

## The Wehr Astronomical Society

<http://www.wehrastro.org>

### Regular Meetings

(Free and Open to the Public)



**Tuesday, January 14, 2003 at 7:00 p.m.**

At the Wehr Nature Center

Talk on Space Science: Patrick Huth, an Aerospace Education specialist

NASA Glen Center in Ohio



**Tuesday, February 11, 2003 at 7:00 p.m.**

At the Wehr Nature Center

Program on Searching Galaxy Clusters: Pamela Gay,

Associate Editor Astronomy Magazine



**Tuesday, March 11, 2003 at 7:00 p.m.**

At the Wehr Nature Center

Life & Extraterrestrial Intelligence in the Universe: Dr. Joe Obi Otu,

Univ. of Wisc. At Waukesha and Madison

### Observatory Activities

(Free and Open to the Public)

January 10	7:00	Observing the moon and deep sky objects See a 1 <sup>st</sup> quarter moon and the brighter deep sky objects. See Jupiter (GRS transit 11:51pm) and Saturn.
January 24	7:00	Deep sky observing Locate Taurus the Bull and the Pleiades. See Jupiter (Io shadow transit 7:30pm, Europa shadow transit 9:05pm) and Saturn.
February 7	7:00	Observing the moon and deep sky objects See a 1 <sup>st</sup> quarter moon and the brighter deep sky objects. See Jupiter (closest to Earth Feb 2 <sup>nd</sup> . Io shadow transit 11:14pm) and Saturn.
February 21	7:00	Deep sky observing Locate Orion the Hunter. See Jupiter (GRS transit 6:26pm) and Saturn.
March 7	7:00	Observing the moon and deep sky objects See a crescent moon and the brighter deep sky objects. See Jupiter (GRS transit 7:58pm) and Saturn.
March 21	7:00	Deep sky observing Locate Gemini, the Twins. See Jupiter (GRS transit 9:30pm) and Saturn.

Note: All observatory dates fall on a Friday, and are held at Froemming Park.  
GRS transit: When Jupiter's Great Red Spot is in the middle of the planet.  
The GRS is visible 1 hour before and after this time.