



The
Webfooted Astronomer

January 2003

2003 Annual SAS Banquet Jan. 11

By Gerald West

2003 Annual SAS Banquet

Jim Evans
Professor

University of Puget Sound

"Material Culture of Ancient Greek
Astronomy"

Saturday, Jan. 11
6 p.m.

Yankee Grill and Roaster
5300 24th Avenue NW
Ballard

Door Prizes

Awards

Roast Prime Rib, Filet of Salmon or
Vegetarian Entrée

THE 2003 Annual Seattle
Astronomical Society
Banquet will be held at 6
p.m on Saturday, Jan. 11, at
the Yankee Grill and Roaster
in Ballard.

Our speaker will be Jim Evans,
professor of physics at the Uni-
versity of Puget Sound. He will
discuss "Material Culture of
Ancient Greek Astronomy."
He will talk about ancient in-
struments, sundials and objects
with a symbolic value for as-
tronomers.

As in past years, we'll also
have lots of door prizes and
awards.

The cost is \$33 and you must RSVP by Jan. 6 to Gerald W. West, 9109
27th NW, Seattle, WA 98117-2840.

Be sure to write or print the word "banquet" on the lower left hand side
of your envelope. Make your checks out to the Seattle Astronomical
Society.

Indicate on your check whether you want Salmon or Prime Rib or
Vegetarian.

Seattle Astronomical Society

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Poor Man's CCD Astrophotography: A Brief Introduction

By Tom Gwilym

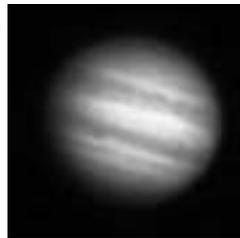
ALMOST 2 years ago, I got back into the astronomy hobby after about a 12-year gap, which I blame on my wobbly old Tasco refractor—you know the type! I got my \$300 tax refund from George W. and figured that would be a good start for paying for a new telescope. I found a good deal on EBay for a Meade ETX90EC, which I used for 7 months before I got a case of aperture fever that could only be cured with an 8-inch Meade LX90.

Shortly after I got the ETX90, I found some interesting Web sites of photos taken with a telescope using an inexpensive webcam. After seeing that some photos I took with the Quickcam VC looked pretty good, I set out on an EBay quest for the camera, which I found for about \$20. It turns out that a plastic 35mm Fuji Film canister is just about the perfect size for a 1.25-inch eyepiece adapter when cut and glued on the camera (after the camera optics have been removed and the CCD is exposed). After a lot of frustrating evenings learning to use the camera on the telescope, I finally figured out how to get the telescope aimed so I could get the image lined up on the CCD. Then I added my 2x Barlow, and had to learn all over again!



I then captured the images as a short .avi video and saved them to the laptop computer for later processing. Here is one of my better Saturn shots with the ETX90 and Quickcam.

I fooled around with that camera for a while, then did some experimenting with the Creative Labs Webcam Pro using the same method, and captured this image of Jupiter. I should note the Saturn image is made up of 68 stacked images, and 82 for Jupiter — more on that later. I never did get around to trying any deep sky images with this scope, I was having too much fun with the planets!

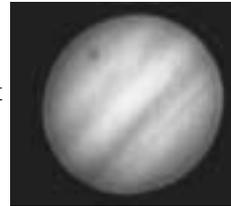


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CCD (Continued from page 3)

By this time I was itching for a bigger mirror and a more serious telescope, so I sold the ETX and bought the LX90. After reading more information on the Internet about the cheap cameras, I bought a Philips Vesta Pro camera. (The Vesta Pro and the ToU-cam are probably the most popular of the webcams used for this kind of photo work – they are just getting kind of hard to find). I figured it was time to do this right, so I ordered a thing called a “Mogg Adaptor”. This is a plastic adaptor that is threaded on one end to nicely fit the threads on the webcam where the lens unscrews. It’s named Mogg, after the guy that makes them – Steven Mogg. He sells them for between \$15 and \$20 depending if you want it threaded for filters or not.

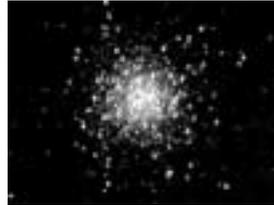
I somehow managed to avoid the curse of new telescope equipment and found clear skies the day after my LX90 arrived. My first target with the new scope was Jupiter, and I even got lucky and caught a moon shadow and a very dim GRS. I spent all of last winter practicing on the planets until they got too



low in the sky to get a good clear shot. The planetary season is back again – so are the clouds – but I managed to recently capture this image of Saturn from just outside the front door of my condo.

When the planetary season was over, I decided to try to do the modification to my camera to allow for long exposures. There are several different options for the modification of the camera: long exposure, long exposure with amp-off, and long exposure with amp-off and cooled. The basic long exposure modification is fairly simple to do if you have some good soldering skills, a sharp Exacto knife, about \$10 worth of Radio Shack parts, and a lot of patience. My first modification was just the basic camera with the long exposure modification. The camera then becomes a “Vesta Pro SC,” the “SC” is after Steve Chambers who figured out how to do this in the first place. I had a switch on the side to go back and forth from normal and SC mode. To make the long exposure work, you need to connect the camera to the USB port, and to an additional connector to the parallel port on the computer (this controls the shutter). There are several excellent free software programs that will do this (see list at end). Aiming and focusing is the same as imaging the planets, but I use a bright star (like Vega) to focus on. Then I switch to the SC mode and aim at the desired dark, dim object and start exposing. Depending on the object, I’ll try with about 15 seconds so I can just barely see the object and I

can then center it up in the scope. After that, start exposing. With the un-cooled camera, I find that I could go to about 20 seconds without too much noise. As each image is taken, it is saved to the computer frame by frame into an .avi video file. Then I would take a dark frame image and subtract the noise later. I won't go into great detail on stacking and processing since that is a whole different article itself. The photo of M13 is made up of 35 stacked images at 13 seconds each, taken from Bellevue.



Unfortunately, the CCD in the camera will get pretty noisy (lots of spots on the screen) after about 20 seconds, as well as glow from the amp in one corner. To greatly reduce the noise, you



must cool the CCD chip down while imaging and turn off the amp. For about \$20 you can buy a peltier device which will cool the camera once connected to 12 volts. It gets hot on one side (you need a heat-sink and fan) and the other side gets icy cold. Obviously, the cold part should be on the inside to cool the electronics. I removed the guts

of the camera, did the SC modification, and put together a custom made box with the cooler in the lid. The amp is turned off by connecting a switching transistor across one of the CCD chip pins. The amp can simply be turned on and off through the software. Once completed, hook the camera up and apply power to the fan/peltier cooler and after a few moments the camera will be cooled down, and very long exposures (I've only gone up to about 45 seconds so far) are possible. Most often, the dark frame image isn't even needed. Ice may form on the exposed cold metal of the camera when cooled, so watch out for moisture (and don't lick it on cool night, you may stick to it!).

This image shows the NGC7331 Galaxy which was composed of 26 stacked images of 40 seconds each, also taken from light polluted Bellevue. I haven't done much past 40 seconds even though the camera can easily do it. The main problem just now is my polar alignment. My scope will drift a bit during long exposures so I end up with a lot more bad



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CCD (Continued from page 5)

frames that I have to toss out, but of course the more frames taken, the better chance there is for good ones in the set.

Looking around the Internet I found some pretty amazing photos of the International Space Station that other amateurs have captured from ground-based telescopes and web cams. My LX90 should be able to track the station as long as the time is accurate, alignment is good, and the two line elements (Keplerian) are updated. I haven't been successful with the auto tracking yet (the scope wants to point at my feet!), but I'm still working on that. I found that using the Telrad finder and manually moving the scope while keeping the station centered usually gives good results. My first attempts were with the f/6.3 reducer on the scope (I figured this would improve my chances of capturing the station). It worked well, but the image comes out very tiny.



After many more nights of trial, error, missed passes, and forgetting to start the computer recording, I think I figured out the trick for a great ISS image. I first use a star of similar brightness to the predicted magnitude of the station that night (see Web site links below) and use that to align the Telrad finder, adjust the camera settings and most important – focus! I found that with my LX90, the following settings work well:

- Gain: 45%
- Brightness: 50% (the default setting)
- Shutter speed: 1/500th second
- Framerate: 5 fps

Have everything ready to go, and point the scope roughly in the direction the ISS will appear. Stand back, relax a few moments, make sure the computer is ready to go at the click of the mouse and wait for the station. When I see the station, I usually wait a few moments for it to get closer and higher in the sky, then start the recording and follow the station across the sky keeping it centered in the Telrad finder as best as I can. The best passes I find are when it's about -1 magnitude and almost 90 degrees straight up. It is only about 250 miles away at this point and a good view is possible. Also, if you are aiming your scope and you feel your legs are bent like a pretzel, you are crouched under your tripod and your neck is breaking—you are in the perfect position! Suffer it out for a couple minutes and the results could possibly be well worth the pain. After the pass is complete, you will have to go frame by

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frame through the .avi file and pick out the frames that contain the image of the station. A little tweaking with Photoshop or other photo editor and you could end up with a great shot. This photo is from last October during the STS-112 mission to the ISS. The truss that was installed is clearly visible on the right side as well as the station above and Atlantis docked below the station.



This is just a very brief introduction to web cam astronomy and I could tell a lot more about it, but that would take several more pages. Below is a list of some very helpful links to Web sites with more information. Please feel free to email me with questions or comments!

My Web site is at <http://www.geocities.com/tegwilym2/astrophotos>. QCUAG (Quick Cam and Unconventional Imaging Astronomy Group): <http://www.astrabio.demon.co.uk/QCUAG/>. Astrocam: <http://www.astrocam.org/>.

Steve Chamber's (the inventor of the mod) modification site: <http://home.clara.net/smunch/wintro.htm>. Steven Mogg (he makes the webcam adaptors): <http://webcaddy.com.au/astro/adapter.htm>.

Heavens-Above – very good site for satellite and ISS tracking: <http://www.heavens-above.com>.

K3CCDTools – great image capture software and image stacker: <http://www.pk3.org/K3CCDTools/>

Registax – one of the best image staking programs I have come across: <http://aberrator.astronomy.net/registax/index.html>

Help Wanted: Newsletter Editor

The SAS is recruiting a newsletter editor. If you're interested in taking on this important and fun job, contact Laurie Moloney at saseditor@hotmail.com or 206-772-3635.

The job entails soliciting and editing articles, occasionally some writing, laying out the newsletter (the club will provide you with a copy of Microsoft Publisher), taking it to and from the printer, preparing it for mailing and delivering it to the circulation managers for mailing. Total time commitment is about 10 hours per month.

The newsletter editor receives a free SAS membership and subscription to either *Sky & Telescope* or *Astronomy* magazine.

From the President . . .

Introducing Your New President

By Stephen Van Rompaey

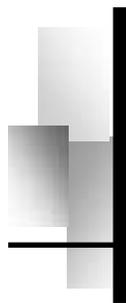
I want to take this opportunity to tell everyone a little bit about myself, my activities as an amateur astronomer, and some thoughts on what I would like to do as the club's new President. I can easily remember when I first became interested in astronomy. It was in Mrs. Lawrence's Second Grade class when she showed a film on the solar system. Back in the early 1960s there was more speculation than knowledge about the planets, but I was hooked. It was also the early days of our space program and I followed the Gemini and Apollo missions closely.

When I was about 10 years old I decided to save my allowance to buy a telescope. Of course, I got one of those infamous "department store" telescopes. I don't remember being particularly frustrated by it, because it was fine for looking at Jupiter and Saturn. I really lacked guidance and didn't know anyone else interested in telescopes, and I didn't realize that there might be a club where I could learn. I used this telescope off and on through high school and then didn't use a telescope again until the past few years.

My family and I moved to Seattle five years ago and I started attending the monthly club meetings at the University of Washington. I did that for a year and decided that I was interested enough to become a member. I began observing regularly from my backyard in Bellevue using my father-in-law's old Astroscan (4.25-inch reflector) until upgrading to an 8-inch Dobsonian reflector last year. I decided that the best way to familiarize myself with the sky and constellations was to work through the Messier list. I also realized that I needed to go to some star parties and was excited when the first star party at Poo Poo Point was announced for August 2001.

Many of you already know that I had the misfortune to be locked in at Tiger Mountain that night, but it was also a great night of observing for me. It was the first time I had taken the Astroscan to a "dark sky" site and I was able to locate and observe 10 new Messier objects before realizing that I was up there by myself. After becoming the Poo Poo Point Keymaster (for obvious reasons) I have come to appreciate the benefits of observing at dark sky locations with experienced amateur astronomers. The goal of the Poo Poo Point star parties was to provide a monthly observing

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January 2003

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1 New Year's Day	● 2	3	4
5 AAS Public Lecture	6	7 AAS Public Lecture	8	9	☾ 10	11 Annual Banquet, 6 pm
American Astronomical Society Meeting, Seattle						
12 Astrophotography at Keith Alred's	13	14	15	16	17	○ 18 Telescope Makers at Peter Hirtle's
19	20 Martin Luther King Jr. Day	21	22	23	24	☾ 25
26	27 SAS Board	28	29	30	31	● 1

President (Continued from page 8)

event for club members at a nearby dark sky site. I saw it as an event that would bring together novices (like myself) with the more experienced members as an opportunity to learn about equipment and how to observe. Unfortunately, the road conditions on Tiger Mountain have made this site less attractive as a monthly observing event and it's still not clear if we will resume our star parties there.

In the coming months the Board will meet to decide our priorities for this year. In the short term I will work on obtaining access to alternative sites on Tiger Mountain and to develop a plan for implementing monthly star parties primarily for club members. Ideally, I want to have sites that don't require a lengthy drive, that are dark, that have a good road to accommodate passenger cars, and a place where we have a reasonable expectation of privacy. Basically, a place where I can take my family to observe with other club members and their families.

Based on my experiences these past three years as a member of the Seattle Astronomical Society, I want to conclude with a few observations. Our club is a voluntary organization and our ability to do anything rests solely on the willingness of members to give their time to the club, whether it's for a public star party, an educational outreach event, or to serve as a club officer. When Mary Ingersoll asked me to consider being President it was easy to think of reasons to say "no," but I decided to pause and think about reasons to say "yes" instead. The club currently needs a new editor for our newsletter and a new representative to the Astronomical League. Those individuals who step forward to take on these positions will receive the full support of the club and will be fully mentored through the transition. I hope that some of you who have not served in the club before will pause and seriously consider volunteering for these positions.

I will support the club's ongoing activities and work with Mary Ingersoll on the new projects she initiated during the past year. I am interested in hearing from anyone who has ideas on how the club might be improved or about resources to help the club achieve our goals. Please feel free to email or contact me by phone.

I have benefited greatly as a member of the Seattle Astronomical Society and I look forward to working on the club's behalf as your new President. I wish all of us clear skies in the coming year and I hope to meet many of you at our monthly meetings and at club events.

Enlightened by the Darkness

By Diane K. Fisher

ON the clearest of nights, I may see a dozen stars from my suburban backyard near Los Angeles. Seldom have I experienced a truly dark, clear, moonless sky. One of those times was a camping trip in Bryce Canyon, Utah. I saw millions of stars (so it seemed) and the cloud of the Milky Way streaking across the sky. It was then I glimpsed my true situation in the universe, a speck of dust clinging to a tiny stone hurtling through the darkness of a cold, infinite universe. I was awestruck by the beauty of the stars and the darkness. In the light of day, I wondered: With around 100 billion galaxies out there, why is it still so dark out there?

Until the 20th century, astronomers thought the universe was infinite. They were perplexed, though, because in an infinite universe, no matter where you look in the night sky, you should see a star. Stars should overlap each other and the sky should be blazing with light. This problem became known as "Olber's Paradox." Astronomers now realize that the universe is not infinite. A finite universe, even one with trillions of stars, wouldn't have enough stars to light up all of space.

Although a finite universe is enough to explain the darkness, the expansion of the universe also contributes. As light travels from a distant galaxy to us, the space through which the light is traveling is expanding. Therefore, the amount of energy reaching us dwindles all the time, thus causing the color of the radiation to be redshifted. The more distant the galaxy, the more redshifted the light. The largest redshift astronomers have measured comes from radiation that was emitted when the Universe was only 300,000 years old. This radiation has taken over 12 billion years to reach us and although it began as infrared radiation, it is now seen as the microwave background radiation.

GALEX (Galaxy Evolution Explorer) is a NASA space telescope that will survey the universe, including galaxies with redshifts that indicate their light has been traveling for up to 10 billion years (or 80% of the history of the universe). Read more about GALEX at www.galex.caltech.edu/.

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration. Diane K. Fisher is the developer and writer for The Space Place Web site.



Minutes

UW Students Radio Telescope

By Thomas Vaughn

THE December SAS meeting began with these general announcements: The SAS Banquet is Jan. 11 at the Yankee Grill and Roaster, Ballard.

The SAS Editor position is available. Contact Laurie Moloney for more information at saseditor@hotmail.com or 206-772-3635.

The American Astronomical Society will be meeting at the Washington State Convention Center from Jan 5–9. There is a free public lecture (associated with the AAS meeting) on Tuesday, Jan. 7, at Kane Hall (UW).

The UW Student Radio Telescope

University of Washington undergraduate students Ali, Hilary, and Megan first gave a brief history of radio astronomy, then described the UW's student radio telescope program.

In 1928 a Bell Labs researcher, Karl Jansky, was working on wireless transmission for cross-Atlantic communications. He found that one source of static was not due to terrestrial origins, but instead came from outer space. By observing the constant hiss over time, he discovered that its source was the center of the Milky Way. Bell Labs cut off his research, since they had all they wanted to know about the state.

Grote Roemer, an engineer in Indiana, read about Jansky's discovery and built his own telescope in his back yard. In 1937 he put together the first radio contour map of the Milky Way.

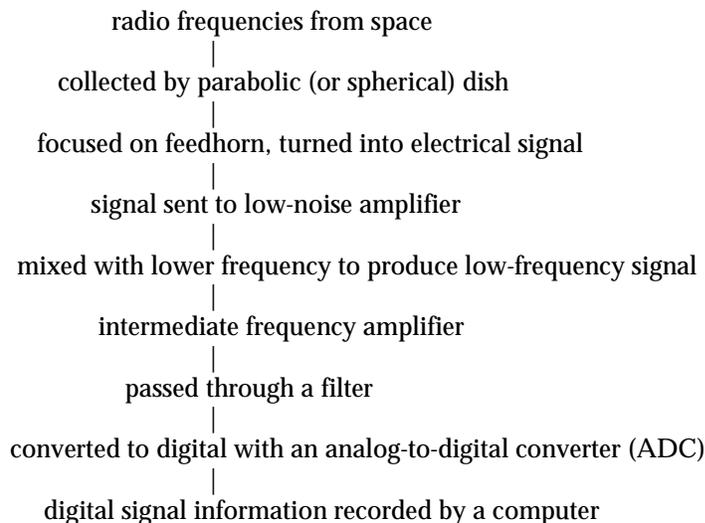
In 1945, the great astronomer Oort and his graduate student Van de Hulst predicted that the 21 cm line of hydrogen should be a strong signal for radio telescopes to hone in on. Radio astronomers tried for years, but could not see the signal. Finally in 1951 Harold Ewen put together a new type of radio receiver, based on a frequency switching technique to cancel out background noise. Within a year he had successfully detected the 21 cm line, something Oort's team in the Netherlands had been unable to do. Once Oort's team tried Ewen's frequency switching technique, they also observed the line.

In 1963, the next great discovery was the cosmic microwave background. Two Bell Labs engineers, Penzias and Wilson, were using an ultra-sensitive microwave receiving system to study radio emis-

sions from the Milky Way. They found a constant source of microwave static, from all over the sky. They assumed the problem was with their equipment, and spent many long months troubleshooting their gear before learning of recent predictions by cosmologists that if the Big Bang theory was correct, the universe should have a constant microwave radiation background. Their serendipitous discovery earned them a Nobel prize, and provided the final piece of evidence that destroyed the Steady State theory of cosmology.

The bigger the dish, the greater the sensitivity of the radio telescope. However, by using interferometry, one can place many small dishes some distance apart, and achieve the same effect as a single large dish. An example of this is the VLA (Very Large Array), in New Mexico. Here there are many good-sized radio dishes, which cooperate to act as a single, large radio telescope. This facility was perhaps made most famous by how it was featured in the movie *Contact*.

The large Arecibo dish in Puerto Rico is another famous radio telescope. It uses a spherical (rather than parabolic) dish. This makes gathering a signal more complicated, but allows them to pick and choose radio frequencies from very small areas of the sky. The rough schematic for a radio telescope looks like this:



The UAI (Undergraduate Astronomy Institute) was founded in established in 1999 by a group of undergraduate astronomy majors. They applied for and received a grant of \$200K to start a

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Minutes (Continued from page 13)

radio astronomy program at the UW. They acquired a dish (donated by UW TV) focused at the 1420 MHz frequency (the 21 cm line). This first dish did "drift scans," meaning it pointed passively up, and let the sky slide by as the Earth rotated. It didn't have any motors, so it couldn't move itself.

The first successful observation with the telescope was the detection of the Sun. Even without much of the required electronics, they were able to feed the rough signal from the dish into a spectrum analyzer, and observed a (small) peak when the Sun passed over the dish.

The UAI decided that a more sophisticated dish was needed, with motors and all the required electronics. They bought a 7-foot dish, again focused on the 21 cm line, and many of the electronic components. However, after buying all of the equipment, the principal students involved all graduated, and the project lay dormant for a year.

Ali, Hilary and Megan took charge of the project this year. After trying to work with the telescope for a while, they realized that in fact it was damaged. During the project hiatus, a windstorm blew the dish over, and damaged some of the support structure. There is still a lot of work to be done. The dish structure needs to be repaired. The electronics need to be set up. The software to drive the dish and collect the signals has not all been written. At the moment they are working out of a small hut, next to the telescopes on the top of the UW's Atmospheric Sciences building. Eventually they'd like more of this to be driven remotely, so they can work somewhere warmer.

The three students' main goal is to get the telescope up and running, so that future classes will be able to perform real experiments, instead of having to fix everything. Some of their proposed experiments would be to measure line-of-sight hydrogen density, or mapping of galactic rotation (by studying doppler shifts of the 21 cm line).

If you have ideas or suggestions, contact megan@u.washington.edu.

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The Seattle Astronomical Society

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