SEATTLE ASTRONOMICAL SOCIETY

The Webfooted Astronomer

December 2002

The UW Radio Astronomy Project

By Mary Ingersoll

December Meeting

Ali Hanks, Hillary Cummings, Megan Cartwright

University of Washington
Radio Astronomy Project

Wednesday, Dec. 18
7:30 p.m.

Physics-Astronomy Building
Room A102
University of Washington
Seattle

Come early at 7 p.m. for coffee and to visit with your fellow members.

Bring your slides to show after the program.

UW graduate students, Ali Hanks, Hillary Cummings and Megan Cartwright, will be the guest speakers at our Dec. 18 meeting.

They will be giving a presentation on how the UW Radio Astronomy Project got started, what they are working on right now, and what their future plans are for the telescope.

The idea for the radio telescope was first thought up about three years ago by a small group of undergraduates, who have now all graduated, that realized that the UW had no radio astronomy courses or research.

They found that the only way to make such courses available was to do the work themselves. They applied for and received a grant that enabled them to purchase the telescope and other necessary parts. The first thing they pointed it at was the Sun, and they actually saw a signal! The radio telescope has now been in use for a year and a half. Our speakers will be sharing their results and how they are presently trying to upgrade the system.

Dark Skies Northwest will hold its monthly meeting prior to the SAS meeting from 6:30-7:30 p.m. in room A216 of the Physics-Astronomy Building.

Seattle Astronomical Society

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Little Bear's Corner

Fly Me to the Moon

By Tim McKechnie

A few weeks ago I was talking to a woman at work about the Moon and the Apollo lunar missions. When she asked how many people had been to the Moon, I mechanically answered that 27 people had orbited the Moon and 12 had landed there. The moment I said it I sensed that these figures weren't right—for some reason I couldn't define. Later I realized that thousands of people have been to the Moon. I've been there myself many times and had wonderful experiences every time. Chances are that you, like myself, have also been there—every time you look at the Moon through the eyepiece of your telescope.

For the owner of a small telescope, the Moon is perhaps the perfect target. It is our closest neighbor in space and as such displays a plethora of detail even in binoculars. Some of the older books on astronomy state that in order to pursue lunar observing seriously, one must have at least a 6-inch reflector or a 4-inch refractor, but I don't believe this is true. One can have excellent views and see a great amount of subtle detail through a 4.5-inch reflector, or an 80 or 90 mm refractor or one of the many 90 to 127mm. compound instruments available these days. Two of my favorite lunar instruments are an old, old 60mm Sears refractor and a 3-inch Tasco reflector, both upgraded with 1.25-inch Orthoscopic eyepieces.

Because of its proximity, the Moon is a real place with recognizable features and directions just like areas of the Earth and so makes a great tourist attraction. Nearly everyone knows where Europe, Asia and Africa are. Many people know where to find the Great Barrier Reef, the Himalayan or Andes Mountains or Tuscany. Through a telescope, one will learn to find on the Moon the Apennine Mountains, the Marius Hills region, the Hyginus and Ariadaeus rille, the Taurus-Littrow valley and many more places of local flavor as well as the larger, well-known features. It's great fun and quite educational to relive those bygone missions, revisit the six Apollo landing sites and partake in those adventures. Here's a high school science project for you: do you know where the six Apollo mission landing sites were and why those specific sites were chosen? What have these sites showed us about the history and geology of the Moon and of our own Earth? These places are there for anyone with a telescope to visit.

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Little Bear's Corner *(Continued from page 3)*

Good eyepieces are a must. The Huygens (H and HM) and Ramsden (R and SR) type eyepieces, both .965-inch and 1.25-inch, which are commonly provided with small imported telescopes are optically quite crude and will not provide adequate performance for eye relief, contrast, resolution and field width. Modified Achromat (MA) or Kellner (K) designs will work well in focal lengths of 12mm or longer but the shorter focal lengths in these designs do not have the required optical corrections or eye relief for critical observations. For this one needs the more highly corrected designs such as the Plössl or Orthoscopic.

While the Plössl has a wider field with better correction for distortion at the edges of the field, the Orthoscopic design has better axial resolution and definition with only a slightly smaller field of view. My favorite lunar/planetary eyepiece is a University Optics 9mm Orthoscopic. By itself it provides excellent medium power views and when used with a 2x Barlow, it is my best combination for higher magnifications. Additionally, a neutral density Moon filter or a polarizer does wonders in cutting down excess light and glare to relieve eyestrain while helping to increase the contrast of subtle detail. A #12 yellow or especially a #80A medium blue filter is also helpful in this regard.

For in-depth explorations of the Moon, by all means get a good lunar atlas such as the *Atlas of the Moon* by Antonin Rukl or *Exploring the Moon through Binoculars and Small Telescopes* by Ernest Cherrington. The *Photographic Lunar Atlas* by Kuiper, et al. is perhaps the best atlas out there, but it was originally produced in the early 60s, has not been in print for some time. *Observing the Moon* by Gerald North is an excellent guide for observations of selected regions. Although his explanations of the geological processes involved to explain a couple of the observed phenomenon are somewhat dated and erroneous, it is an otherwise handy guidebook with superb sectional photos taken by the University of Arizona 1.5 meter Catalina Observatory telescope. And for a definitive but not overly technical investigation of lunar geology and the Apollo missions, I can highly recommend David M. Harland's book *Exploring the Moon* from Springer Praxis Press. This one is a terrific read and should be in every astronomers library.

Happy exploring!

2003 Seattle Astronomical Society Banquet

Saturday, Jan. 11, 2003
6 p.m.

Yankee Grill and Roaster
5300 24th Avenue NW
Ballard

Speaker: Jim Evans,
University of Puget Sound
"Material Culture of Ancient Greek Astronomy"

Door Prizes

Awards

Roast Prime Rib, Filet of Salmon or
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Black Holes: Feeling the Ripples

ASTRONOMERS have finally confirmed something they had long suspected: there *is* a super-massive black hole in the center of our Milky Way galaxy. The evidence? A star near the galactic center orbits something unseen at a top speed of 5000 km/s. Only a black hole 2 million times more massive than our Sun could cause the star to move so fast. (See the Oct. 17, 2002, issue of *Nature* for more information.)

Still, a key mystery remains. Where did the black hole come from? For that matter, where do *any* super-massive black holes come from? There is mounting evidence that such "monsters" lurk in the middles of most galaxies, yet their origin is unknown. Do they start out as tiny black holes that grow slowly, attracting material piecemeal from passing stars and clouds? Or are they born big, their mass increasing in large gulps when their host galaxy collides with another galaxy?

A new space telescope called LISA (Laser Interferometer Space Antenna) aims to find out.

Designed by scientists at NASA and the European Space Agency, LISA doesn't detect ordinary forms of electromagnetic radiation such as light or radio waves. It senses ripples in the fabric of space-time itself—gravitational waves.

LISA will study the super-massive black hole in the center of the Milky Way galaxy.

Albert Einstein first realized in 1916 that gravitational waves might exist. His equations of general relativity, which describe gravity, had solutions that reminded him of ripples on a pond. These gravity ripples travel at the speed of light and do not interact with matter. They can cross the cosmos quickly and intact.

Gravitational waves are created any time big masses spin, collide or explode. Matter crashing into a black hole, for example, would do it. So would two black holes colliding. If astronomers could monitor gravitational waves coming from a super-massive black hole, they could learn how it grows and evolves.

Unfortunately, these waves are hard to measure. If a gravitational wave traveled from the black hole at the center of our galaxy and passed through your body, it would stretch and compress you by an amount far less than the width of an atom. LISA, however, will be able to detect such tiny compressions.

LISA consists of three spacecraft flying in formation-a giant triangle 5 million km on each side. One of the spacecraft will shoot laser beams at the other two. Those two will echo the laser signal right back. By comparing the echoes to the original signal, onboard instruments can sense changes in the size of the triangle as small as 0.0000000002 meters (20 picometers).

With such sensitivity, astronomers might detect gravitational waves from all kinds of cosmic sources. The first, however, will probably be the weightiest: super-massive black holes. Will "feeling" the ripples from such objects finally solve their mystery, or lead to more questions? Only time will tell. Scientists hope to launch the LISA mission in 2011.

Time to Put Away My Red Pen . . .

After nearly 5 years as newsletter editor, it's time for me to retire. As my parents age, they are needing more of my time, so I'm stepping aside to let someone else take the newsletter to new creative heights. If you're interested in taking on this important and fun job, contact me at saseditor@hotmail.com or contact any board member.

The job entails soliciting or writing articles, laying out the newsletter with desktop publishing software (I use Microsoft Publisher and can get it for you at a discount), taking it to and from the printer, preparing it for mailing and delivering it to the circulation managers—Pat Lewis and Joanne Green, who label the newsletters and sort them for bulk mail. Total time commitment is 10–12 hours per month.

Many thanks to all the members who have contributed to the newsletter over the years. You made it easy and fun!—*Laurie Moloney*

From the President's Pen . . .

Two Great Years

By Mary Ingersoll

CONGRATULATIONS to the new board members elected into office at our November meeting. I will be moving over to the "chairman of the board" position for the next two years, and I look forward to working with President Stephen Van Rompaey, Programs VP Brian Allen, Education VP Mike Langely, Membership VP Roger Steyaert, Publicity VP Mark deRegt, Secretary Thomas Vaughan, and Treasurer Jim Peterson.

The past two years has been great working with the "old" board members. They've been a wonderful group of people who have worked vigorously for the benefit of the club. Some of these folks have been at it for many, many years in various roles. A heart full of thank-yous to: Randy Johnson, George Best, Karl & Judy Schroeder, Ron Leamon, and Greg Donohue. A special thank-you goes to Brian Allen who not only put in two years as VP Publicity, but volunteered for the Programs position at the last minute, *and* will be our banquet chairman for 2004.

Jerry West will be retiring from the banquet chairman position after our Jan. 11 banquet. He has been the organizer of the annual banquet for four years in a row. I am extremely pleased with how well he has put together our banquets, and always at the lowest possible cost to our members. (And those chilled chocolates after the dinner are especially appreciated!)

After many years as our Astronomical League representative, Loren Busch will be stepping down from that job. We are looking for a replacement at this time, so if you are interested, please contact Steve Van Rompaey.

As of the end of November the club welcomed in 98 new members, and our bank accounts are in the black. The coming year will bring with it many new opportunities and a fresh outlook as the new board gets to work. Happy Holidays to you all, and I'll see you at the banquet on Jan. 11.

Messier Certificate Award

Congratulations to Seattle Astronomical Society member Joanne N. Green for receiving her Binocular Messier Club certificate and pin from the Astronomical League. Joanne recorded observing 53 Messier objects using only binoculars.

December 2002

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3 ●	4	5	6	7
8	9	10	11 ◐	12	13	14 Green-lake, Cromwell Park Star Parties
15	16	17 Saturn at opposition	18 SAS Meeting	19 ○	20	21 Winter Solstice Tele-scope Makers
22	23	24	25 Christmas	26 ◑	27	28
29	30	31	1 New Year's Day	2	3	4

American Astronomical Society Meeting in Seattle January 5–9

THE 201st meeting of the American Astronomical Society (AAS) will be held at the Washington State Convention and Trade Center in Seattle on Jan. 5–9.

More than 2000 professional astronomers from around the world will attend. From early indications this will be the largest and one of the most exciting meetings of the AAS. There will be a variety of special events, including an address by NASA Administrator O'Keefe. Several invited talks on the latest research, four of them by UW faculty, will be presented.

Bruce Margon, a former Professor of Astronomy at UW and now the Associate Director for Science at the Space Telescope Science Institute, will give a free public lecture called "Hubble Space Telescope: Glimpsing the Birth of the Universe" on Tuesday, Jan. 7, at 8 pm in UW's Kane hall Auditorium room 130. This talk is open to everyone at no charge. See www.astro.washington.edu for more information. The talk is sponsored by the AAS' Second Century Fund and the Department of Astronomy at U.W.

The meeting registration fee for the daytime events is $225–$300, less for students. However, the AAS will be seeking volunteers to help for a couple of ½-day sessions. All meeting registration fees for daytime sessions will be waived for volunteers.

To volunteer, contact Bruce Balick, balick@astro.washington.edu, or Diana Alexander, diana@aas.org.

For more information on the conference, see For details, see http://www.aas.org/meetings/aas201/program/.

The American Astronomical Society (AAS), established 1899, is the major organization of professional astronomers in North America. The basic objective of the AAS is to promote the advancement of astronomy and closely related branches of science. The membership also includes physicists, mathematicians, geologists, engineers and others whose research interests lie within the broad spectrum of subjects now comprising contemporary astronomy.

Minutes

Now You See It, Now You Don't: The Remarkable Tale of NGC 6822

By Greg Donohue

GENERAL elections for club officers were held at the November meeting. The slate of candidates was approved by a "near unanimous" voice vote of the members in attendance. (We are always kept "honest" by at least one unnamed dissenter who fights a lonely battle to maintain the democratic ideal that "nothing should ever be unanimous"….)

Following the elections, George Best introduced the evening's speaker, Paul Hodge, University of Washington professor emeritus (http://www.astro.washington.edu/hodge/). Dr. Hodge retired from the teaching half of his position at UW just last year "so he wouldn't have to wear a tie!"

But he continues to be active, with his students and other collaborators, in many areas of research centered around the local group of galaxies. Dr. Hodge's address focused on a single local galaxy, NCG 6822, which has played a big role in astronomy, but has a somewhat mysterious and checkered past.

According to Dr. Hodge's, NGC 6822's remarkable history includes being "…an object that was discovered, and then it seemed to change its location and its characteristics. And then it seemed to disappear entirely, and it took years to figure out just what was going on with this object."

Dr. Hodge and his students have been studying this object using the Hubble Space Telescope, and Apache Point telescope. But he began by sharing the history of the object.

Originally discovered by E. E. Barnard (1857-1923) in 1884, Barnard's galaxy (it's informal designation) was the very first officially recognized external galaxy. Barnard is considered one of the greatest observational astronomers of all time. He discovered three comets before age 25, discovered Jupiter's 5th moon, Almathea, in 1892, and found, in 1916, within the boundaries of Ophiucus, the star with the fastest proper motion (LFT 1385) – now appropriately known as Barnard's star. Barnard's detailed observation of stars in and around the "gaps" in the Milky Way helped to determine that these were in fact dust lanes that obscure objects behind them. It is worth noting that "Eagle Eye" Barnard never *could* see the famous

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Martian canals reported by the likes of Percival Lowell, Giovanni Schiaparelli, and others. Of course history has vindicated Barnard in this regard, since we now know that the "canali" were only artifacts of perception. E.E. Barnard and Dr. Hodge share something in common: Dr. Hodge has been the editor of the *Astronomical Journal* for almost 20 years, and Barnard served as the journal's associate editor for almost three decades.

But returning to the main story line, NGC 6822 started out life as Barnard's *nebula*, since at the time of the object's discovery, the Milky Way galaxy was widely regarded as the entire universe, and all other objects were believed to lie within its bounds. Barnard discovered the object using his 5-inch comet finder wide-field telescope. But the object did not show up in his longer-focus 6-inch refractor. He describe the nebula as large (10-15 arcminutes), and having low surface brightness.

Though today astronomical discoveries propagate through the internet at nearly the speed of light, such was not the case not so long ago. Three years passed before someone else bothered to follow up on Barnard's announcement. In 1887 an astronomer using the 26¼-inch refractor at the University of Virginia's Leander McCormick observatory reported that Barnard's nebula was smaller, farther north, and of higher surface brightness than Barnard had described. Furthermore, it had a similar companion close by.

During this time period, John Louis Emil Dreyer (1852-1926) of Ireland's Armagh Observatory was in the process of creating the *New General Catalogue of Nebulae and Clusters of Stars* (NGC), based on Herschel's *General Catalogue*. This was an attempt to document and describe every non-stellar object in the sky. Dreyer catalogued Barnard's nebula as his 6,822nd object (hence NGC 6822), and gave it the cryptic description "vF,L,E,dif", meaning "very faint, large, extended, diffuse". In the first *Index Catalogue* (IC) that Dreyer published in 1895, he thought the brighter of the two objects reported by the Leander McCormick observatory was probably NGC 6822, though it was not precisely where Barnard had reported it being. The dimmer Leander McCormick object he designated as IC 1308, and provided the description "eF,eS,lE,gbM" – "extremely faint, extremely small, little extended, gradually brightening to the middle".

In 1898, Herbert Alonzo Howe observed this enigmatic object with the 20-inch refractor at Denver University's Chamberlain Observa-

tory. But once again, these observations failed to resolve the discrepancies of the various previous reports.

At the turn of the century, the French astronomer Guillaume Bigourdan (1851-1932) observed the area purported to contain NGC 6822 with the 12-inch refractor (F/17.2) at Paris Observatory and concluded that it did not exist.

Max Wolf (1863-1932), using the observatory at Koenigstuhl near Heidelberg, managed to take a photograph of the object in 1907. Wolf thought that NGC 6822 and IC 1308 were the tiny nebulae at the top, and that the big nebula in the lower middle was a new discovery. In fact, it was eventually given the designation IC 4895. It wasn't until 1922 that the Argentine-American astronomer Charles Dillon Perrine (1867-1951) used a series of photographs taken at the Corboba Observatory to untangle the mess. The large nebula (with the bogus designation IC 4895) was in fact Barnard's original object, NGC 6822!

The reason for all the original confusion was the many different types of telescopes used in the visual observation of NGC 6822.

A plate of NGC 6822 taken by Duncan with the 100-inch Mount Wilson telescope intrigued Edwin Hubble. Hubble went on to use the Mount Wilson scope to study Barnard's nebula. He was studying large nebulae (such as M31), and wanted to know if they were nearby clouds in the Milky Way, or something else. In point of fact, Hubble finished and published his work on NGC 6822 before finishing work on M31.

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By using the period/luminosity relationship for 11 Cepheid variables within it, Hubble determined the NGC 6822's distance to be 700,000 light years, making Barnard's nebula the very first external galaxy to have its distance accurately measured. (More accurate calibration of the period/luminosity relationship and CCD photometry now "officially" place NGC 6822 at 1.8M ly, though Dr. Hodge thinks it may be more like 1.6M ly based on recent fitting of the data.)

Modern observations of NGC 6822 have unearthed some interesting information. A 1988 Kitt Peak CCD survey found 144 gas clouds. The object Hubble called "III", is a giant stellar-wind-blown bubble. Hubble V is an area of lots of recent star formation, as is Hubble X. Both regions are ~8Ma old, and probably still forming new stars.

Studies by Dr. Hodge of potential globular clusters in NGC 6822 using the 3-meter telescope at Lick Observatory showed some of them to have the right color to be globulars, but 3 of them were too blue. Globulars in the Milky Way are all old (many billions of years). But the globulars in Barnard's galaxy have a wide range of ages, from the expected 10-15 Ba, all the way down to as young as 80Ma in the case of Hubble VI. Is NGC 6822 peculiar in this regard? It turns out that other galaxies have globulars with broad age ranges, and it is our own Milky Way galaxy that is somewhat atypical in having only old globulars.

If you care to check out this object of Dr. Hodge's affection, you can find it during summer (using a rich-field, short-focal-length scope) in NE Sagittarius. It has a visual magnitude of 9.3 and size of 20 arcminutes.

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