

THE SPECTRUM

Volume 2 Issue 1

Late Spring Edition

May/June 2000



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COULD SOMEBODY BE LISTENING ? -- PART II

In the April 2000 *Spectrum* we introduced the subject of whether radio signals from Earth could be detected by an alien civilization in another solar system. One claim often made by SETI advocates is that we could communicate with another Arecibo radio telescope located on the other side of the galaxy—about 100,000 light-years away. How does that work out for modern day transmitting and receiving equipment?

First we need to decide on the right frequency to transmit, and hope that the listener will draw the same conclusion. Using conventional wisdom, we might choose the spin-flip frequency of hydrogen at 1420 megahertz, suggested by Cocconi and Morrison more than four decades ago. At that frequency the 1000 foot Arecibo antenna has a beamwidth of about 0.042 degrees and a power gain of roughly 31 million times. A beamwidth of 0.042 degrees covers about one part in 30 million of the total angular area of the sky. Now, if the receiving antenna (which also has a beamwidth of 0.042 degrees and the same gain) intercepts the transmitted beam, and the receiver is tuned to the precise frequency of our transmission when it arrives (Doppler shifts might modify the transmitted frequency), and the listener happens to be listening at the same time the signal happens to be present, then - what will he (or she, or it) hear?

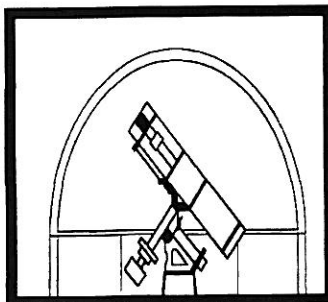
Much depends on the properties of the receiver. It was mentioned in the earlier article that noise is the antithesis of reception, and that noise can be reduced significantly by making the receiver very cold (like one degree Kelvin) and the bandwidth very narrow (like one Hertz). Both

properties, though practical, are challenging. However, a one Hertz bandwidth for both the transmitter and the receiver (the transmitter has to have a narrow bandwidth too or its power will be expended over all the frequencies in the band, and the power in each frequency will be correspondingly reduced) means that both must be on exactly the same frequency, within one Hertz out of millions. Fortunately, modern receivers used at SETI installations can process millions of narrowband frequencies simultaneously.

However, the signal will be dismally weak. At a distance of 100,000 light-years the loss of signal strength at this frequency is 455db. Translating into English, this amounts to a reduction of a billion times a billion, times a billion, times a billion, times a billion, and a little bit more.

The final, but critical parameter, is transmitter power. Way back in 1975 a 450,000 watt radar transmitter was installed at Arecibo. In fact, that was the transmitter that sent the famous message identifying us to the globular cluster, M13. While a radar transmitter may not be the best choice for "communication" for various technical reasons, it does provide a measure of what power is available. A radar transmitter sends a short pulse, then waits for a time to receive a return, so the average power is less than the peak power. Assuming the radar transmits for one-tenth of the total time, the average power output is reduced to a still formidable 45,000 watts. Since a pulsed signal spreads the energy over many dis-

Continued page 2 "listening"



Astronomy Day Saturday, May 13

The BAA will hold its annual Astronomy Day festivities on Saturday, May 13 2000 at Tift Farms (across from the small boat harbor on Furman Blvd.) Start time is 2pm into evening. There will be short talks given by BAA members, Astronomy exhibits & demonstrations, planetarium sky tours and scopes for viewing. Volunteers are needed. Astronomy Day is an event that every family member will enjoy. In addition Tift Farm will have a variety of nature experiences to share. Contact Bob Hughes for more info phone 833-2407.

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MS Word or Wordperfect ok
scanning available

**DEADLINE FOR JULY/
AUGUST ISSUE IS JUNE 15**

crete frequencies, the strongest of them will be just under 5000 watts for this example. The actual frequency of this radar was 2380 megahertz, not the 1420 megahertz we consider ideal for communication—the frequency where aliens might expect us to transmit. We may assume that if this radar can be built at 2380 megahertz, then one of comparable power could be built at 1420 megahertz. With all the factors of transmitter power, antenna gain and receiver noise taken into account, one finds that the signal to noise ratio at the receiver across the galaxy will be negative 46 db, making the receiver's noise about 40,000 times greater than the signal. With skill and determination we may be able to identify the signal when its power is equal to that of the noise. We might do even better with sophisticated signal enhancement techniques, but in light of having ignored several loss factors in this brief analysis, we shall call those enhancements and losses a wash.

So, at what distance does the signal equal the noise, the point where a reasonable chance of detection is possible? It comes out to about 520 light-years. A radio engineer will probably tell you that a better signal to noise ratio than one to one would significantly improve the chance of successful communication, and might opt for a target only half this distance. That isn't bad, there are plenty of stars within 260 light-years of us, perhaps 200,000 of them, of which maybe 10,000 are similar enough to the sun to have the potential of having planets that could harbor life.

Speaking of M13, will our message, sent a quarter of a century ago, get there in 25 thousand years or so? It will, more or less, but the chance of its being detected is less than tiny, given that an Arecibo type installation, only 500 light years distant, appears to have a problem detecting this faint signal. All this assumes that M13 will be there when the message arrives. Current thinking contends that the senders missed the target; after all M13 moves, and apparently its orbital motion around the Milky Way was not adequately taken into account. Since the entire transmission lasted only three minutes, what's the chance that "they" will be listening to 2380 megahertz when it does arrive? Besides, since when were a bunch of old, metal-poor stars good candidates to nurture life?

A popular notion is that the Earth basically "glows" from all the transmissions occurring routinely. Television is often cited as a likely inadvertent signal source because it has been around for a long time and transmits at relatively high power on many frequencies (channels).

If we consider the detectability of TV transmissions, two technical parameters have to be reviewed. First is the bandwidth of the transmission. A typical TV transmission spreads its energy over about 5 megahertz of bandwidth. A narrowband detection scheme, like SETI, would look at only a small portion of the radiated signal. Fortunately, the video carrier has a significant portion of the total energy, so this single frequency has the best chance of being detected. Sec-

Continued page 3 "listening"

FUNDRAISING OPPORTUNITY

We are trying to get a fundraising project started for the BAA, to create and sell a year 2001 calendar. This will be a 12-month calendar listing interesting astronomical facts for each day and incorporating astronomical images from members. If you are interested in donating images or original artwork to this project please contact **Bill Aquino (731-9366)**, **Alan Friedman (881-4310)**, or **Dan Marcus (773-5015)**. More information will follow once we move past the planning stage. We are hoping to have the calendars ready for sale by the September 2000 general meeting.

Bill Aquino

MEETINGS CANCELLATION POLICY

If, for any reason, (most likely snow or ice storms), there might be cause for cancellation of the meetings of the B.A.A., tune your radio to either WBEN (930) or WGR (550). Also if Buffalo State College has been closed due to inclement weather, so will the meeting of the B.A.A. be cancelled.

BEAVER MEADOW TELEPHONE

The telephone at Beaver Meadow, 716-457-3104, is for emergency use only at no cost. Local calls may be placed for a small charge - see the

collection box by the phone. This phone cannot make long distance calls.

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*Last chance!
This is it!
Now or never!
Be a hero!*

AUDUBON CENTER

*If you're a, "I'll do it when I
get around to it"—your
TUIT is above.*

Target: \$3000
Apr 23 BAA tally: \$2306
Drive ends MAY 20th



**Uncle
BAA
needs
you!!**

What's this all about:

The Buffalo Audubon Society is enlarging their main building, the Fred T. Hall building, at Beaver Meadow Environmental Center. It is nearing completion in construction but not financially. Our observatory is located there.

What do we get from Audubon?

The BAA has a 25 year relationship with the Audubon Society — a relationship that benefits both of us.

Audubon	Owns the observatory building	Paid for its initial construction in 1975
	Paid for the expansion in 1993	Funds any significant repairs
	Allows us access to the Fred T Hall building	Will allow us access to the new lavatories
	Maintains the grass and parking lot	Provides security for the facility
	Pays for the utilities	Promotes our events in their newsletters
The BAA	Operates the observatory	Holds evening public events in skywatching & astronomy
	Is open during Audubon events	Supplies maintenance labor

WOW! How can I help?

The BAA Board of Directors supports this project and is asking our membership [for the last time!] to contribute to the on-going financial support the Audubon Society needs to complete construction.

We have raised \$2306 from only about 20% of the membership as of April 23rd. A separate mailing has been sent to those we haven't heard from. **If you'd like to donate please send either that form or the one at the bottom of this page by May 15th. Thanks!!**

LET'S GET BEHIND THIS EFFORT - PLEASE ENABLE US TO ACHIEVE OUR WORTHWHILE OBJECTIVE.

But I don't use the observatory:

Some of our membership may say that they seldom use the observatory, so why support this program? Beaver Meadow Observatory is the flagship of the BAA's commitment to astronomy. It is our primary vehicle to bring astronomy to the public and to provide an advanced facility open to all members. After all - observing is the first thing that astronomy is all about. Finally, if you haven't been out there — stop by and see how far a few bucks

You bet I want to help support the Audubon expansion project!!

Contributions to the fund can be made in the name of the Buffalo Astronomical Association by mailing your checks to:

Beverly Orzechowski
125 Roycroft Blvd.
Buffalo, NY, 14226
839-9109 or 632-7091
May 15th is the deadline.

Name _____

Amount _____ Donations are tax-deductible.



Thank you!
Cheers!
Sensational!
Applause!
Standing ovation!
Splendid!
A++!
Magnificent!
Dazzling!
Bravo!
Far-out!
Super-duper!
Terrific!
Hooray!
Excellent!

"listening " cont. From page 2

ondly, since the radiation pattern of the TV transmitting antenna is designed to illuminate Earth receivers, the energy radiated into space is reduced from the total transmitted. For the purpose of simplification, we will assume that all of the energy appears in the carrier and that it is all directed into space. With a radiated power of 1/2 megawatt and operating on, say, TV channel four, the signal received by a 1000 foot antenna, located in the Alpha Centauri system, 4.5 light-years away is approximately -236dbw, or 10 to the negative 23.6 watts. (The term dbw means "decibels below one watt.") The noise power in a one Hertz bandwidth receiver, using the best technology at this frequency, is about -199 dbw. This is considerably noisier than can be achieved at higher microwave frequencies because of a contribution from galactic noise. The noise power is greater than the signal power by 37 db, making the noise about 5000 times greater than the signal, an almost impossible detection problem.

For the signal strength to equal the noise we need to move the receiver to just a little less than a tenth of a light-year from Earth. Apparently our concern that *I Love Lucy*, or other TV programs, will be detected by aliens, who might draw adverse conclusions about our civilization, are ill founded.

Another claim is that a distant civilization could determine that there is something odd about the spectrum of our sun, in that anomalous radio signals that depart from black body radiation could be detected. Those spurious signals are, of course, our own radio, TV, radar, et al. signals.

The most powerful signals in use today are radars. The highest radiated power is the Arecibo radar thanks to its high gain antenna, but it is not in continuous use. The Ballistic Missile Early Warning System, on the other hand, is in continuous use. It typically has an antenna of about 30 meters in diameter and a peak transmitter power of 15.4 megawatts at about 1400 megahertz. Its 6.5 percent duty cycle results in an average transmitter power of about one megawatt and a radiated power of roughly 250 gigawatts (250,000 megawatts)—certainly something you wouldn't want to stand in front of. Much like the Arecibo system it radiates pulses, so a narrow band receiver would see only a small portion of the radiated power—about 10 percent. Using Arecibo as a model for the receiving system, this radiated power produces an equal signal to noise ratio at a range of about 170 light years. This range is optimistic in that an equal signal to noise ratio presents a true processing nightmare. To enhance detection, a more realistic range value might be half that, or 85 light years. This still presents a usable signal to a large number of possible listeners. Remember, however, that the beamwidth is narrow, about 0.5 degrees, and the exact frequency is both uncertain and variable due to transmitter characteristics and Doppler shifts. Also, the antenna beam is continuously scanned, so long integration times at the receiver won't be effective.

Will this signal exceed the sun's radiation at this frequency? It turns out that the power from one of these radars would have nearly ten billion times the signal strength emanating from the sun's thermal radiation, provided one is looking for this narrowband signal at exactly the right frequency. Indeed, the sun's spectrum would look mighty peculiar. Particularly so because the sun couldn't be detected within the receiver's noise at all at this narrow band-

width unless the observer moved to within about a tenth of a light-year of the sun.

From all the above, some conclusions may be drawn. Radio wave transmissions over interstellar distances aren't as easy to achieve as imagined. While these transmissions do propagate forever, their intensity becomes very small very fast. Also, reception and detection are highly dependent on the receiving antenna size and the receiver performance. Going from the 300 foot Arecibo model to a modest 30 meter antenna reduces range by a factor of 10. The receiver postulated here used the best technology the laws of physics predict. Going to a more modest, non-cryogenically cooled, receiver can also cost another factor of 10 in reception range.

A common misconception is that all radiated signals can be added together for detection. Not so, because they are not at the same exact frequency. The result of all this—we aren't very obvious to anyone who may be looking. As a matter of fact, despite our fondest wishes, we are very well hidden by physics. Similarly, they are well hidden from us.

Some thoughts about the future. One often hears the argument that other civilizations could be far ahead of us in technology. Certainly a good possibility. Would they then be much more able to detect our presence? YES and NO! The probability of detecting a signal is partly determined by the receiver and partly by the transmitted signal. The laws of physics come into play here. The signals we are transmitting now have not changed greatly in the last 50 years. We have achieved high enough power levels to do almost everything we want, so advances aren't being pushed. The receivers in use are near the end of the physically possible. This leaves only antenna improvements. While antennas could be made larger, especially if located in space, they result in very narrow beamwidths and hence, severe pointing problems.

Finally we may conclude:

1. Sending a signal across the galaxy appears out of the question. Even a powerful radar gets only out to a couple of hundred light-years, a far cry from 100,000 light-years.
2. our "here we are" message to M13 is almost as unlikely to be heard. In fact, it now appears that M13 won't even be "there". We can assume the intention was merely to make a gesture, not a real attempt to announce our presence.
3. It appears that our TV signals are unlikely to cause us much embarrassment, unless the aliens are visiting our solar system. At best, we may provide entertainment for UFO pilots.
4. Even a relatively weak artificial signal from Earth would show up as an odd line in the sun's spectrum, provided the observer hit upon the exact frequency and was near enough to detect it.

by Carl Klingenschmitt and Rowland A. Rupp

NEW BAA WEB SIGHT

Tom Bemus and Bill Smith put together a new club web sight at : <http://members.aol.com/BuffAstro/>

Contact Tom or Bill with any ideas or suggestions

LIGHT POLLUTION CONTROL BILLS!!

by Tom Bemus & Bill Smith

NYS Light Pollution Control Bills A6357 / S6799

Sensible bills for putting more light where it is used and preventing waste, glare and light trespass are in the New York legislature NOW. Please see <http://www.ggw.org/selene/> for background information and how to help by letter writing your representatives. SELENE stands for Sensible and Efficient Lighting to Enrich the Nighttime Environment and comes from the Greek word for moon. This web page is an informational tool to assist people who wish to support NYS Bills A6357 / S6799 for the control of light pollution.

THINK ABOUT IT ---We have recessed lighting and lamp shades indoors; why not outdoors?

The site contains:

LIGHT POLLUTION NEWS | THE BILL | LEGISLATURE NAMES | RESOURCES | LP BASICS
LETTERS | PEP TALK | HELP | ACKNOWLEDGMENTS | APPENDIXES

The only bad question is the one that doesn't get asked.

The only bad letter is the one that doesn't get written.

The only bad action is the one that doesn't get done.

FROM THE PEP TALK:

The biggest problem is the lack of awareness, and the second is apathy. Just remember that if you don't do something you are part of the problem and you will get what you deserve - nothing. The Massachusetts light pollution bill suffered a serious set back because of apathy on the part of its residents. The House of Representatives was all set to go for it, and the public support was not there. Several thousand subscribers to Sky and Telescope Magazine were individually contacted and only a handful responded.

The NYS bill came as a complete surprise. Mr. Grannis was surfing the web and found the Massachusetts light pollution bill. If he thought it was worthwhile, we can reinforce his thinking. If you want to add to the bill or makes changes, send your comments to Mr. Grannis. He is very busy with many different pieces of legislation and can't be completely up on everything. This is a team effort.

Much is happening elsewhere, and we are on a roll. Let's not get left out. We have a good shot at this in the next legislative session. So, please write. Spread the word, and don't forget that all important follow-up contact. This is not just an astronomy issue; sky glow is only a part of the evidence that something is wrong. We need support from senior citizens, who have even more difficulty with blinding glare, other conservation groups, and every segment of the population. Everybody can be a winner including those who fail to consider all the issues with an open mind and continue to harbor false perceptions. We need good and responsible lighting - not overkill and abuse of technology just because it is there to be used or there isn't a law against it.

"Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has." - Margaret Mead, Anthropologist

WRITE TO YOUR REPRESENTATIVES

Write to your state assemblyman and senator requesting their support, **and ask them to consider becoming cosponsors**. Also, letters to Mr. Brodsky, the chairman of the Assembly En_Con Committee, and Mr. Marcellino, the chairman of the Senate En_Con Committee, can be CRUCIAL to moving the bill along.

Also we are mailing signed support sheets at regular intervals to the representatives. Feel free to copy the samples and collect signatures in support and either mail them directly or bring them to next BAA meeting and we'll mail them.

I Support A6357 and S6799

New York's Light Pollution Control Bills

Preserve The NIGHT SKY!

I urge your support for requiring good lighting design to:
Save tax dollars, stop light trespass, reduce glare and skyglow, increase public safety, save energy, reduce light pollution and acid rain & stop wildlife habitat destruction NOW!

Voter: _____

Address: _____

MEETINGS NOTICES

Friday May 12, 7:30 pm New Science Building at Buffalo State College Steve Barnes from the Hamilton Astronomy Club will give a talk on astrophotography.

Friday June 9, 7:30 pm New Science Building at Buffalo State College The BAA will hold its annual elections. Candidates will be announced along with nominations accepted from the floor. Contact the nomination committee: Rowland Rupp or Carl Milazzo if you would like to step forward and run for an office. Fred Gordon will also be giving a planetarium show after club business and elections. As usual, refreshments will follow.

MEETINGS ARE HELD ON THE SECOND FRIDAY OF THE MONTH FROM SEPTEMBER TO JUNE AT BUFFALO STATE COLLEGE IN THE NEW SCIENCE BUILDING. ALL ARE ENCOURAGED TO ATTEND.

SPY and TELL

by Edith Geiger

Ernst Both was appointed director of the Buffalo Museum of Science in 1984 and president in 1990. In 1959, he became a staff member as curator of astronomy, and in 1978, curator of mycology was added to his duties plus a two-year contract as acting director of the museum. Though Ernst retired as director in 1995, he will serve as interim president of the museum until a replacement for Michael Smith is found. Smith, who was president and chief executive officer, resigned on January 7th. Further information on Ernst's years at the museum can be found in the February 2nd issue of The Buffalo News. (1st page of the Local News)

Jeff and Janice Gardner went to Las Vegas to view and photograph the January 20th lunar eclipse. The sky was clear and the temperature was in the 60's. They met up with the Las Vegas astronomy club, and also looked through some telescopes at the community college.

Orrin Christy had the highest number of six patents in the United States for 1999 Congratulations!

Former BAA president, **Ken Biggie** is now teaching English at Orchard Park High School, which keeps him very busy. When time permits he does some observing. He sends his best to all his BAA friends.

On Friday, January 21st, **Fred Gordon and Carl Milazzo** gave a talk in the museum auditorium on constellations and mythology, after which the group did some observing through the museum telescope. On February 18th, Carl gave another talk in the auditorium on how to photograph the moon and stars, followed by an observing session.

Both **Fred Price and Gene Witkowski** were supposed to be at the annual meeting of the College of Fellows at Rowland Rupp's, but neither could attend. Fred was in England, and he had asked Gene to shovel the snow at his home in Buffalo. As Gene arrived, he found the water department looking for a leak. They asked if he had a key to get in. Gene didn't, but he knew there was a woman down the street who checked Fred's mail and had a key to Fred's home. Gene found the directions to her house and procured the keys. On entering Fred's house, he found 16" of water in the basement. He shut the main water valve off after he found the leak and got two pumps going to pump out all the water. Gene had to stay while the pumps were on. He contacted the Sunbeam people to repair the furnace and

hot water tank which were both under water. The basement temperature was 34 degrees. With the furnace repaired, the radiators and toilet which were frozen, thawed out. Two radiators had to be isolated from the system because they broke. Gene punched holes in the ceiling because water was leaking into the room in five different places. One elbow cracked, and the basement floor was filled with soaked cardboard. Fred will be back in March. Welcome home!

Bev and Joe Orzechowski, Bill Smith and Carol Lorenc, and Kat and Tom Bemus attended the Winter Star Party held in the Florida Keys in the first week in February. Bill and Carol also celebrated their 10th wedding anniversary while there. The couples left the snows of the north to enjoy the stars above and the warmth of the beach.

At the end of February, **Rowland and Irene Rupp** vacationed in the western Caribbean, visiting Mexico and Belize.

Elaine Knecht, a valuable staff member at WNED, known for her hosting the Morning Classics music program and other musical programs, has moved to a new position at Catholic radio's WLOF (101.7 FM). A fine article appeared in the Sunday March 5th issue of the Buffalo News in the Arts and Entertainment Section.

On March 11, **Darwin Christy** talked to the Men's Club of Emanuel Lutheran Church, in Tonawanda, on "Comets, their Origin and Destructiveness". He gave the same talk at the Presbyterian Church on Broad Street in Tonawanda. On March 28th he sang a double bass solo at the Lenten service at the Salem United Church of Christ in Tonawanda of which he is a member.

On Friday, March 17, **Fred Gordon** gave a talk at the museum on "Binocular Astronomy". He gave another presentation April 21, on "Spring Constellations".

Tristan Dilapo has finished his roll-off roof observatory on top of his garage. Tristan has plans to use his 12" LX200 inside the observatory for astrophotography and CCD.

The NFCAA held its meeting on April 8th at the Skyline Brock Hotel with about 70 people in attendance. The following BAA members enjoyed the evening: **Jeff and Janice Gardner, Mark Reville, Ken and Karen Schlum, John Dean, Bill Townsend.** Kenneth Hewitt White from Vancouver was the speaker. His talk was on "Astronomy as a way of Life"

THE JOYS OF NAKED EYE ASTRONOMY

by Carl Milazzo

Many amateur astronomers think that there is little one can do in the world of astronomy without the use of a telescope. This is far from the truth, and we take them for granted. Sure, eyes have low power and gather a small amount of light, but they do have many advantages over telescopes. They have a wide field of view; they're portable, always on hand, and free. No taxes, no shipping, no assembly and no need for a place to store them. You can clean them in just a blink of an eye, and they never dew-up. With the naked eye, there is a quick setup and take down, no need to collimate, and if the full moon is too bright, try using sunglasses.

For over 30,000 years people have been drawing the phases of the moon. Most of the dark lunar seas can be seen with the naked eye, yet most amateurs can't identify the sea of tranquillity. With a safe filter like a number 14 welding filter one can safely observe large sunspots every other month around the solar maximum. With a filter such as this, one can observe a partial eclipse, which can also be done with a cardboard pinhole camera.

There are plenty of constellations to see. In fact 73 can be seen from Western New York yet most amateurs can't identify twenty of them. They come in hand in navigation and with finding: planets, double stars, deep sky objects, describing meteors and aurora. Because the naked

BAA ANNALS

by Rowland A. Rupp

5 YEARS AGO - "Four Giant Steps of George Hale" was the title of Rick Albrecht's talk on the pioneering work done by Hale in establishing Yerkes, Mt. Wilson and Mt. Palomar observatories. Albrecht, an astronomer from Rochester, had toured these observatories. In June, Dean Oberg, a member of the Reaction Research Society for Amateur Rocketry, spoke on this group's plans to someday launch a rocket carrying a telescope into space. Rowland Rupp wrote an article entitled "Astronomy 1879", a series of extracts taken from Henry Warren's *Recreations in Astronomy*, highlighting the state of our astronomical knowledge at that time. Another article, this one by Orrin Christy, had much more modern content. He reviewed a new software program, *RedShift*, readily mastered by his eleven year old son. Since it calculates positions of planets in different time frames, one might use it to predict those dangerous planetary alignments. Edith Geiger wrote a "profile" of our president, Terry Farrell. We also had book reviews. Bill Smith reviewed five sources of information on planetary nebulae, diplomatically concluding that "No one can be judged 'best'." John Boslough's, *Masters of Time* was reviewed by Rowland Rupp. The main thrust of the book was that the Big Bang was soon to be replaced by a new, revolutionary theory of the creation of the universe. What it was to be had not yet been ascertained—it still hasn't been.

10 YEARS AGO - The annual dinner meeting, then held in May, was at the Lord Amherst restaurant, where Ernst Both spoke on "Voyager", the explorer to the outer planets. We had two talks in June: one by Bob Hughes on "How Sunspots Affect the Ionosphere", and one by Marylou Bebak on—guess what—"Voyager". An NFCAA meeting was scheduled at St. John Fisher College in Rochester for May 5. The main speaker was Rick Albrecht on George Hale. Small world, isn't it? No articles by BAA members graced this SPECTRUM. Ditto for observation reports. There was an article on amateur radio astronomy by Jeff Lichtman of the Atlanta Society. Ed Lindberg's "Instrument Notes" dealt with his visit to the Starrett tool factory, an event precipitated by a fogged out eclipse and a broken down car. Darwin Christy contributed four constellation reviews. The SPECTRUM carried the obituary for our astronomical poet, Esther Goetz.

15 YEARS AGO - The May 1985 meeting was the first dinner meeting. it was held at the Wilcox Mansion. Tristan and Debbie Dilapo hosted the buffet; Ernst Both spoke on "Astronomical Foibles", setting the precedence for lighter topics at our dinners. Darwin Christy spoke in June on light pollution. The BAA hosted the NFCAA meeting at Buffalo State College in May. Ed Lindberg, who coordinated the program, put out a call for speakers at the event. Bill Smith contributed an article listing about 40 deep sky targets that could be seen near Messier objects. A profile of Thomas William Webb (1807-1885), the author of the famous *Celestial Objects for Common Telescopes*, was written by Fred Price. Rowland Rupp reported on Ken Fulton's *The Light-Hearted Astronomer*, and evidently thought it rather poor both in content and in taste. Observation reports were given by Carl Milazzo and Michael Idem. Carl was Observatory Director at BMO at the time. He changed public nights to Sunday to make Saturday nights available to members. He also called for more volunteers, and suggested changes in observatory equipment and usage.

25 YEARS AGO - "The Solar Neighborhood" was Fred West's topic for May 1975. Dr. West, a BAA member and professor at Buffalo State, spoke on the stars and star systems near our sun. We also had a bake sale with the funds used to finance BMO, which was then under construction. The SPECTRUM doesn't tell what happened in June. In those days the June meeting was often strictly devoted to winding up the year's business. It wasn't until later that we figured out that a speaker would encourage better attendance. The remainder of the SPECTRUM contained an article by Fred West entitled "The Asteroids". in it he discussed the Bode-Titus law and the resonances in asteroid distribution caused by Jupiter that result in "gaps" uncovered by Kirkwood. He also dealt with Trojan, Amor and Apollo asteroids. The first occupy Jupiter's Lagrangian points, the latter two approach Earth.

35 YEARS AGO - Ed Lindberg spoke on an "around the world trip" he took, while in June we dispensed with the regular meeting and, instead, visited Allegheny Observatory. The June SPECTRUM (they were monthly then) contained a biography of one of our earliest, and most respected members, Rudy Buecking. No author was given, but I suspect it was Edith at work. Summer star parties were scheduled at the Stoklosas' and the Boths' homes, as well as at Newstead Observatory and at Camp Sprucelands.

Continued from page 5 "Joys"

eye has such a wide field of view, it is the best way to observe meteors, auroras, and long comet tails. Though not necessary it is more enjoyable if you have warm clothing, a lounge chair, dark country skies and a friend or two to scare away the bogeyman.

Another object that are too large for a scope is our own galaxy the Milkyway. The best part is the hub, which is the brightest and the most detailed in Sagittarius. This area is loaded with bright and dark knots, star clusters, and dust regions, even emission and reflection nebula.

Over 30 deep sky objects can be seen with the unaided eye. Some are too large to be seen in it's entirely with most scopes. For example: M44 the beehive cluster in Cancer and the North American nebula, also known as NGC7000 in Cygnus. The zodiacal light and the gegenschein are too large to be seen with a scope. All one

has to do is look during the spring or fall as twilight ends in the evening or begins in the morning with a dark horizon. Zodiacal light is much brighter than the winter Milkyway. It is 20 degrees wide at the horizon and tapers to a point 60 degrees above the horizon on a good night.

Also too long for most scopes is the tail of bright comets or it's coma. In 1983 I saw a coma 3 degrees in diameter from comet IRAS-Araki-Alcock. In 1996 there was a 45-degree tail from comet Hyakutake. Try seeing that through a telescope with a field of view of only one degree.

Most concoctions are too wide for most telescopes. They are rare, but to the naked eye you can see several each month. It's hard to beat seeing a crescent moon with earthshine next too a bright planet or star. In fact many countries involve them with their national flags.

Continued page 7 "joys"

OBSERVATION REPORT — THE JANUARY ECLIPSE

Thursday afternoon in one of my postings to the e-group I mentioned that according to the National Weather Service there was a chance it might clear at least someplace in Western New York in time to view the eclipse. The problem was finding out where the holes would appear.

I decided to go to the observatory to work on the warming cabinet problem and figured this was as good a place as any to wait for a clearing. I spent about three hours at the observatory eating, drinking and making merry with a friendly bunch of fellow eclipse chasers waiting like "Linus" in the pumpkin patch for the great clearing to arrive. Much to my disappointment all it seemed to do was snow on and off, sometimes quite heavily. Every once in awhile the snow would stop and the clouds would thin just enough to see a very murky moon slowly slipping into totality. It soon became only 30 minutes away from totality and I was getting depressed. Especially after making frantic calls to people all over Western New York trying to find out if it was clear ANY WHERE. Even my wife (50 miles away at home) was refusing to stick her head out the window, even one more time, to give me another damn weather report (she used the word damn, not me).

At this point all hope seemed lost and my quest to view the first lunar eclipse of the new millennium appeared hopeless. Then the phone rang! "Hello". I said grumpily. "This is the Beaver Meadow Observatory". "Bill? Bill, are you there?". It was Don Knecht, an eagle-eyed observer and fellow eclipse enthusiast calling from North Buffalo. "How is it down there?". I could barely hear him. "It's lousy, nothing but snow and an occasional murky glimpse of the moon."

It looks like we are clouded out again. How is it where you are?". "I can make out the partially eclipsed moon and at least all of the brighter stars in the nearby constellations". It sounded like he was speaking on a cordless phone from his backyard. "At least you have a partial clearing. Can you see any color?". I asked. "A slight tinge of orange on the dark side". This was the most encouraging thing I had heard all night. "Thanks for the report, Don. We are clearing out of here and heading North". "Good luck!". He said, as I hung up the phone.

We cleared up the dinner mess in a flash and tossed all of our equipment in the vehicles. Anything was better than watching snow. We broke up into two groups, Dennis and Tom heading North-West towards Orchard Park and Dan and myself heading North towards Grand Island and Wheatfield. All in agreement to any where along the way if the sky cleared. Although no one

said anything, I am sure we all felt that we were simply going to end up driving home. A dismal end to a dismal evening. I know my own expectations were not very high at this point. But sometimes, the stars smile down on us.

The drive up to route 20A was slow because of the sloppy roads and blowing snow. We even lost track of Dennis and Tom after stopping along the way for some hot coffee. As Dan and I finally approached route 20A the blowing snow stopped suddenly and unbelievably the sky actually cleared. We pulled to the side of the road to gawk at the now totally eclipsed moon. It was beautiful.

We needed to find a place to setup Dan's scope quickly, it was not safe along the roadside. We ended up a few miles away parked in the back lot of a Mobil station at the intersection of routes 20A and 78. It was not the most ideal observing location (kind of closed in) but the sky SEEMED pretty clear with only wispy looking clouds to occasionally block our view. Much to my delight we spent the next half of an hour observing the totally eclipsed, copper colored Moon and the beautiful "Beehive" open cluster only seven degrees to the southwest of the moon. We used Dan's Richfield telescope and my 10 x 50 binoculars. The dark northern limb was a deep copper color with a white-ish ring halfway around the brighter southern limb. There was a gradual blending of copper shades from the bright to the dark limb, across the face of the full moon.

All in all, a beautiful sight. And what impressed me the most was how many faint stars could be seen through the binoculars so close to the Moon's limb. We also noticed a strange "bright-ish" cloud directly overhead which seemed to get brighter and dimmer randomly as time passed. We even commented to each other that the cloud seemed somehow to be illuminated, even though the moon was in totality. Kind of strange, but it looked real pretty next to the moon. Dan and I had a very limited view of the sky. Surrounded by buildings and tall trees we could really only see the sky directly above us. The horizon was completely out of our view. But it wasn't for everyone.

I found out at work the next day that Dennis and Tom had a very similar experience. They too had pulled off the road, and only several miles away from Dan and me at the Mobil station. Like us, they observed and even managed to photograph totality. However, their view of the sky was much lower to the horizon, and they confirmed that during totality a beautiful "dancing" Auroral display also took place. Now those wispy clouds made sense. Overall, a beautiful eclipse, despite the snow flakes.

by Bill Aquino

"Joys" continued from page 6

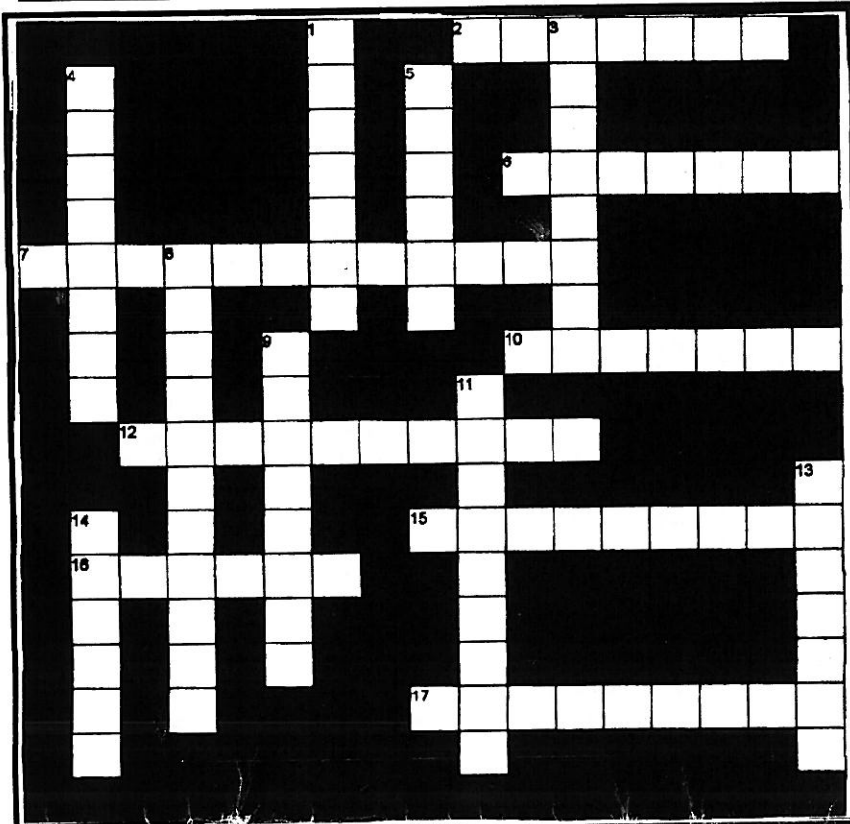
Most amateur astronomers think that only 5 planets can be seen with the naked eye. When Uranus is at it's brightest it can be seen with the naked eye. Even the asteroid Vesta can be seen when it is in opposition. When there is a planet wide dust storm on Mars one can see the planet change in color from orange to yellow. It is hard to believe how easy it is to see Venus in broad daylight. All one needs are deep blue sky, to know where to look, and to align it with an object such as a pine tree or a flagpole.

Every now and then, there is a naked eye Nova. For example, Aquila had a 3rd magnitude in 1999, and in 1992 there was a 4th magnitude nova in Andromeda. In 1975 I saw a 2nd magnitude nova in Cygnus, that was blue when it was at it's brightest. Each day it became dimmer by a magnitude, and it changed colors from white, to yellow, to orange, and red as it cooled within a week. Someday a brighter nova will light up the sky, as it did in 1918, with a magnitude -1.4 in Aquila. This nova was visible for six months to the naked eye.

About a dozen variable stars can be monitored. The easiest and the brightest is Mira in Cetus. Its average maximum is about 3rd magnitude and is visible to the naked eye for a month or two, once a year.

There are several naked eye double stars, with the best known being Alcor and Mizar. Another easy one is Alpha Capricornus. If one quickly compares the brightest stars to each other their colors become apparent. Try yellow Capella, Orange Betelgeuse and blue Sirius to see their naked eye color tints. Naked eye astronomy is astronomy on a high school or college student budget. Without knowing practical basics of constellations and magnitudes of the naked eye stars one is lost in the night sky.

Astronomical Crossword Puzzle



ACROSS:

2. "the goat star"
 6. Gamma Booti
 7. Analyzes light
 10. Zeta Cancr
 12. Spreading of light
 15. M51
 16. Alpha Aquilae
 17. Apparent brightness

DOWN:

1. 8th brightest star
 3. Beehive cluster
 4. Path of the sun
 5. gamma adromedae
 8. midway between rising & setting
 9. a variable star
 11. 5.88 trillion miles
 13. Beta Cygni
 14. 206,000 AU

Astronomical Word Scramble

AQARSU	_____
ATSK	_____
DMUNETIGA	_____
IEEPSHDC	_____
MRHCAI	_____
OIRNRTSAEP	_____
PRIONSIESD	_____
RPECSA	_____
TCCPILE	_____
XNIEUOQ	_____

Ed. Note : I will try something new here with a few puzzles . The crossword will test your knowledge in astronomy and the scramble will probably tease your mind to the point where you will probably want to kill me . These puzzles are by no means "GIMMES" . It might be a good idea to keep the good old Burnhams Celestial Hand books ready . Answers will be in the next issue

OBSERVING OUR NEAREST NEIGHBORS by Joe Orzechowski

I am, of course, referring to our nearest neighbors in space so please take a moment to erase any voyeuristic thoughts that may have, however briefly, popped into your minds. OK, let's continue. When it comes to deep sky objects my 4" refractor puts me at a significant disadvantage when compared to the 8", 10" and larger scopes that many of you own and use. Add the light pollution found at my home in Snyder, PA and you can see why I'm always on the lookout for something different and brighter to observe. The Moon, Sun and planets can keep me occupied for only so long. Well, a couple of months ago I was paging through the latest edition of the RASC Observer's Handbook and stumbled across the section titled "The Nearest Stars". After perusing this list I started thinking that this might be an interesting observing project to tackle. It was just easy enough to allow me to put a good dent in the list with my 4" (especially if I took it out to Beaver Meadow) and it was just perverse enough to satisfy my need to try something different. As I got started on this little project I thought it would be nice to share my experiences with you.

For starters, let's take a quick look at the list itself. I won't repeat it here; you can find the list I am using in the Observer's Handbook 2000. And I'm sure there are several other publications that have a similar list. I've also come across different versions of the list on the Internet. The list consists of 55 stars or star systems ranging from Proxima Centauri (part of the Alpha Centauri system) at 4.20 light years out to Altair at 16.78 light years. Seven stars or star systems are less than 10 light years away, 32 more are found 10 to 15 light years away and 16 are more than 15 light years from the Sun. I would like to point out that the list includes several binary star systems and a couple of triple star systems. In general, I count each star system as a single entity even though information is given for each star in a system.

So who are our neighbors in space? Well, some of the stars, like Sirius, Procyon and Altair, are well known to most if not all of us while others carry somewhat less familiar names like Barnard's Star, 61 Cygni, or Tau Ceti. However, most of our nearest stellar neighbors are small, faint stars with cryptic designations assigned to them by one or another star catalog. Examples are L726-8, G51-15 and BD+44 2051. The visual magnitude of the stars in the list range from -1.44 (Sirius, fifth in the list) down to 15.60 (LP731-58, 37th in the list). Looking at the

It's Star Party Time

What is a Star Party? It is where we all get together someplace like a person's home, a park, or the Observatory and enjoy astronomy. You bring all your "astro toys" and we all try them out on each other's equipment. Sometimes night time viewing is in conjunction with a bring-a-dish to pass picnic. The only requirement is having a good time, and doing astronomy. Usually I suggest that they are held rain or shine, as it gets confusing when it is partially nice, and you may get people coming on both the scheduled and the rain date. If that is ok for you schedule a rain date! I also respectfully request that the star party does not conflict with a public night, unless you are willing to host the public night as well.

First Star Party of the Summer! — Friday June 2

Anthony Davoli is holding the second annual AstroNut Star Party. The festivities start at 7pm. Anthony will supply the hotdogs and hamburgers, and suggests that you bring your telescope and a dish to pass. It is a new moon weekend and the planets rise kind of late. We will be trying out the new laser collimator to tune up the big DOB for some deep sky stuff. If you have not had a chance to check out all our upgraded equipment - Cookbook camera, Astrovid camera, computers, and 10" LX200 now's your chance.

July 28-29 Stellafane Convention in Vermont USA

August 1-6, Pennsylvania. Astroblast 2000 will be held at the Oil Region Astronomical Society's observatory site in Two Mile Run Park in Franklin. Write to the society at P.O. Box 351, County 16343, or call John O'Hara at 814-677-3972; astroblast@oras.org, URL: <http://www.oras.org>

August 24-27 Starfest Astronomy Convention held by the North York Astronomical Association at Mt Forest, Ontario, Canada. This is around a 2 hour drive from Buffalo and if you have not been to an astronomy convention I highly recommend it. If you wish more information you can log on to their site at <http://www.nyaa-starfest.com/> and get the information on lectures when they come available. If you have any questions, or wish to hold a star party, please call me Dan Marcus at 773-5015

MEMBERSHIP UPDATE

The 2000 Membership Directory should be in the mail as you read this issue of the Spectrum. If you are a new to the BAA, the directory will offer you info on the club's resources and structure. You will also find that a wealth of astronomy knowledge and experience resides in our members. And these are friendly folks. BAA members are happy to share their knowledge on a specific subject, or just talk astronomy. Use the directory and stay in touch!

At the back of the directory you'll find a membership renewal form for 2000-2001. It is my personal mission to convince you to renew your membership by or before the due date (September 1st). If everyone renewed their membership in August, rather than in dribs and drabs over a six month period, think of all the time your membership committee would have to direct their energies towards encouraging our new and prospective members. And we could have

an up-to-date directory out by the middle (rather than the end) of the membership year. So don't delay - renew today. Any questions or comments - just give us call. We're in the directory!

Alan Friedman
Tristan Dilapo
Membership co-chairs

Letter to the Editor

Dear Editor,

While I have been a new member, since joining November of 1999, I have received two issues of **The Spectrum** and have found them to be quite entertaining and of great use within the world of Astronomy. Up until that time, I had not even been aware that such an astronomy club had existed within the Buffalo/Western New York area. Now that I know it truly exists, I am very glad and within the next few months, intend to make use of my new membership with this society.

I first became aware that your organization existed when the Buffalo Astronomical Society held a seminar dealing with telescopes with Larry Carlino, as I was attempting to look around for getting a new telescope. Previously, I had owned a department store-bought 2- Inch refracting scope. While it was a useful tool in my search of the wondrous skies at night for many years (I had several years sabbatical and lost touch from time to time with the skies, now coming back), I felt it was time to move on to a much bigger and better telescope. The seminar given by The Buffalo Astronomical Society at the Buffalo Museum of Science was exactly what I needed in helping my search be fruitful, since I knew very little about telescopes. In fact I knew so little, I knew more about Binoculars than the mighty telescope! But having acquired the necessary knowledge from the lecture from Larry, I was able to take it further and obtain a new Telescope. I now have a 4.5" (114mm) reflecting telescope from Meade, Inc. (To be precise - Meade Model DS-114EC Telescope). I also bought the Optional Autostar Computer Controller, but have not used it yet (waiting for a good weather time and need to refresh myself over and over on the "how to use" aspect of the device). I have had the telescope since December of 1999 and have used it on many occasions. I am delightfully fascinated how this telescope has performed. I was able to see some things in the sky that I was not able to see before in the old telescope! For this, I have to hold the Buffalo Astronomical Society in my debt. The reason? It so happens that this was the Telescope Larry had mentioned that was a decent scope to use which can be bought at a department store - WalMart (I had took Larry's advice from the seminar and bought that Telescope at a WalMart Store. It has been a wise investment indeed.

Currently, I am browsing through the latest issue of **The Spectrum** (April Issue) in awe and look forward to coming issue(s) the next few months. Perfect timing for the summer season. With that in mind, I am sure (not sure of when), that I will take a trek to the Beaver Meadow Observatory, a monthly meeting or a star party. When I do, I look forward in doing so with great trepidation.

BEAVER MEADOW OBSERVATORY

The observatory is open to "checked out" members any time. Call Neil Dennis (322-7596) to get checked out. Public nights are held on the 1st and 3rd Saturday nights April through October. There is "members only" viewing after every public night. Help is always needed and appreciated for our public events. You don't need a lot of experience to help out. Stop by and be an "observer" and see just how easy it is. The "vets" will show you how.

Continued from page 9 "letter"

Again, thanks for existing, thanks for the great telescope advice (from Larry of course), and lastly thanks for a wonderful newsletter. Till then, keep looking up!!!

Sincerely,
Anthony J. Canney, Jr.

"neighbors" continued from page 8

spectral class of each of the stars, you will quickly see what I mean about small and faint.

But first, if F5III, M4V and DA mean absolutely nothing to you, read on. Spectral classes are used to group stars based on their surface temperatures and, consequently, a number or other related characteristics such as color. The astronomer Annie Jump Cannon, working at Harvard, analyzed the spectra of thousands of stars and grouped those with similar looking spectra into a single category. She identified each category with a letter of the alphabet. Later, these categories were rearranged according to surface temperature and some categories were deleted or merged with others. The result is a seemingly random set of letters O, B, A, F, G, K, M, R, N which are used to designate the chief stellar spectral classes from hottest to coolest. A number from 0 to 9 is added after the letter to identify one of ten subdivisions within the main class. Thus, the spectral designations F9, G0, G1, G2 (our Sun) and G3 identify five spectral classes ranging from hotter to cooler. A Roman numeral from I to V is sometimes appended to identify the luminosity class. Very luminous supergiants are class I, giant stars are class III and dwarf or main sequence stars are class V. Then, just to make things a little more confusing a "p" is added if the spectrum is pe-

culiar or an "e" may be added to indicate hydrogen emission lines (Generally a star's spectrum only consists of absorption or dark lines). So what's a DA star. Apparently, white dwarfs or degenerate stars get a special class of their own. An example is SiriusB, the companion star in the Sirius binary star system, also known as the Pup. The A is used to classify the white dwarf's surface temperature just like for ordinary stars.

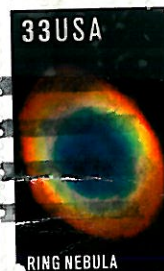
Now, getting back to the list, of the 64 stars with a spectral classification (this time I'm looking at individual stars in multistar systems), 45 or 70% are class M. These are stars much less luminous and less massive than our own Sun. The surface temperature of class M stars is down around 3000K compared to the Sun's 6000K. Nine more stars are class K with surface temperatures around 4500K, two are class G like our Sun and five are white dwarfs. The three remaining stars are Procyon (class F5IV-V), Altair (class A7V) and SiriusA (class A1V).

Now that you have been introduced to the prey, here is my plan. For my first pass through the list I am limiting myself to stars which lie north of declination -35 degrees and which are brighter than magnitude 10. This pares down the list of 55 stars to a mere 19. I have been pouring over star charts, the Guide Star Catalogue, and downloaded star survey images to develop the finder charts I need to locate these 19 stars. Now I think I'm ready to hunt them down. In future articles I'll identify the selected stars and describe my success or failure in locating them in the sky. Along the way I'll try to add additional background information and observations of other nearby objects, even some deep sky stuff. I may even include a finder chart or two so that you too can give it a try.

**NEWSLETTER OF THE BUFFALO ASTRONOMICAL
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