The Prairie Astronomer

The Official Newsletter Of The Prairie Astronomy Club, Inc.

December 2002 **Volume 43 Issue #12**

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CLUB EVENTS

Club Star Party
Friday, December 27, 2002

PAC Meeting 7:30pm
Monday, December 30, 2002
Hyde Observatory

Club Star Party
Friday, January 03, 2003

PAC Meeting 7:30pm
Tuesday, January 28, 2003

DECEMBER PROGRAM

December program: Larry Stepp, Manager,
AURA New Initiatives Office
http://www.aura-nio.noao.edu/

PAC-LIST: If you have an e-mail address and are not on the PAC List, you may subscribe by submitting an e-mail to list@4w.com. Write "Subscribe PAC-List" in the body of the e-mail.

READ THIS NEWSLETTER ONLINE

Those who wish to help with publishing and postage costs by receiving only the on-line version of the newsletter should contact Liz Bergstrom at 464-2038. Mark Dahmke or Liz can give you the logon account and password for access. You may receive both the mailed version and the on-line version if you wish. A printable PDF version of this newsletter is also available through the website.

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The Prairie Astronomer is published monthly by the Prairie Astronomy Club, Inc. Membership expiration date is listed on the mailing label. Membership dues are: **Regular $20/yr, Family $22/yr**. Address all new memberships and renewals to: **The Prairie Astronomy Club, Inc., PO Box 5585, Lincoln, NE 68505-0585**. For other club information, please contact one of the club officers listed on the last page of this newsletter. Newsletter comments and articles should be submitted to: **Mark Dahmke, PO Box 80266, Lincoln, NE 68501 or mdahmke@4w.com,** no less than ten days prior to the club meeting. The Prairie Astronomy Club meets the last Tuesday of each month at Hyde Memorial Observatory in Lincoln, NE.

Secretary's Report — Lee Taylor

Prairie Astronomy Club meeting minutes for Tuesday, Nov. 26, 2002.

President Dave Knisely called the meeting to order, no new visitors.

The last PAC star party was attended by Dave and Joey Churilla.

The next PAC star parties are Nov 29, Dec. 27, and Jan 3.

The 25th anniversary of Hyde Memorial Observatory was Sunday Nov. 10, 2002. It was a great success from the guest speaker at UNL to Mayor Wesley's proclamation at Hyde that evening, we had a great day. We had 150-300 visitor and plenty of press, including a televised interview of our own *human goto* Joey Churilla by 10/11 news.

Also, on the evening of Nov 18/19 Hyde was open again for the Leonid Meteor Shower, this time all evening long, thanks to Dr. Martin Gaskell, Lincoln Parks and Rec and the Lincoln Police Department. With just a slight delay, the peak arrived between 4:30 and 5:00 AM, with local television in attendance and Dr. Gaskell live on AP Radio. Solar activity is decreasing, but there was one event worth watching in the past week or so.

Saturn is a great target after sunset for the next few months, complete with a new white spot visible on the face.

Some details are becoming clearer on the new club 'scope. It will be a 120mm F/6 refractor with 2 plossl eyepieces. Some details are still being looked at, including the possibility of a barlow.

The Geminids peak on Dec. 14 at 9 UT, but again, as it did with the leonids, the moon interferes.

The next PAC meeting will be MONDAY December 30, 2002, with our usual December guest, Larry Stepp.

The next UNL student observatory open house has yet to be determined.

If you're interested in participating in any of the AL's observing programs, see our observing chair, Jeff King. Also, on that note Steve Lloyd and yours truly, Lee Taylor are planning to get serious about getting our Messier Certificates by helping each other during Club star parties. If you'd like to join us, just show up at a star party or put an email up on the pac-list about going out to observe.

Program Chair, Brian Sivill is always open to new ideas for programs, if you've done something of interest, and would like to share it, let Brian know.

First among the new '03 is 'Scopes premier night in January.

A new addition to the PAC library is the Book Halley Watch, including a quote for our president Dave Knisely about observing, courtesy NASA. To check out any of the books in the PAC library, see club VP Dave Brokovsky.

Treasurer's Report: The bank account is in good shape. We're seeing significant savings on stamps courtesy the new electronic newsletter. To receive the online newsletter and stop receiving the mailed version, contact a club officer or newsletter editor Mark Dahmke for the password. The Royal Astronomical Society of Canada's observing annual for '03 was ordered during this meeting. $16.00 each. Ottwell's annuals are available for $20.00.

The annual club audit has been set to occur by Feb. '03. by Jeff King, Liz Bergstrom and _____.

Behlen observatory will be open to the public on Dec. 6, 2002.

Erik Hubl moved to adjourn and Del Motycka seconded. Adjourn to program of Dave Knisely's demonstration of the freeware program: Celestia.

Respectfully submitted by,

Lee Taylor

Hyde Observatory Volunteer Schedule

Date	Team Leader	Operators		Supervisor
Winter Hours (7:00 PM to 10:00 PM)				
December				
12/21	Bill Wells	Dan Delzell	Jared Delzell	Rick J
12/28	Brian Sivill	Jeff Campbell	Bob Leavitt	Dave H
January	***(Tentative)***			
1/4	Bill Wells	Josh Macechek	Lee Taylor	Dave C
1/11	Dave Churilla	Joey Churilla	Steve Lloyd	
1/18	Jeff King	Justin DeVries	AJ Benker	Brian S
1/25	Dave Hamilton	Jeff Campbell	Bob Leavitt	Rick J

Life, Evolution and the Universe (Part 3 of 3)— Mark Dahmke

Superstring Theory and Life

How is it that the physical laws of our universe are so uniquely suited to the needs of terrestrial life? There are several possible answers to this question. Without getting into the math behind superstring theory (which I must confess I have only a limited understanding of), cosmologists conjecture that the universe we're familiar with expanded from a point source of infinite density. Superstring theory is actually a set of equations that contain parameters that can be adjusted to produce universes similar to ours. The theory requires, depending on who you talk to, eleven dimensions instead of just the four we're familiar with. As the universe expanded and cooled, three of the spatial dimensions expanded to create the space we inhabit, but the remaining dimensions stayed curled up at the quantum or subatomic level, which is why we can't see them. As the universe cooled, the physical laws we're familiar with, such as the strong and weak nuclear forces, electromagnetic force and gravity, became separate and distinct, with properties that affect the formation of fundamental particles. This is a greatly oversimplified version of the theory, but should be adequate for purposes of this discussion. For example: the strength of the weak nuclear force mediates radioactive decay. This value has to be finely tuned for our type of life to exist. Earthly life is based on carbon, but carbon was not formed at the time of the big bang. It is only formed when stars of a certain size go supernovae. If this value happened to be slightly lower, supernovae could not explode because the neutrinos emerging from the core of the star would not transfer enough energy to the star's outer layers. If the value happened to be slightly higher, the neutrinos would remain trapped in the core of the star and it would fail to explode.

One possible answer to this dilemma is to invoke the anthropic principle, which basically comes down to arguing that our very existence proves that no matter how unlikely it is for the right set of circumstances to come about to form a universe compatible with life, and indeed to allow for the evolution of self-replicating molecules, they must have occurred at least once or we would not be here to discuss it.

There are other possibilities that we must consider. One is that the universe we see around us is not the only universe. This might sound like a rather odd statement, since by definition the universe must contain everything that exists. Before getting into that subject let me explain what I mean by "other universes." First, let's consider the possibility that there is only one universe in the traditional sense, but that it goes through cycles from big bang to big crunch, recycling itself over periods of tens of billions of years. In this scenario, each big bang might produce a universe with slightly different physical laws. Perhaps over thousands, millions or billions of cycles, universes form that are sterile, or that have physical laws, which cause them to immediately collapse. Only occasionally does a universe form that has the potential to create life, and only some of those actually see the formation of complex organisms or intelligence.

Another variation on this theme is based on the chaotic inflationary model—which I won't go in to here – that causes the formation of many separate "bubbles," isolated from each other and with different physical laws. Expanding on this theme is a suggestion by physicist Lee Smolin that universes self-propagate. Let's say that a universe forms which has a set of physical laws that allow the formation of collapsed stars and black holes. Some black holes with the right properties spawn new universes, producing another isolated domain which has slightly different physical laws than the parent universe. He postulates that universes formed in this way might alter their physical laws just enough so that each subsequent child universe would fine-tune the physical constants, improving the odds that a universe would eventually be created that could sustain our type of life. Is this just metaphysics or is it science? It turns out that Smolin's hypotheses might be something we can test. Although we only have access to one universe, we might be able to someday learn enough about superstring theory and the evolution of life to be able to calculate the physical constants that would maximize the potential for earthly life to form, producing the best possible universe for life. We could then compare these values with those of our own universe to determine if there is room for improvement. A possible conclusion is that our universe is part of an evolutionary process that is leading toward universes with parameters that are optimally suited to the formation of life.

Quantum Mechanics and Life

Quantum mechanics is another property of our universe that seems to be a prerequisite for the formation of life. In the 19th century it became clear that the classical Newtonian mechanistic world view did not explain many of the phenomena being observed. For example, it became apparent that light does not always act like a wave-- sometimes it behaves as if it's made up of particles, now known as photons. One of the properties of quantum mechanics is the Uncertainty Principle. To summarize, you cannot know enough information about a given particle such as a photon, to predict both its position and momentum. If you measure its position, you will alter its momentum, and vice versa. At such a small scale, the universe just doesn't behave the same way it does at our macroscopic level, where we deal only with millions or billions of particles. A classic experiment involves shining coherent light, such as a laser beam, through two slits. Like ripples in a lake, if you were to drop two stones in the water at the same time, their wavefronts would overlap, causing interference patterns. Light passing through two slits will do the same thing if the wavefronts are in step with each other. This demonstrates that light has wave-like properties. But what happens if you reduce the intensity of the light until only one photon particle is emitted? The answer is that you will still see an interference pattern. How can one photon pass through two slits and interfere with itself? There are several possible explanations for this. But what is even stranger is

that if you attempt to set up an experiment to try to measure the photon to determine if its passing through one or the other slit, the act of measuring it collapses its wave function and prevents the interference pattern.

For those who are not familiar with quantum mechanics, I'll use the standard textbook example: Schroedinger's Cat. Let's say that you put a cat in a sealed box, with no external method of detecting what's going on inside the box. Next, you attach some form of sensor, for example a very sensitive Geiger counter that can detect the decay of a single atom, in such a way that one decay event registered by the counter may or may not cause a poisonous gas to be released inside the box, killing the cat. Assuming that there is no external method of determining the state of the apparatus, we have no way of knowing if the cat is alive or dead. In a strict quantum mechanical sense, the cat occupies both states at once—it is both alive and dead. What cannot be measured simply has no meaning in the quantum world. Opening the box causes a measurement to be performed – you looked at the cat. Then and only then does the quantum superposition collapse into classical reality. The cat is forced to choose one state over the other (In our macroscopic world that includes cat-sized objects, these effects are not seen because of decoherence -- particles interact with the surrounding environment, causing the wave function to collapse, so you have to substitute atoms for cats in this analogy). Quantum superposition might sound bizarre and impossible, but it's true, and quantum effects are currently being used for such things as tamper-proof communications, and quantum computers. The superposition of states can be extended beyond just dead and alive or on and off. If properly motivated, molecules can take on a multitude of simultaneous states.

No one really understands what's going on at a deeper level. Someday we'll figure out if superstring theory really provides an accurate representation of the universe, and maybe then we'll come to some deeper understanding of what's going on. For the moment though, one of the most popular interpretations of quantum mechanics is called the Copenhagen or "many worlds" interpretation. When a particle takes on more than one state at a time, or interferes with itself as it goes through two slits, one can imagine that the universe splits into two copies. In each parallel universe, the particle takes on a different state or position. In one universe it goes through the left slit, in the other, the right. In one universe the cat is alive and well, and in the other it's dead. Both are equally valid and real, it just depends on which universe you happen to be in. When we make a measurement and the wave function collapses, the two universes merge. Whether or not this actually represents what's going on at a deeper level, it's a convenient metaphor. And in practice, it's being put to use to build computers that can perform many simultaneous computations by exploiting thousands or millions of parallel universes.

Quantum Evolution

McFadden, a Reader in Molecular Microbiology at the University in Surrey, England, proposes that quantum mechanics accounts for the very existence of life, and is required for the day to day operation of cells. Here's one possibility: as I mentioned before, no one has yet come up with a plausible way that a self-replicating molecule could, using classical physics, form at random on the prebiotic earth. The sequence of chemical reactions required to get it right would be as unlikely as getting Shakespeare out of a room full (or a universe full) of monkeys randomly pressing keys on typewriters.

Short sequences of amino acids have been constructed that can be made to replicate themselves. Suppose we start with a short peptide of 32 amino acids. Using the 20 amino acids used by earthly life, there will be 20^32 (20 to the 32nd power) or 10^41 (10 to the 41st -- 10 followed by 41 zeros) possible ways to assemble a chain that is 32 amino acids long. A Darwinian solution to this problem is almost impossible. Until you can self-replicate, there can be no natural selection that would produce the right sequence of molecules.

However, if you allow for quantum effects, we can envision a situation where a chain of amino acids starts growing, unmeasured and unperturbed, adding one superposed quantum state on top of another. At each step, the molecule takes on another superposition of states, adding all 20 possible amino acids. Again, following from the many worlds interpretation, the universe we inhabit is the one out of all of these superposed states that resulted in a self-replicating molecule, eventually leading to life.

The depressing aspect of this model is that it can only happen once per universe. If life originated on earth using this method, then we are alone. Life could not have arisen separately on any other planet. McFadden offers other possibilities that don't necessarily leave us in a universe devoid of life, but they involve even more subtle quantum effects that would take too long to cover here. For anyone interested in this subject I would recommend reading his book "Quantum Evolution."

Space Invaders

As I mentioned earlier, I've focused on our chances of finding evidence of microbial life that has formed independently on other worlds. But what are our chances of detecting intelligent aliens? If our the galaxy has about 100 billion stars, and if even a fraction of those have planets that provide a suitable environment for life, and if a small fraction of those developed intelligent life, the galaxy should still be teaming with aliens. Why haven't we ever encountered any of them? Even without light speed travel, most of the galaxy could be colonized in a period of a few million years. Aliens should have overrun the earth many times in its long history.

I think the answer can be found in our own culture and way of thinking about ourselves. Humans like to travel. We want to physically go somewhere to see it with our own eyes. Sending robots out into space might be efficient but it's not emotionally satisfying. We feel the need to go there in person. Also we have no experience with voyages that could last

many lifetimes-- we tend to think in terms of freezing ourselves or going into hibernation so we can live long enough to reach the nearest stars in person. In science fiction we see the use of multigenerational ships that allow a human colony to maintain itself on a journey that might last centuries. But at least some piece of us, perhaps only our DNA found in our descendents, will actually reach these distant places to start a new human society.

As our technology improves, we can now see that there are other more efficient possibilities. In Arthur Clarke's "Songs of Distant Earth," frozen embryos are sent on long duration voyages, to be revived, incubated and raised by human-like robots. Later more advanced robot ships carried only DNA patterns stored in computers, which are used to recreate humans and the rest of our biosphere when suitable planets are located.

Even these techniques could be considered primitive by galactic standards. Perhaps intelligent aliens might abandon their bodies entirely and transmit themselves electronically. Or they might be superseded by their own creations, as we are about to do on this planet. Advancements in nanotechnology will soon create self-replicating machines that will utilize quantum effects just as life does. I feel that there's a better than average chance that within 50 to 100 years we will become obsolete as our creations evolve beyond us. A really advanced civilization might store all its knowledge in micron-sized structures and use self-replication as a means of safeguarding their information, by spreading nanotech machines throughout the galaxy. They might have already colonized the Earth, living deep below the surface. We might never know they're even here, nor would they be aware of our presence on this planet.

The Meaning of Life

Since we still don't know if there is life anywhere else in the universe, what should we do to safeguard life on earth? The universe could be full of life, but it could be decades or centuries before we know for certain. And even if we find that the origin of life is a widespread phenomenon, does that mean that earthly life is nothing special in the scheme of things? Comets have hit the earth many times in the past. A sufficiently large comet or asteroid could put an end to all life on earth, and it could happen at any time.

The primary purpose of life is to reproduce itself and pass along its store of information. Life has found its way into every available niche on this planet, from the upper atmosphere to Antarctica, to deep ocean volcanic vents and to rocks miles deep under the surface. Its purpose is to exploit every environmental niche available to it. As I mentioned earlier, it's possible, but not yet proven, that life could make an involuntary journey from one planet to another and survive the trip. However this is an entirely random process and one that has a low probability of success. As a means of propagation it's not very reliable.

For the first time in the history of this planet, a species has evolved the ability to send spacecraft to other planets. For scientific reasons we've been very careful to avoid contaminating other planets until we know what's there and if life has evolved independently. Regardless of the outcome of those investigations, I'd like to propose that our goal should be to propagate life to other worlds when the opportunity arises. We need to look beyond our own planet to find a way to protect the information in our DNA, not to mention the knowledge we've accumulated with our minds. When a species is introduced into a new geographical region or ecological niche on this planet, it doesn't look around and decide that its competitors are more worthy of survival, turn around and go home-- it multiplies and competes with whatever species are found in the new ecosystem.

Clearly, if we discover some form of life on Mars, it will be the most important event in human history, and we'll want to spend plenty of time studying it. But unless it's intelligent and starts shooting at us, should we leave it alone and abandon any ideas of terraforming Mars as a way of ensuring the continuation of our own biosphere?

Leonid Report from Hyde Observatory— Martin Gaskell

First, although Erik asked me to take the lead in organizing this, I have to say that it was very much a team effort by everyone. I think I saw that all but two of the Hyde Observatory board of supervisors members were there during the course of the night. Then there were volunteers running the deck, and giving talks all night.

I guess we could say that for Hyde Observatory the evening began even before we opened with Hyde getting national attention over the Associated Press radio affiliates. They had Erik Hubl on live during the dinnertime news and he arranged for me to be on live with them from Hyde later during the night.

It was hard to predict how many members of the public would show up and when. I was actually mildly relieved to see that there was still space in the parking lots when I arrived! There were probably about 50 people there during the first couple of hours. Jeff Campbell and A.J. Benker gave talks and we ran "The Night the Stars Fell" for them. We explained that the radiant was below the horizon and that they should come back in the pre-dawn hours. Almost all of them left by midnight.

About four Leonids were reported around 10:00 p.m. Although that would not have been much to see, I was excited because it had important implications. If we were seeing Leonids with the radiant well below the horizon then things must have been really cooking over Europe!

Erik set up the call to the Associated Press network. We stood outside with his cell 'phone on the lawn to the south of the observing deck. There we were, right after the United Nations arms inspection team in Saudi Arabia, a report live from Hyde Observatory being heard coast to coast! As I waiting to go on the air I practiced saying the expected time of

maximum in the various time zones: "5-6 on the E. coast, 4-5 here in the center of America, 3-4 in Mountain time, and 2-3 in California" Erik commented after the brief interview that it was exciting that what Hyde was doing was having a national impact.

Back inside Mark Dahmke had a lap-top set up with a modem so that we could try to get rates. The information on the radio meteor site was not readily digestible, except that it told us that a lot of people were listening in to the shower. Mark failed to get any live optical rates promised by websites. The websites were not giving real numbers yet, just blank graphs or predictions.

I went outside with Ron Veys for maybe 10 minutes or so around 10:45 and only saw one almost certain Leonid (its speed made the identification almost certain). Because the radiant was getting closer to rising this lower rate (lower compared with what people had seen around 10:00) suggested that the first peak was now dying down. I was still wishing very much that we could get a rate graph for Europe over the internet though.

I kept looking outside as the radiant rose. Things were pretty quiet as the radiant began to rise around 11:30. There were a few fast, fairly faint Leonids, but it was nothing like that remarkable warm night in November 1999 when lots of us were out at Olive Creek State Recreation Area and we saw a very good display as the radiant rose. This year the first peak was clearly over as the radiant rose. Allowing for the altitude of the radiant and the moonlight though there was a good rate. The ZHR (i.e., the idealized corrected hourly rate) would have been well over 100 per hour. That's about the same as the best annual showers like the Quandrantids, Geminids, or Perseids, but somehow it doesn't seem like much when you're primed for a big Leonid storm

Back inside we entertained the now small number of visitors by talking about the meteors and showing Jupiter, Saturn, and other objects through the telescopes on the deck. We had another showing of "The Night the Stars Fell." Things were still relatively quiet outside. Suddenly we got through on Brian Sivill's laptop to a site with count rates from the aircraft flying from Spain to Omaha. I got very excited as I saw the graph and everyone laughed at my excitement! Sure enough Europe had seen a big peak, provisionally a ZHR of almost 2000! The graph also showed the population index (the ratio the count rate increases by as you go one magnitude fainter). I discussed what all this meant with everyone.

By now it must have been around 1:00 a.m. Little by little the observed rate increased, but it was clear that the ZHR must have been holding flat around 100 per hour.

Rebecca Harbison, and Liz Klimek had a few races to the trees and back to keep warm. Everyone was having fun. As Jeff Campbell has mentioned there were quite a number of students from my classes at UNL. One of the reasons I'd suggested we open up Hyde for the shower was so that people would have a safe convenient place to come and watch the meteors from. I didn't take a head count but it seemed that if one subtracted out the PAC members, there were more women than men who came, at least that was true of my students. A man might feel OK about going out into the street in the middle of the night to watch meteors, but it's different when you're a woman. As we'd requested, the police drove by through the park a few times during the night.

Channel 10/11 (Chris Hunt) showed up around 3:30 and started filming the crowd. Although everyone was enjoying the meteors - especially the bright ones - the rate was still staying flat. I reckoned that our observed rate was now about a factor of five below the prediction. Chris Hunt filmed me discussing the graph from the airplane and I'm told that that footage made it on 10/11 in the morning. I told people that my best guess of the situation was that the peak was going to be less than predicted, and/or later. I hoped for the later choice. Actually I should have considered another option: the peak was going to be narrower.

Fortunately around 4:15 the rate began to pick up a lot. With some difficulty I dragged myself away from the sky and made my previously scheduled follow-on call to the Associated Press network. Right before I went in there was an almost head-on fireball that left a glow that some people said they saw for up to 30 seconds in binoculars. As I listened to the AP broadcast over the 'phone I could hear that they had given up for the night on arms inspectors in Iraq looking for nuclear weapons. As far as they were concerned the big story was looking for meteors! They decribed what was going on around the world, how people in Britain had been mostly clouded out, and how the Canadians they were in touch with were clouded out, but then they continued, "but in Lincoln Nebraska . . ." and then they introduced me again. "Well, I'm here at Hyde Memorial Observatory in Lincoln Nebraska with a large crowd watching meteors shoot across the sky . . ." I began. Once again what was going on at Hyde Observatory was being heard of across the country! I didn't need to worry about keeping listeners time zones correct this time. "If listeners go outside right now they'll see it!" I told the AP audience.

Taking my own advice I headed straight back outside. The cirrus was mostly gone. The moon to our backs was getting low so the sky was getting darker. There were plenty of Hyde supervisors and volunteers there and from an organizational point of view everything was going perfectly so I just lay down by the side of the road with a group of women from the honors program at the University to try to record some meteor observations. I put my tape recorder on continuous record. The peak was very sharp within a few minutes of 4:47 a.m. CST. Most of the meteors were faint. The rate was very high. Earlier in the evening I had been carefully recording meteor magnitudes to within the nearest half magnitude. Now the rate was so high that all I could record was "there's one, and another, and another, . . . there were two at once" and so one. If you try reading aloud what I just wrote you'll get an idea of the rate. Even with the bright moonlight there was at most only a few seconds between meteors. At one instant there were five meteors coming out of

the radiant almost simultaneously! The observed rate was close to what we saw last year (2001) at the peak, but the meteors were fainter.

The crowd that had been oohing and aahing was now much quieter. There were just too many meteors to say "ooh!" and "ah!" each time. Instead people were transfixed watching the show. Brian Sivill got a good laugh when he said that for a bunch of people who knew that the earth was being bombarded by debris from space, we weren't being very smart being outside where we could be hit! Chris Hunt recorded people's reactions. Kevin Dowd's son John gave an excellent on-camera description for 10/11 viewers of one meteor with a long-lasting train that he'd seen. Chis then asked Kevin's wife Jane why they had come out. "Because this was probably the last chance in my lifetime to see a meteor shower like this" she replied.

After the maximum the rate dropped abruptly. By 5:00 people felt that the best of the show was over and were packing up. As quietly as they had come people went home to get ready for work or to grab a few hours of missed sleep. By 5:20 there were only a few diehards left out on the lawn.

Now only the occasional meteor was streaming out of Leo. Yes, there were still a few bright ones, but the big show was definitely over. I stared up at Leo and thought to myself that probably never again in my lifetime would I see so many meteors coming at such a rapid rate from a point in the sky. And really, thanks to the publicity Hyde Observatory gave to the event, we got to share in this rare experience with probably thousands of people in Nebraska and across the country. This is what the Prairie Astronomy Club and Hyde are all about.

WHAT WAS THE RATE?

OK, let's talk numbers! Just HOW good a show was it in quantitative terms?

As will be gathered from the above I was distracted for most of the night talking with people and not counting meteors. To get some hard numbers I needed to rely on my family at home! My wife, Barbara, took the three kids out into our backyard to watch the show from about 3:45 until 5:00. Trees and our house block quite a bit of the view from our yard, but my son Daniel (age 10) counted 350 meteors. His younger sister Laura (age 6) counted 212. This is also similar to what one of our UNL students got out at Hyde. Barbara says that Daniel saw a greater number partly because he had the least obstructed view of the sky. Although they looked for 1.25 hours, if one applies a rough correction for time not looking at the sky, these numbers will be close to their observed hourly rates. My wife thought that the maximum was around 4:45. Daniel and Laura's observed hourly rates are comparable to what Dave Knisely reported. In fact, if you allow for the obstruction of the sky in our backyard Timothy and Daniel's rates are higher. This illustrates that there was little to be gained from being in a darker location, and this, of course, was the rationale for having Hyde open instead of heading out to Olive Creek or somewhere.

Here is a crude ZHR calculation: assuming a roughly triangular profile to the maximum, the peak will be about 2.4 times Daniel's average rate per hour. Let's assume that we need to multiply by 1.3 to correct for the fraction of the sky hidden behind trees. The remaining factor in the ZHR calculation is the effect of the limiting magnitude. Let's suppose that it was 4.5 rather than the standard 6.5. The big question is what population index to use. If it is 1.5 then Daniel's ZHR is 2500; if it is 2.0 then Daniel's ZHR is 4400. For typical meteor showers the index is 2.5 which would translate into a ZHR of 6800. For comparison, the peak we saw last year through the cloud was a ZHR of 1800 according to (International Meteor Organization) IMO figures. So, based on Daniel and Laura's counts I'm guessing that the ZHR will be over 2000. In due course we'll learn what the final IMO answer is.

For reference the predictions had been:

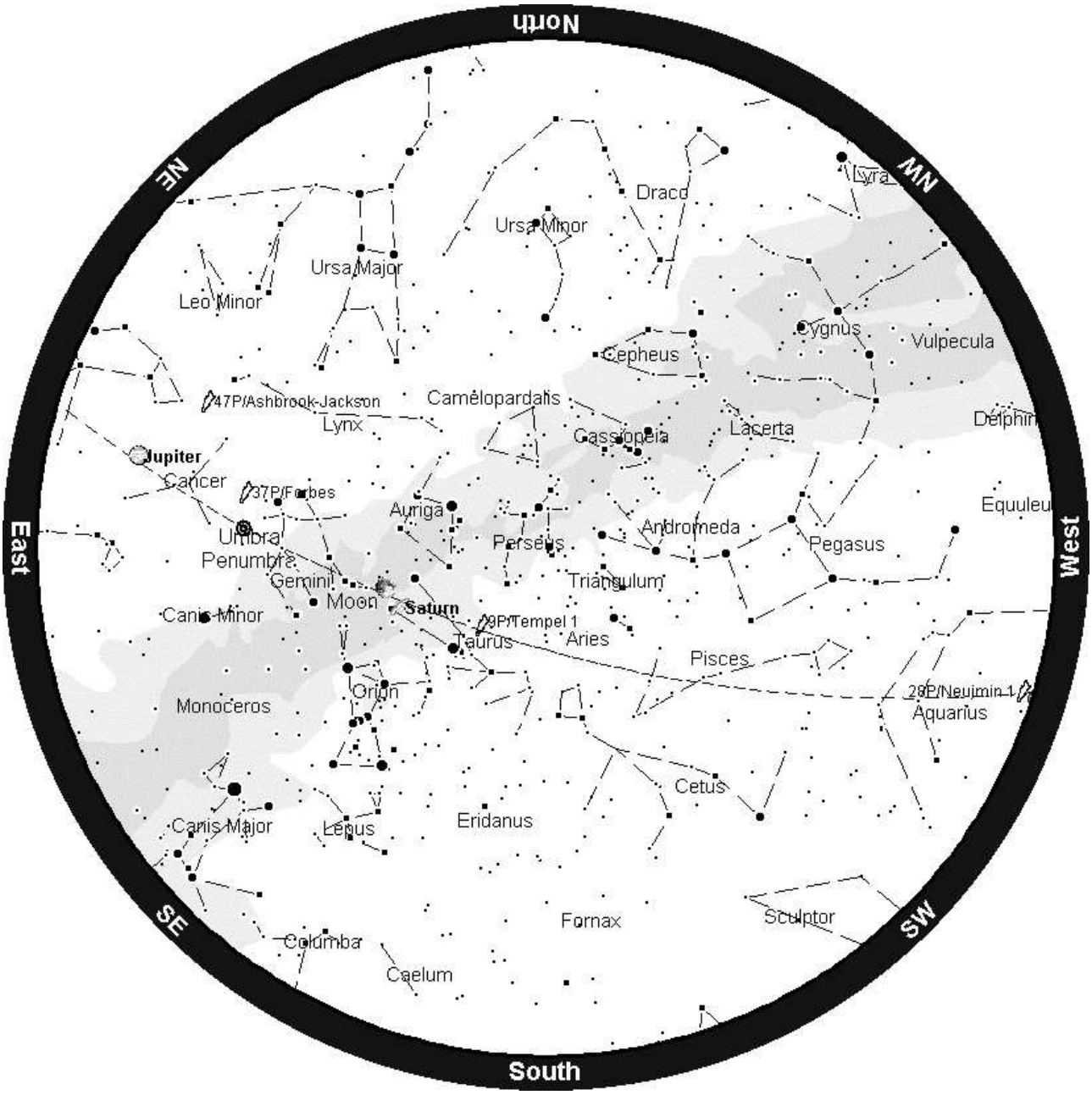
Asher/McNaught 4:39 CST 6000 per hr
Lyytinen 4:40 CST 2600 per hr
Vaubaillon 4:47 CST 3000 per hr
Jenniskens 4:23 CST 5400 per hr

The time of maximum wasn't as early as the Jenniskens predicted time that a lot people were talking about, but you can see that the others were close and Vaubaillon was right on.

The main difference between the predictions and what was observed was the narrowness of the peak. This was what was causing me anxieties around 4:00 that the shower might be a flop. One can hardly fault the predictors for predicting a broader width. I think they were mostly guessing the width. We have to recognize the tremendous strides meteor prediction has made in just the last four years. Four years ago the time of maximum was in error by half a day; the last two years the error has been measured in minutes. In the last year or so we're getting reasonable ZHR predictions for almost the first time.

I have to mention an important non-observation. During all my Leonid watching last night I ONLY SAW ONE SPORADIC! I don't know how long I was looking at the sky, but I should probably have seen many times that number. This is a nice simple argument for a substantial correction factor to the observed Leonid rate to get the ZHR.

January Star Chart


North
NE
NW
East
West
SE
SW
South
Draco
Ursa Minor
Ursa Major
Leo Minor
Lyra
Cygnus
Vulpecula
Cepheus
47P/Ashbrook-Jackson
Camelopardalis
Lynx
Cassiopeia
Lacerta
Delphin
Jupiter
Cancer
37P/Forbes
Auriga
Equuleu
Umbra
Penumbra
Perseus
Andromeda
Pegasus
Gemini
Triangulum
Moon
Saturn
Canis Minor
9P/Tempel 1
Taurus
Aries
Pisces
Orion
29P/Neujmin 1
Aquarius
Monoceros
Cetus
Canis Major
Lepus
Eridanus
Fornax
Sculptor
Columba
Caelum

Events Calendar

January 2003

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1 Sun: 07:50 - 17:09	2 Sun: 07:50 - 17:10	3 Sun: 07:50 - 17:11 Club Star Party	4 Sun: 07:51 - 17:12 Hyde Observatory open to the public
5 Sun: 07:50 - 17:13	6 Sun: 07:50 - 17:14	7 Sun: 07:50 - 17:14	8 Sun: 07:50 - 17:15	9 Sun: 07:50 - 17:16 NSP Planning Meeting 7:30	10 Sun: 07:50 - 17:18	11 Sun: 07:50 - 17:19 Hyde Observatory open to the public
12 Sun: 07:49 - 17:20	13 Sun: 07:49 - 17:21	14 Sun: 07:49 - 17:22	15 Sun: 07:48 - 17:23	16 Sun: 07:48 - 17:24	17 Sun: 07:47 - 17:25	18 Sun: 07:47 - 17:26 Hyde Observatory open to the public
19 Sun: 07:46 - 17:28	20 Sun: 07:46 - 17:29	21 Sun: 07:45 - 17:30	22 Sun: 07:45 - 17:31	23 Sun: 07:44 - 17:32	24 Sun: 07:43 - 17:33	25 Sun: 07:42 - 17:35 Hyde Observatory open to the public
26 Sun: 07:42 - 17:36	27 Sun: 07:41 - 17:37	28 Sun: 07:40 - 17:38 PAC Meeting 7:30pm	29 Sun: 07:39 - 17:40	30 Sun: 07:38 - 17:41	31 Sun: 07:37 - 17:42	

Directions to Olive Creek Observing Site

Shorter:

Take Hwy 77 South out of Lincoln until you get to the Crete corner (junction Hwy 77 and Hwy 33). Go West on Hwy 33 (toward Crete) until you get to SW 72 St. Turn Left (South) on SW 72 St. and go about 5 miles until you get to SW Panama Rd. Turn right (West) until you get to SW 100 St. (SW 100 St does NOT go through to Hwy 33). Turn Left (South) on SW 100 St and go about 1 to 1 1/2 miles until you see the sign and entrance to Olive Creek (this is the West side of the Park). It's on your left (East) side of the road.
More Black Top:

Take Hwy 77 South out of Lincoln until you get to the Crete corner (junction Hwy 77 and Hwy 33). Go West on Hwy 33 (toward Crete) until you get to about SW 114 St. - the first intersection after SW 100 St. (forgot to look at this street sign, sorry - you'll see a sign for Olive Creek though at this road- but don't count on anymore signs after that, I didn't see any). Turn Left (South) on SW 114 St and go about 5 miles or so until you get to SW Panama Rd (you'll see a church and small school on your right). Turn Left (East) and go about a mile to SW 100 St, then turn Right (South) and go 1 to 1 1/2 miles until you see the Olive Creek entrance and sign (on your left hand side of the road).

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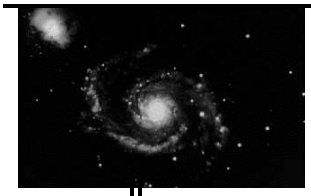

The Prairie Astronomer
c/o The Prairie Astronomy Club, Inc.
P.O. Box 5585
Lincoln, NE 68505-0585

First Class Mail

Next PAC Meeting
December 30, 2002
7:30 PM
Hyde Observatory