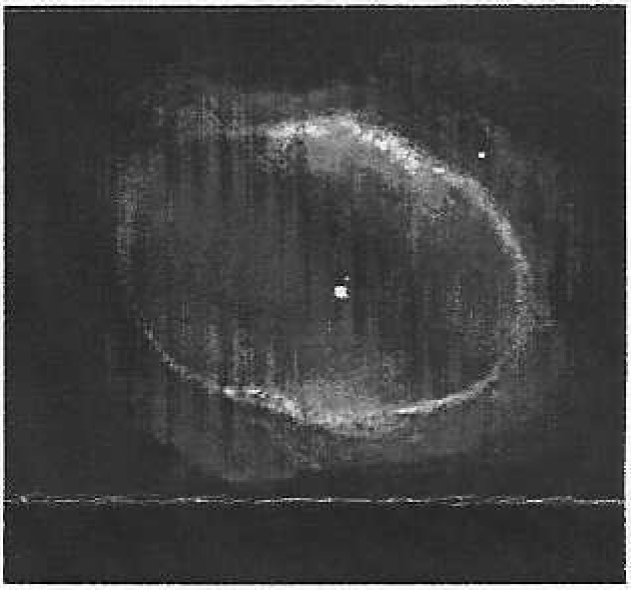
Reflections Refractions

of the University Lowbrow Astronomers

November, 1998

Credit: Hubble Heritage Team (STScI/AURA/NASA)
NGC 3132 is a striking example of a planetary nebula. This expanding cloud of gas, surrounding a dying star, is known to amateur astronomers in the southern hemisphere as the "Eight-Burst" or the "Southern Ring" Nebula.



The name "planetary nebula" refers only to the round shape that many of these objects show when examined through a small visual telescope. In reality, these nebulae have little or nothing to do with planets, but are instead huge shells of gas ejected by stars as they near the ends of their lifetimes. NGC 3132 is nearly half a light year in diameter, and at a distance of about 2000 light years is one of the nearer known planetary nebulae. The gases are expanding away from the central star at a speed of 9 miles per second.
This image, captured by NASA's Hubble Space Telescope, clearly shows two stars near the center of the nebula, a bright white one, and an adjacent, fainter companion to its upper right. The faint partner is actually the star that has ejected the nebula. This star is now smaller than our own Sun, but extremely hot. The flood of ultraviolet radiation from its surface makes the surrounding gases glow through fluorescence.

The University Lowbrow Astronomers

The University Lowbrow Astronomers is a club of Astronomy enthusiasts which meets on the third Friday of each month in the University of Michigan's Physics and Astronomy building (Dennison Hall, Room 807). Meetings begin at 7:30 pm and are open to the public. Public star parties are held twice a month at the University's Peach Mountain Observatory on North Territorial Road (1.1 miles west of Dexter-Pinkney Road; further directions at the end of the newsletter) on Saturdays before and after the new Moon. The party is canceled if it's cloudy or very cold at sunset. For further information call (313)480-4514.

This Month:

November 14 - Public Star Party at Peach Mountain Observatory - Jupiter & Saturn high in the southern sky.
November 17 - LEONIDS METEORS WATCH ! at Hudson-Mills Metro Park, dusk to 3:00 am See Bernard Friberg for more information.
November 20 - Meeting at 807 Dennison - Mark Deprest will present Star Hopping through Vulpecula.
November 21 - Public Star Party at Peach Mountain Observatory - Comet Giacobini-Zinner at perihelion - mag 8.9. See map on page 107, Nov. Sky & Telescope.
November 22 - ATM Group - Mtg time & location TBD

Next Month:

December 12 - Public Star Party at Peach Mountain Observatory - Watch for early Geminid meteors.
December 18 - Meeting at 807 Dennison - Speaker TBD
December 19 - Public Star Party at Peach Mountain Observatory - Comet C/1998 M5 Linear at 9.5 mag 18h52m +39degrees (due east of Vega +/- 2 degrees).
December 20 - ATM Group - Mtg time & location TBD.
December 21 - Winter Solstice 8:56 pm, shortest day of the year.

NOV 13 - Lowbrows at Leslie Science Center

The Leonids

by Milton French
(selected text from various web sites)

From the site: http://www.cyberpath.net/leonids/

"... It would seem as if worlds upon worlds from the infinity of space were rushing like a whirlwind to our globe... and the stars descended like a snowfall to the earth."

"... I heard a faint voice near my door, calling my name... beseeching me to rise, and saying, 'Oh my God, the world is on fire!'..."

On the night of November 12, 1833, the residents of the United States were thrown into a state of panic by a spectacular celestial fireworks display. To those out in the night, it appeared that almost every star in the sky was falling from heaven; even those asleep indoors were awakened by the brilliant flashes of meteors and peered fearfully out of their windows, sure that the world was coming to the end. However, there were cooler heads, some belonging to the Pawnee, who watched the meteors without fear, for they remembered the story of the man Pahokatawa. After being killed by enemies and left as animal fodder, he was revived by the gods and came among the Pawnee, exhorting them not to fear falling stars, for they were not a sign of the world's end. There was also some rationality along the Eastern seaboard, as can be seen in this writing by Agnes Clerke: "a tempest of falling stars broke over the earth... The sky was scored in every direction with shining tracks and illuminated with majestic fireballs. At Boston, the frequency of meteors was estimated to be about half that of flakes of snow in an average snowstorm. Their numbers were quite beyond counting; but as it waned, a reckoning was attempted, from which it was computed, on the basis of that much diminished rate, that 240,000 must have been visible during the nine hours they continued to fall."

Observations like these, especially those of Denison Olmsted, gave birth to meteor science. The Leonids would storm again in 1866 and 1867, but with a diminished intensity compared to the major displays of 1799 and 1833. The 1866 apparition is especially notable, for it was then that a greater understanding of the nature of meteor showers was attained with the realization by the Italian astronomer Schiaparelli (famous for his drawings of the Martian canals) that the Perseid meteors were caused by particles ejected from Comet Swift-Tuttle. The source of the Leonid meteors was soon determined to be the newly discovered Comet Tempel-Tuttle, which completes one orbit about the Sun every 33 years. This being established, astronomers looked forward eagerly to 1899, when the Leonids were expected to roar once again.

However, mid-November of 1899 did not manifest a meteor storm, there being only a modestly enhanced shower (normally the Leonids have a rate of about 10-15 meteors per hour; in 1899 there were about 40 per hour). The same thing happened in 1932, when the Leonids barely managed about 200 meteor per hour. Astronomers forgot about the Leonids, thinking that the great meteor storms of the 18th and 19th centuries would not be seen again. 1965 proved them wrong, for the Leonids once again reached storm levels, achieving a rate of some 5000 per hour. The following year,1966, was when the Lion really showed its teeth, for 150,000 meteors per hour were seen in the greatest Leonid display of all time. Past Leonid meteor storms have been no cause for concern, for the meteors are so small that they never make it anywhere near the ground, vaporizing at altitudes greater than 90 km. However, nowadays we have hundreds of active satellites in Earth orbit and in near-Earth space, none of which have the protection of the atmosphere. Can these satellites be damaged by a storm of Leonid meteors, which, due to the orbit of the parent comet relative to that of Earth's, sweep by us at a blazing 72 kilometers per second? This question is not easy to answer, for it involves several factors, some of which are the probabilities of Leonid storms in the next few years, the expected intensity of the storm(s), and the vulnerability of a given satellite to the effects of a meteor impact. The latter can only be answered by the various satellite operators and designers, so the following paragraphs shall attempt to address the other two factors mentioned.

The storm probabilities for the next few years can be obtained via one of two methods - an analysis of past Leonid activity or by the generation of computer models of the stream of meteoroids, taking into account planetary perturbations, radiation pressure, and the characteristics of the meteoroids ejected from the comet.

From the site: http://www.imo.net/leohints.html
(International Meteor Organization)

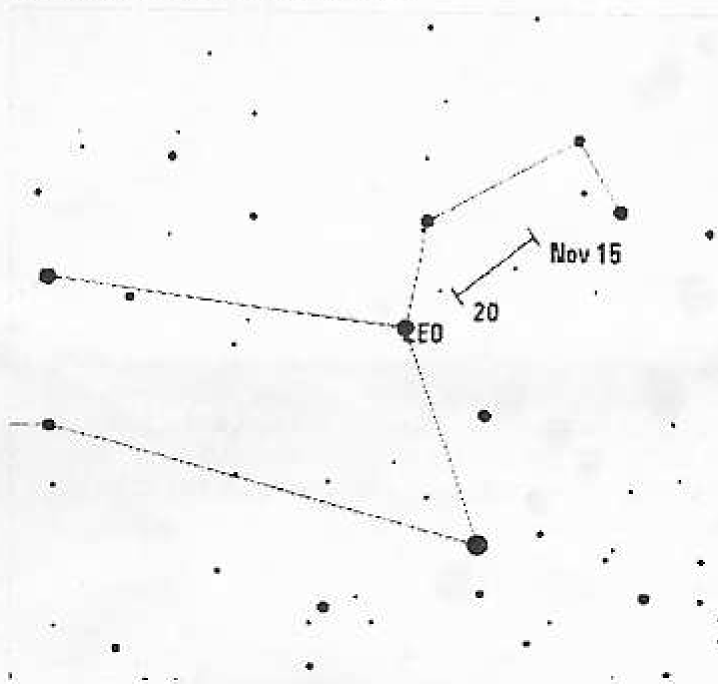
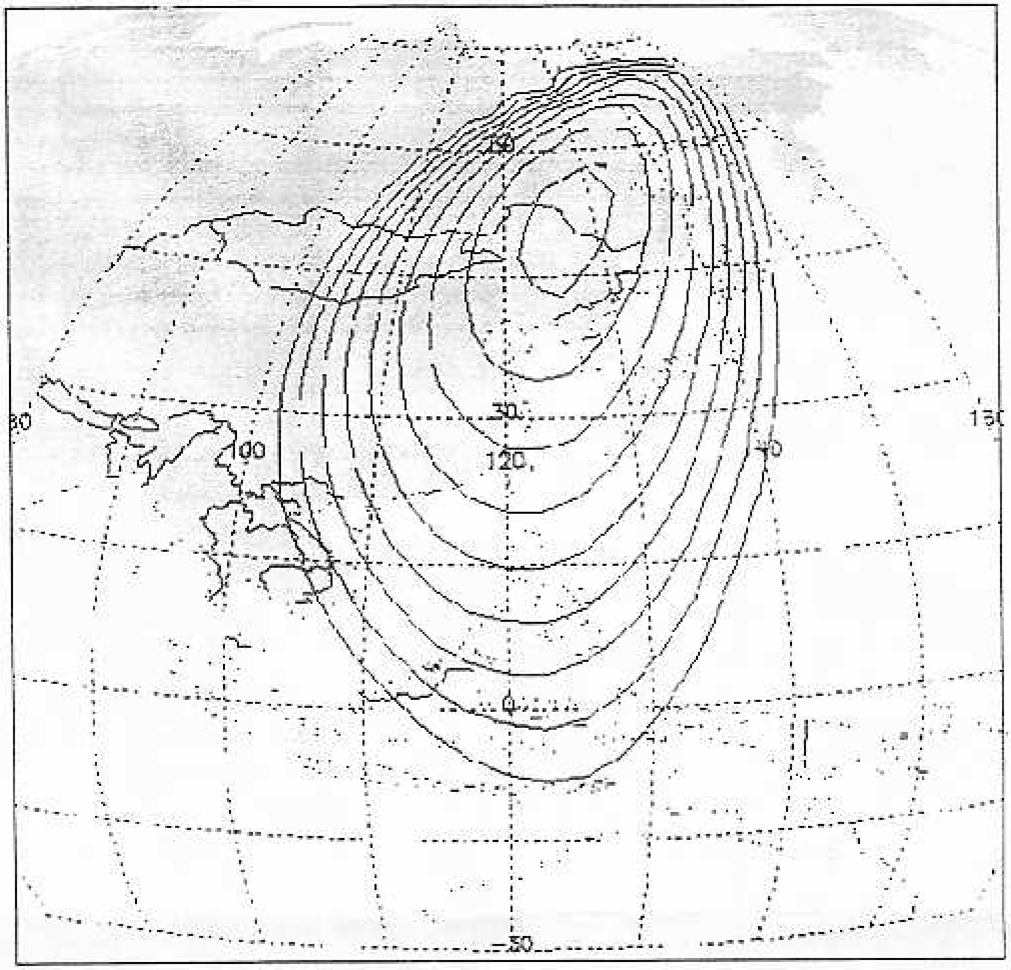


Figure 11: Radiant position of the Leonids



Observing Hints for the 1998 Leonid Return

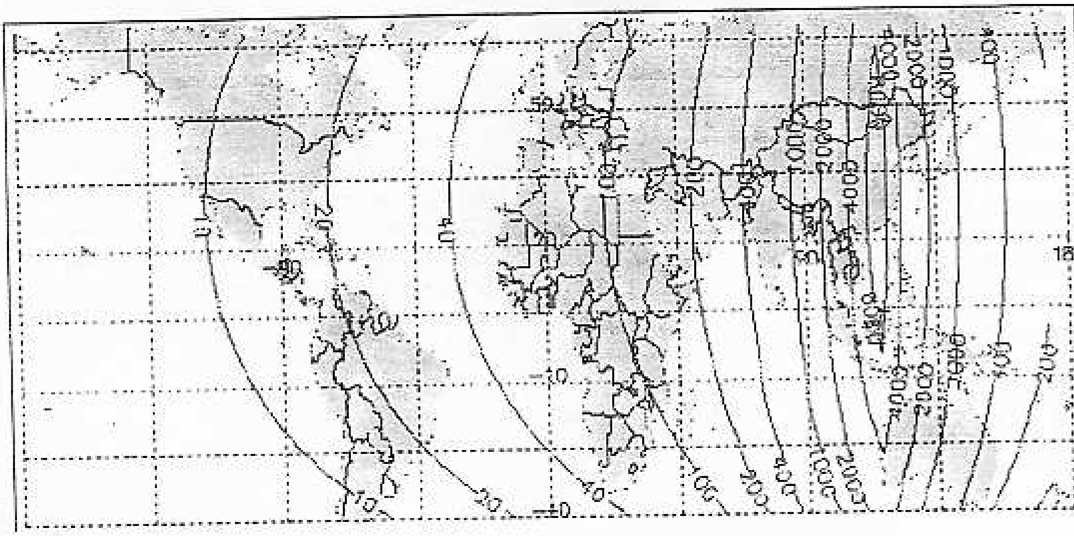
A guide to observing the 1998 Leonid activity is given. Expectations of peak time and activity profile are presented, and hints on visual, telescopic, video and photographic observations are given with the intention to derive scientifically useful data about the whole activity range of the 1998 Leonids.

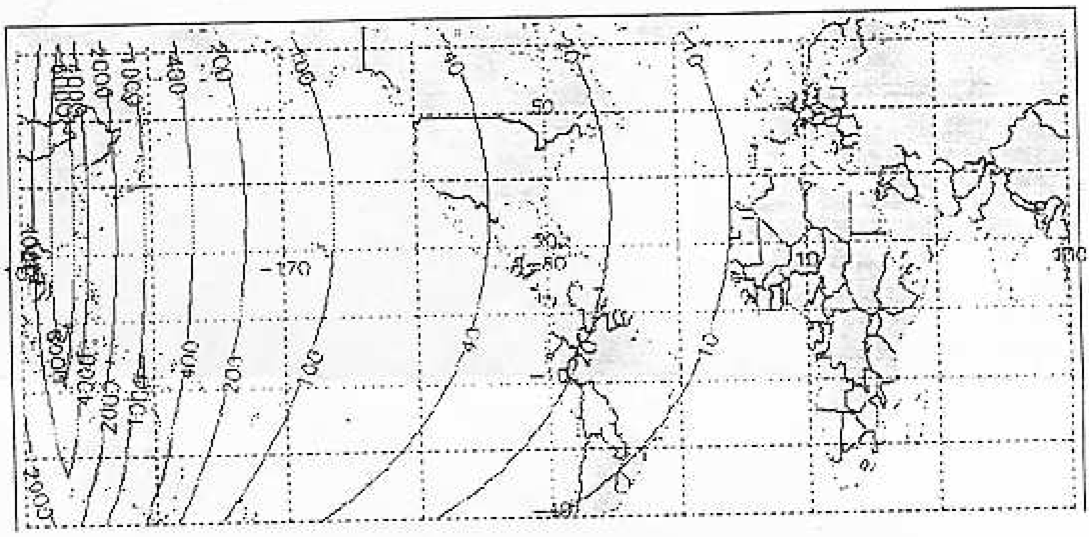
What is expected

The return of the Leonid meteor shower is no doubt the major astronomical event of 1998. The observing network which has been established within the International Meteor Organization in the last 15 years, provides us with all means for getting a complete picture of the Leonid meteor shower. This guide covers the whole range of activity we are expecting, not just the moment of highest rates, since we should not forget about deriving accurate results for off-peak rates as well.

The Leonid meteoroid stream is linked to the periodic comet 55P/Tempel-Tuttle. The comet has an orbital period of 33.2 years and was rediscovered on March 4, 1997 [1]. For a prediction of the peak time of meteor activity, the time of nodal crossing of the comet is important. The node lies at omega=235.258 , and the Earth will pass the node at lambda=235.29 which corresponds to Nov 17, 20h UT. Comparing the 1998/1999 Leonid return with past events, we find that the encounter conditions are similar to those of 1866. If we use the 1866 ZHR profile of [2] for a prediction in 1998, we find ZHRs above 1000 between November 17, 19h and 21h UT. The ZHR will have returned to a level of 100 at 23h UT. The background component is fairly broad and lasts for about 12h with ZHRs above 50 according to the 1996 results [3] and for about 10h according to the decay exponent of 1866 given in [2]. Figure 1 shows a sort of visibility function of the Leonids. It will be interesting to know how many hours before the peak time the radiant will be sufficiently high above the horizon. The later limit will be dawn, and the period before the Sun approaches the horizon will be interesting too. We coupled both times by multiplication, since this operation gives only one maximum where both times are equal. Best observability with a minimum radiant elevation of 40 and a minimum depression of the Sun of 12 is in the north-east of China.

Visibility function of the Leonid peak on November 17, 20h UT. The number of hours with the radiant above 40 elevation and the number of hours with the Sun more than





12 below the horizon are multiplied. The contour lines are not radiant elevation lines; they indicate where the best combination of dark hours and high-radiant hours can be found. The area in the north-east of China has the best conditions, provided the peak-time prediction is correct.

We may construct a scenario with a peak equivalent ZHR of 10,000 meteors per hour. Given this maximum rate, Figure 2 shows an overview of expected activity at different geographical locations. All positions refer to the same local time - 3h 30m, when the peak is expected in eastern Mongolia and north-eastern China. The activity profile was defined by the exponential-decay constants derived for 1866 in [2]. You can read the geographical longitude as a time axis: Positions east of Mongolia represent times before the peak, positions west of Mongolia represent times after the peak. The radiant elevation at that local time is included as well, giving the visible meteor rate at a limiting magnitude of 6.5. Observers in Japan will see about 1000 meteors per hour in the night November 17-18, shortly before the peak will take place. As it is dark until more than an hour later in Japan, they will observe strongly increasing activity. European observers will see a rate of 100 at best in the same night, that is, after the maximum. American observers will face a low activity of 10-20 on November 17-18. They may have seen, however, higher rates before the peak as shown in the lower part of Figure 2. Visible rates are between 20 and 50 in the night November 16-17. Hawaiian observers are closest to the peak on the western hemisphere with rates of 100. Note that the date now switches to November 17-18 when you consider Japan as above. Again, note that this graph of visible rates is only one of the scenarios possible, the predicted peak activity of 10,000 may well be wrong by a factor of 10 towards both lower or higher rates.

Expectation of visible rates for all geographical positions. The predicted visible rate at lm=6.5 mag is given for a local time of 3h 30m local time at each position. The upper graph refers to the night November 17-18, the lower graph shows the night November 16-17 for America, Europe, and Africa.

Although these predictions look quite accurate, we should definitely not rely on them and be prepared for the full range of activity at any location. It is indeed most unlikely that the peak will be shifted by more than 2 hours or that the background activity is much higher than anticipated. However, if something very unusual happens and we are not properly prepared, we will lose the chance of the first global, scientific monitoring of a Leonid meteor storm. For everyone who intends to travel to central or eastern Asia, the hints for using astronomical equipment on cold climates [4] are warmly recommended. Night temperatures below -20 C (below -4 F) are very common in Asian desert and prairie areas in November.

From the site:
http://medicine.wustl.edu/~kronkg/leonidhis.html
(Gary Kronk)
The point from where the Leonid meteors appear to radiate is located within the constellation Leo and is referred to as the radiant. The radiant is located in the western portion of that constellation in what is commonly referred to as the "sickle" or "backwards question mark." The radiant rises around 12:30 a.m. local time. Although a few Leonids can be observed prior to this, more will be seen after it rises. At about 3:00 a.m. the radiant is about 30 degrees above the horizon. The radiant location with respect to the horizon is shown below. The Leonids and the Birth of Meteor Astronomy.

The night of November 12-13, 1833, not only marks the discovery of the Leonid meteor shower, but sparked the actual birth of meteor astronomy. During the hours following sunset on November 12, some astronomers noted an unusual number of meteors in the sky, but it was the early morning hours of the 13th that left the greatest impression on the people of eastern North America. During the 4 hours which preceded dawn, the skies were lit up by meteors.

On the night of November 17, 1966, expectations were high worldwide, but few observers got to see the Leonids as well as Dennis Milon and a dozen other amateur astronomers situated under the clear skies of Arizona. Observations began at 2:30 a.m. (November 17.35 UT) and 33 Leonids were detected during the next hour. After a short break, the next hour began at 3:50 a.m., with 192 Leonids being observed. The team had been keeping magnitude estimates during the early part of the shower, but this ended around 5:00 and, by 5:10, the observers were detecting 30 meteors every minute, but the display was far from over. Rates at 5:30 were estimated as several hundred a minute and the team estimated a peak rate of 40 per second was attained at 5:54 (November 17.50 UT)! The activity declined thereafter, and by 6:40 it was down to 30 per minute, despite the fact that astronomical twilight had begun 9 minutes earlier. To sum up, it would seem the 1966 return of the Leonids was one of the greatest displays in history, with maximum rates being 2400 meteors per minute or 144,000 per hour.

SUMMARY - Although spectacular displays of the Leonids have been seen in the past, I think that observers in Michigan will likely be disappointed this November. First, the month of November is the second cloudiest month of the year next to December. The probability of clear skies is about 25-30%. Second, we are almost exactly opposite of the area of the earth where the highest rates are most likely to be seen. The predicted time of maximum activity is about 2:45 PM on November 17. The closest available viewing time nearest the maximum is before sunrise on November 17. After sunset on the 17th is the closest time to the maximum with dark skies, but the radiant is far below the horizon. Third, there is significant uncertainty in the exact number of meteors that will be seen this year. However, it is true that you will never succeed if you don't try. I still plan to look for meteors on the morning of Nov. 17 and the night of the 17-18 weather permitting.

There is a substantial amount of material available on the Internet, which should satisfy the most interested observer. I list 6 links that I found the most useful.

http://www.imo.net/
http://medicine.wustl.edu/~kronkg/
http://www.skypub.com/meteors/
http://www-space.arc.nasa.gov/~leonid/
http://ssd.jpl.nasa.gov/leonids.html
http://www.cyberpath.net/leonids/

Benoit Mandelbrot, Fractals and Astronomy (Part 1)

by Dave Snyder (dgs@umich.edu)

Fractals are mathematical objects with strange properties. They have been known for many years, but had been relegated to an obscure corner of mathematics. In the beginning fractals were curiosities, very few people thought they had any real applications. Ludwig Boltzmann and Jean Perrin were among the exceptions. All that changed when Benoit Mandelbrot began his career. Mandelbrot discovered that complex phenomenon in a variety of sciences, including astronomy, that could be understood in terms of fractals.

Fractal geometry along with several other sciences were motivated by examining human senses. For example, the sense of sight led to the study of electromagnetic radiation and the sense of hearing led to the study of acoustics. However until recently, there had never been any science of roughness.

Starting in the late 1800's and into the early 1900's, a number of strange mathematical objects were developed by Georg Cantor, Helge von Koch, David Hilbert, Giuseppe Peano, Carl Ludwig Sierpinski and others. They were called "monster curves" as if they were unruly beasts who needed to be locked up before they did some real damage (the word fractal would come later). Unlike other objects like circles and sine curves which are smooth, these objects are rough and this roughness persists even as the object is magnified. As the object is magnified more and more, the same amount of roughness is present. They are created using a simple process known as aggregate replacement. By repeating this process indefinitely images of these objects form, showing that a complex object can result from a simple procedure.

Even though a group of talented mathematicians had spent a great deal of effort developing these curves, they remained confined to an obscure part of mathematics until Benoit Mandelbrot started his career. Mandelbrot obtained a master's degree in aeronautical engineering and a Ph.D. in mathematics. After obtaining his Ph.D., Mandelbrot conducted a wide variety of investigations that went, as he described it, "in a number of directions." He began to realize there was an underlying theme to what he had been working on: these "useless" mathematical objects discovered earlier had a use. He coined the word "fractal" and started applying fractal ideas more systematically. Mandelbrot knew a precise definition of roughness was crucial. There were already several ways to measure roughness (they all came under the vague label "fractal dimension"), but they did not always produce the same result. Mandelbrot realized that the most useful of these was the Hausdorff dimension, though it is the hardest to calculate.

The applications discovered by Mandelbrot and others include problems in biology, chemistry, physics, astronomy, geology, psychology, computer science and economics; however I will limit my discussion to astronomy. One of the applications of fractals in astronomy appears when we examine the orbits of planets. Planets, like all objects in the universe, obey Newton's law of gravity. However even though Newton's law is relatively simple, it can be difficult to apply in practice. The so-called N-body problem asks the question "if we have three or more objects each of which exerts a gravitational field, how can we predict the motions of these objects?" No precise answer is known except under a few special cases. You may be wondering at this point "can't we accurately determine the orbits of the planets in our solar system?" Well we can, sort of. Astronomers use approximations to determine orbits, and these approximations work well enough that we can predict where any of the planets will be next week or twenty years from now. However some astronomers believe we cannot accurately predict where they will be a million years from now. A similar result occurs with any group of objects moving in a gravitational field, such as the particles making up the rings of Saturn or the stars within a globular cluster.

I must make this clear, the orbits of the planets are not fractals: they are very close to perfect ellipses. However if we plot the predicted positions of a particular planet under a number of conditions we find they all fit within a boundary curve called the basin of attraction. This basin is often a fractal.

Fractals built with aggregate replacement are not the only types of fractals known. Other methods of generating fractals go by the names L-system and IFS. It is also possible to use equations involving a mathematical creature known as a complex number to generate what are known as Julia Sets. Julia Sets are intimately linked to another object now known as the Mandelbrot Set. The Mandelbrot Set, named after its inventor and sometimes called the "most complicated object in mathematics," is also generated using complex numbers.

As an aside, many of these fractals have been used to produce computer images, some of which are quite beautiful. These images are typically very colorful and have caught the attention of some artists. Note that the images are usually based on black and white fractals, the colors are simply added by the computer. While these images have played an important role in making non-specialists aware of the subject, computers played very little role in the development of fractal geometry.

To the best of my knowledge L-Systems, IFSes, Julia Sets and the Mandelbrot Set have no application to the study of astronomy. However there are other types of fractals. The fractals I've mentioned so far are all deterministic. In other words, each time they are constructed they look exactly the same as the previous time. On the other hand, a stochastic fractal is generated with a random process, such as tossing a coin. Two stochastic fractals generated with the same process will look different. Most deterministic fractals can be modified to produce a stochastic fractal.

To find more applications of fractal geometry, we need a special type of stochastic fractal known as a "multifractal measure." In order to explain how multifractal measures are used, I will need to discuss distribution functions and a particular type of distribution function known as "1/f". Multifractal measures may prove useful in describing the distribution of craters on the moon as well as the distribution of galaxies in the universe. I will discuss these ideas in part two of this article.

Before ending part one, I need to emphasize something that Mandelbrot has emphasized repeatedly. Fractals have applicability in wide range of scientific disciplines, however fractals are not a panacea. They are useful for <I>describing</I> some phenomenon and even <I>accounting for</I> variability. However they cannot describe all phenomenon of nature. Even when they are useful in describing they rarely are of much help in <I>predicting</I> or <I>explaining</I>. While multifractals have been used to model stock market fluctuations, I have serious doubts that anyone could use fractals to make specific predictions. For example, it might be useful to predict the price per share of Microsoft stock on January 1st, 2000, but I don't know how to use fractals to make such a prediction. The same problem occurs in other applications of multifractals, including astronomy.

Most of the ideas for this article came from two talks Dr Mandelbrot gave at the University of Michigan this past October, however I also made use of many additional reference materials. The complete bibliography is too long to include here, but I will be happy to show it to anyone who is interested.

MORE RAINY-DAY MUSINGS

By Lorna Simmons

Here we are again--inclement weather and no break in sight. Before you decide to end it all for the umpteenth time, I would suggest that you continue to learn to find your way around the sky in order to whet your appetite for clear skies, wherever they are. In Arizona? New Mexico?

First, get yourself comfortable. Turn off your computer (for now). Settle into a cushy chair/sofa next to a bright light. Oh, dear–I forgot the books! Gotta get up! Go to the bookshelf. Pick out books. Details, details.
There are several books which will show you some of the celestial objects which (if the weather were willing) could be located through your telescope(s). Since this is Michigan, and the weather is not often willing, you are forced to adjust. Do not stick your head underneath a pillow; take second best.

Summer Stargazing, by Terrence Dickinson, is a thin book which is divided into sections: "Introducing the Night Sky," "The Main Charts," "Close-Up Charts," and "Celestial Phenomena."

"Introducing the Night Sky" includes brief discussions concerning observing, in addition to information intended to help you get started in your skywatching (if only the weather would oblige). After a section, entitled "How to Find Stars and Constellations," there are "Key Charts" of the constellations for "Late Spring and Early Summer" and "Summer and Early Autumn." Each of these "Key Charts" includes four smaller charts, "facing north," "facing west," "facing south," and "facing east."

Now, we get into the beautiful part: There are "Main Charts," each of which contains color photographs on the left and right-hand pages. The left-hand page consists of full-page photographs (without identifying notations) of the portion of the sky in the headings. This left-hand page is intended to show what you would actually see at a dark site through binoculars. Consider this to be applicable for naked-eye viewing (if your vision is keen). Your eyes do not need to become dark-adapted for this armchair/couch virtual-viewing session! If you do not recognize the celestial objects, fret no more. The right-hand page, in each instance, shows the same photograph of the same portion of the sky as the left-hand page (which has no identifying markings). However, on the right-hand page, notations identify the constellations, important stars, and important celestial objects. The right-hand page also is divided into sections labeling a close-up which is to be found on a later page; the right-hand page also has markings to help you find your way around the left-hand page which has no markings. These seven "Main Charts" are entitled:

1. "The Dippers and the Northern Sky."
2. "Late Spring/Early Summer: Facing West."
3. "Late Spring/Early Summer: Facing South."
4. "Late Spring/Early Summer: Facing East."
5. "Mid-to Late Summer: Facing West."
6. "Mid-to Late Summer: Facing South."
7. "Mid-to Late Summer: Facing East."

Following all of these charts are pages with a mixture of color photographs with aids for finding consequential objects; some of the color photographs include markings identifying pertinent constellations. There are color photographs of important celestial objects (perhaps to whet your appetite) and/or further diagrams with finding aids. These pages are entitled:

"Close-Up: Cassiopeia and the Big Dipper."
"Close-Up: Summer Triangle."
"Close-Up: Scorpius Milky Way."
"Close-Up: Galactic Hub Region."
"Close-Up: Celestial Treasures."

These sections are followed by charts of "The Sky in other Seasons": "Early Autumn," "Late Autumn," "Winter," and "Early Spring," and pages of gorgeous photographs and explanations concerning "Meteors," "Auroras," "Lunar Eclipses," "The Sun and Solar Eclipses," and "Comets." It ends up with a section about "Planet Visibility 1996-2010," complete with aids for finding the various planets. I, myself, most certainly intend to be around for these!

The pictures are beautiful. They are very helpful in those sections which permit you to find the sky objects without aids before you sneak a peek for confirmation. (No cheating is permitted! That's the law. Hear?)

Now comes the pièce de résistance of virtual observing! The Photographic Atlas of the Stars, by H. J. P. Arnold, P. Doherty, and P. Moore, with a foreword by Sir Arnold Wolfendale (Institute of Physics Publishing) is a book which is similar to "Summer Stargazing", but even more gorgeous. Be careful about deciding to read this book. You will never want to return to the chilly night sky, but forever will be content to sit in that comfortable cushy chair viewing pictures of celestial pleasures way beyond anything we can get naked-eye at Peach Mountain (because of the light pollution from Ann Arbor and beyond). Of course, to be truthful, at Peach Mountain you are viewing the real deal!

The main body of this book is divided into 45 full-page, glossy, color photographs of groups of constellations (Northern and Southern Hemispheres), each page showing the view that one would get at a dark site with naked-eye observing. With each of the full-page photographs (on the right-hand page) there is (on the left-hand page) a carefully-drawn, full-page star chart of that particular section of the night sky. This book of photographs is intended by the authors to be an aid for those who wish to learn the night sky.

There is one problem with this book: it is so beautiful that you will not want to get it all messed up by actually turning the pages. For those people, I suggest buying two books–one book to read and the other book to treasure! The book is rather expensive; therefore, to do that, you ought to begin forgoing lunch for awhile in order to refill your piggy bank.

While you are holed up and unable to view the celestial sphere, you might try looking at the photographs in an atlas, such as the classic, black-and-white photographs of The Hubble Atlas of Galaxies, by Allan Sandage, Mount Wilson and Mount Palomar Observatories, Carnegie Institute of Washington, and California University of Technology (1961). You will be viewing some of the first photographs taken of galaxies during the 20th Century astronomy.

On the other hand, the stunningly-beautiful photographs of The Color Atlas of Galaxies, by James D. Wray (Cambridge University Press, 1988), should also help keep you out of the doldrums on one of those nights of inclement weather. This volume omits the galaxy, Andromeda, which easily can be found in many other astronomical books. You will get an idea of the great variety of shapes and orientations (in reference to Earth) of these magnificent celestial giants.

Most of these books are perfect for beginners who live around bright lights where viewing anything other than the full moon is a challenge. You "amateur" astronomers can get some enjoyment also. At worst, you can always vent your rage by using (illegal) copies of pages from these books for target practice and making points by hitting important stars in the various constellations. Of course, you would not want to dirty the originals.

A closing note (somewhat on topic): Years ago I learned from a Native American dancer what was purported to be an "authentic American Indian rain dance." I promise never to perform it–at least not on Peach Mountain nights. Promise. I mean it. (Crossing fingers.)

IT'S CALENDAR TIME!

by Doug Scobel

It's that time of year again - time to order calendars for 1999. I have changed things a little from last year, so here goes. I ordered 40 "Wonders of the Universe" wall calendars from Hansen Planetarium. These are the beautiful wall calendars containing excellent images (astronomical and terrestrial) and daily notes on sky happenings. YOU DO NOT HAVE TO ORDER OR RESERVE THEM FROM ME. I will simply make them available to you on a first come, first served basis. Price will be $9.00, same as last year. I should have them at the November 20 meeting.

I also ordered 10 "Year in Space" 1999 desk calendars from Starry Messenger Press. This year it has been expanded to 172 pages, contains 53 space images, and more. AGAIN, YOU DO NOT HAVE TO ORDER OR RESERVE ONE - they will be available to you on a first come, first served basis. Price will be $9.95 each. I should have these at the November 20 meeting also.

I will be placing an order to Sky Publishing Corp. on December 1. I will be ordering one "Observer's Handbook 1999", published by the Royal Astronomical Society of Canada, for use in the observatory. These are popular with the club, but due to their relatively high cost, I must ask that you order one from me if you want one. I do not want to pre-order a bunch and then have some left over at almost $20.00 a pop. So, if you want to get in on the order and order one, and/or anything else in the Sky Publishing catalog, then you must provide me with the item name(s), catalog number(s), and (here's the important part) THE MONEY BEFORE DECEMBER 1! NO MONEY, NO ORDER! Don't worry about shipping costs - the 10% discount will just about pay for shipping, so simply give me the price of the item(s). If all you want is an Observer's Handbook, then send me 17.95 per handbook desired. I must cut it off at December 1 so that there is time to receive the shipment before next month's meeting on December 18. Sky and Telescope subscribers should already have a copy of the catalog by now, and I will bring my copy to the November 20 meeting. You can also visit Sky Publishing online at www.skypub.com.

IMPORTANT NOTE REGARDING PLACING YOUR OWN SKY PUBLISHING CATALOG ORDER: To get the 10% discount on items in their catalog, Sky Publishing now requires that you (a) subscribe to Sky and Telescope magazine, and (b) that subscription must be made through the club. Before, simply being a member of the club entitled you to the discount.

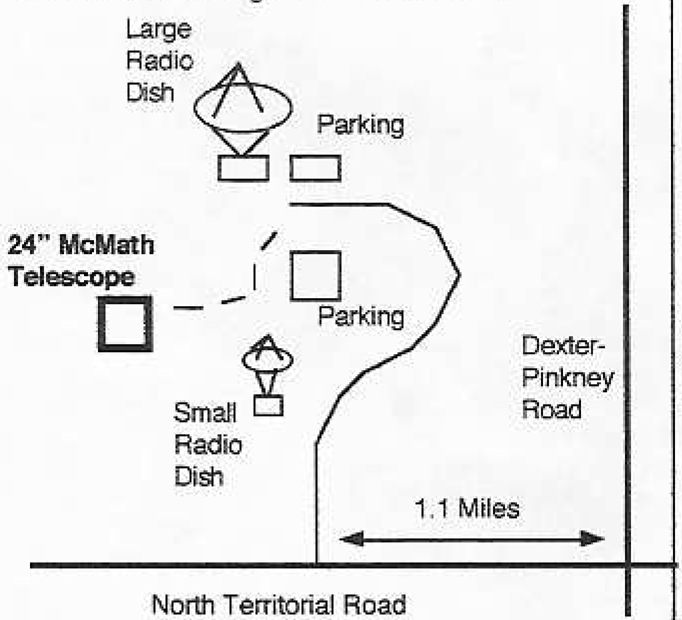
CUB SCOUT SPACE NIGHT A HUGE SUCCESS

by Brian Ottum

On October 15, I hosted "SPACE NIGHT" for Saline's Cub Scout Pack 419. It was a magical night for the 130 attendees. Success would not have been possible without the generous help from the following Lowbrow members: Doug Scobel-who manned the 20" in the dome. John Causland-who wowed the scouts his computerized scope. Dave Snyder-who kept up with the zillions of questions they asked. Mark Deprest-who explained the solar system with much enthusiasm. John Ridley-who inspired many future scientists. Paul Walkowski-who kept the focus on Jupiter, despite lots of bumps to the scope. Bernard Friberg-who helped explain what everyone was seeing. Thanks to all!

Places and Times:

Dennison Hall, also known as The University of Michigan's Physics and Astronomy building, is the site of the monthly meeting of the University Lowbrow Astronomers. It is found in Ann Arbor on Church Street about one block north of South University Avenue. The meeting is held in room 807.



Peach Mountain Observatory is the home of The University of Michigan's 25 meter radio telescope as well as the University's McMath 24 inch telescope which is maintained by the Lowbrows. The observatory is located northwest of Dexter. The entrance is on North Territorial Road, 1.1 miles west of Dexter-Pickney Road. A small maize-and-blue sign marks the gate. Follow the gravel road one mile to a parking area near the radio telescopes. Walk along the path between the two fenced in areas (about 300 feet) to reach the McMath telescope building.

Monthly meetings of the Lowbrows are held on the 3rd Friday of each month at 7:30 PM in 807 Dennison Hall. During the summer months, and when weather permits, a club observing session at Peach Mountain will follow the meeting.

Public Open House/Star Parties are held on the Saturday before and after each new Moon at the Peach Mountain Observatory. Star Parties are canceled if the sky is cloudy at sunset or the temperature is below 10 degrees F. Call 480-4514 for a recorded message on the afternoon of a scheduled Star Party to check on the status. Many members bring their telescopes and visitors are welcome to do likewise. Peach Mountain is home to millions of hungry mosquitoes - bring insect repellent, and it does get cold at night so dress warmly !

Amateur Telescope Making Group meets monthly, with the location rotating among member's houses. See the calendar on the front cover page for the time and location of next meeting.

Dues:

Membership dues in the University Lowbrow Astronomers are $20 per year for individuals or families, and $12 per year for students and seniors (age 55/+). This entitles you to the monthly REFLECTIONS newsletter and the use of the 24" McMath telescope (after some training). Dues can be paid to the club treasurer Doug Scobel at the monthly meeting or by mail at this address:

1426 Wedgewood Drive
Saline, MI 48176

Magazines:

Members of the University Lowbrow Astronomers can get a discount on these magazine subscriptions:

Sky and Telescope: $27 / year
Astronomy: $24 / year
Odyssey: $16.95 / year

For more information contact the club Treasurer. Members renewing subscriptions are reminded to send your renewal notice along with your check when applying through the club Treasurer. Make the check payable to "University Lowbrow Astronomers".

Newsletter Contributions:

Members and (non-members) are encouraged to write about any astronomy related topic of interest. Call or E-mail to Newsletter Editors at:

Bernard Friberg (743)761-1875 Bfriberg@aol.com
Chris Sarnecki (734)426-5772 chrisandi@aol.com

to discuss length and format. Announcements and articles are due by the first Friday of each month.

Telephone Numbers:

President:	Mark Deprest	(734)662-5719
Vice Pres:	Lorna Simmons	(734)525-5731
	Dave Synder	(734)747-6537
	Paul Walkowski	(734)662-0145
Treasurer:	Doug Scobel	(734)429-4954
Observatory Director:	Bernard Friberg	(734)761-1875
Newsletter Editors:	Bernard Friberg	(734)761-1875
	Chris Sarnecki	(734)426-5772
Keyholders:	Fred Schebor	(734)426-2363
	Mark Deprest	(734)662-5719

Lowbrow's WWW Home Page:

http://www.astro.lsa.umich.edu/public lowbrows.html
Dave Synder, webmaster

Monthly Meeting:

November 20. 1998 7:30 pm

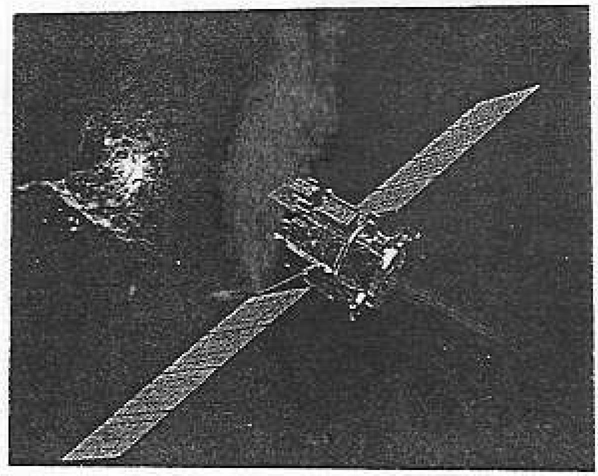
Room 807 Dennison Hall
Physics & Astronomy Building
The University of Michigan

Mark Deprest presents:

Star Hopping through Vulpecula

and

Report from the Officer's Meeting



NASA/JPL/Caltech - Deep Space 1 (DS1) is NASA's first spacecraft of the New Millennium Program which is investigating less expensive and advanced technologies for use on future space science missions. DS1 will test an ion propulsion system and will visit Asteroid McAuliffe, Mars, and Comet West-Kohoutek-Ikemura in it's two year mission..

University Lowbrow Astronomers
3684 Middleton drive
Ann Arbor, Michigan 48105

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Check your membership expiration date on the mailing label !

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