



THE  
GALACTIC  
CENTER

12-85



I stated last month that the December newsletter would begin a series on the origins of the universe. Well, I lied! Actually, in my research on globular clusters (and galaxy formation) I ran across an interesting article dealing with the "Beast" at the center of our galaxy, i.e. the possibility of a black hole at the center of the Milky Way. And I'd like to pass along some of what I learned.

We have all gazed up at the broad band of light that winds it's way overhead, running from northeast to southwest in the summer and northwest to southeast in winter. The galaxy in which we live, the Milky Way, presents us with hours and hours of fascinating observing. Just sweeping a telescope or pair of binoculars across the band of stars opens up an entire spectrum of objects and clusters to explore. And as we move across the thousands of visible stars, we can even imagine the galaxy as it would look from thousands of light years away, a large rotating disk with a bright center. From here on Earth, we can't really see the center of the galaxy. Looking up at the constellation of Sagittarius, we see only bright foreground stars backed by the bright haze of what appear to be thousands and thousands of background stars along with large rifts of darkness created by dust and gas. Radio telescopes which can 'see' through these dark clouds indicate a tremendous amount of energy across the entire spectrum originating from this point in the sky, from low-energy radio waves to the high energy X-rays and gamma rays. Surely, matter itself is being created and destroyed at the galaxy center, but exactly how and by what, we do not yet know.

Many astronomers today believe there to be a black hole creating much of this radio energy from our galaxies center. Black holes create such energy when they accelerate dust, gas, and stars to speeds close to the speed of light, creating tremendous amounts of heat from the friction. This heat is radiated in the form of energy, i.e. gamma rays, X-rays, etc..

In 1970, a balloon borne telescope launched by a Rice University team lead by Robert Haymes discovered gamma radiation coming from very near the Milky Way's center. The source was quite remarkable in that a major part of it's energy was concentrated into a single wavelength. And what was even more interesting was that this wavelength was the product of a very specific reaction. Photons emitted from a black hole collide, creating electrons of ordinary matter and positrons of antimatter. These particles, in turn, encounter each other with such violence that they are destroyed in a great burst of energy, which is carried away from the scene of the mutual annihilation by photons of this single wavelength. This meant that somewhere near the center of the galaxy, matter and antimatter were being created and destroyed in large quantities, in a process of unimaginable violence and power.

(CONT. PG 2)



It's hard to say that the gamma ray source is exactly at the galactic center, but it is quite close...being only about 4 degrees away. Nothing else in our galaxy remotely resembles this source.

About a year after the gamma ray source above was discovered, an astronomy satellite named Uhuru was launched to study X-rays. It discovered X-rays coming from Sagittarius, and since then the Einstein Observatory has pinned down the X-ray source to within one arc-minute from the galactic center. Is it possible that the same source is putting out both types of radiation? No one is quite sure.

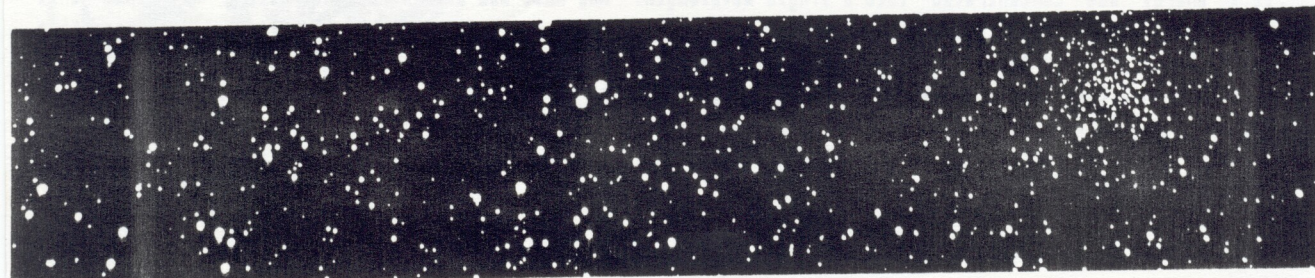
In the mid 1970's another wavelength was added to the study of the galactic center. Paul Harvey and his colleagues used NASA's Kuiper Airborne Observatory to record infrared observations of the center. Although they concluded that the center region included stars with enough energy output of a few hundred thousand suns, more recent studies have shown the output to be more equivalent to the output of 10 million suns. Although whatever is there must be extremely large to produce such energy, there is no direct way to measure its mass. But there are ways to infer it. One way is to look at the motion of the doughnut shaped gas cloud surrounding the center. The gas cloud is affected by the gravity just as planets around a sun are. By knowing the gas clouds speed and distance from the center, we can calculate the centers mass. Doing this we find a mass of only 2 to 5 million solar masses, not near enough to account for all the infrared energy being emitted. Either the original figures were wrong or not all the energy is coming from ordinary stars.

This past summer, a group of scientists at the University of California at Berkeley lead by Charles Townes accurately measured the velocities of gases at different distances from the galactic center and estimated the mass that must be contained within their core. The researchers became convinced that only a massive black hole of four million solar masses in conjunction with a lighter cluster of stars could create the observations made. This model goes a long way in explaining why there was such a discrepancy in the estimated central mass originally. Calculations made from the infrared readings should be low because they don't take into account the black hole. Still, the researchers can't say exactly where the object exists or what it looks like.

But the story is not yet over. Radio waves are unlike the higher energy sources mentioned above in that they are long enough so that neither gas nor dust impedes them. In 1975, the first high resolution map of the galactic center was made. The region was called Sagittarius A, and the region contains not one strong radio source, but three! The first is called Sagittarius A East, and is a shell some 20 ly in diameter. It's probably a supernova remnant and is fairly ordinary. About 160 ly away the radio map is dominated by two more sources. Sagittarius A West is also not a star but a large hot cloud whose radio waves are generated by simple radiation, another fairly ordinary object.

But the third radio source is not ordinary. Designated as Sagittarius A\*, it is an object so small that its true diameter has not yet been measured. Its radio waves are not being produced by ordinary stellar processes or radiative cooling. Sag. A\* acts like a synchrotron, a sort of celestial atom smasher in which particles are accelerated to near the speed of light by an interplay of powerful electrical and magnetic fields. It lies very close to the galactic center.

So what is at the center? No one knows for sure. It could be a massive black hole, a grouping of stars, or as most astronomers now believe, a small black hole. But only time, maybe, will tell.





# President's Message

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As the newly elected President of the Prairie Astronomy Club of Lincoln Nebraska, I will be fair and honest toward the club and it's members. (How's THAT for an opening statement!!!) This should be an interesting year in amateur astronomy. I have some ideas for the club, and I hope YOU do too!

Something new that I will be trying to implement will be a monthly book review of books from the club library. Every month a book from the library will be reviewed at the meeting, and anyone interested in it can check it out while at the meeting. This should help promote the amount of use the club library gets. Norma, the club librarian, will be giving the book review this month, but if any club member has a book that they would like to review at some other club meeting, feel free to contact Norma Coufal, and she will be glad to have you review the book.

In the past, the club officers have talked about having a public relations officer. I think this would be a very good idea. This person would be appointed by the President to notify local news papers, radio stations, and television stations of upcoming PAC events. If anyone would like to volunteer for this position, notify Norma at the next meeting, otherwise someone will be appointed.

You may have wondered why Norma has been mentioned so much in this message. It's because Norma is the new Vice President of the club, and since I'm President I can make HER do all of MY work (no, just joking!). I am going to be skiing in Steamboat, Colorado the last week in December, so Norma will be running the December meeting.

If anyone has ideas for future club events or programs, or if you have any questions about anything that's on your mind concerning the club, feel free to call any of the club officers anytime..day or night. (You see, I can say stuff like this because I won't be at the next meeting to catch any flack!) I'll see you at the January meeting!

Andy Corkill

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The Prairie Astronomer is published monthly by the Prairie Astronomy Club Inc., and is free to all club members. Membership expiration date is listed on the mailing label. Membership dues are: Junior Members and Newsletter Only Subscribers...\$8.00/yr, Regular Members...\$22.00/yr, Family Membership...\$25.00/yr. Address all membership renewals or questions to: THE PRAIRIE ASTRONOMY CLUB, INC., P.O. BOX 80553, LINCOLN, NE. 68501. For other club information contact one of the following: Andy Corkill (Pres) 488-1096, Norma Coufal (V.Pres) 483-5685, John Lortz (Sec) 390-9821 (Omaha), Lee Thomas (Tres) 483-5639, Dan Neville (Prog. Ch.) 476-7772. All articles should be sent to newsletter editor JOHN LORTZ 9255 CADY AVE #14, OMAHA, NE 68134, no later than six days before each club meeting.



# AT THE LAST MEETING...

The last meeting produced some changes in the PAC. The club hats with the new logo were ready and available to members for the low price of \$4.95. Since our current source for shirts had dried up until spring, it was decided to put off the club shirts until March or so of next year. We will still be shooting to purchase quality shirts that will fair well over the years.

The last of the 1986 Exploring The Universe Calendars were delivered by Lee, as well as the remaining RASC Handbooks.

After discussion of possible price increases in Sky & Telescope next year, as well as information on current club treasury status, the membership voted to increase dues (effective January 1st, 1986) to the following amounts...

Newsletter ...	\$8.00
Juniors .....	\$8.00
Regular .....	\$22.00
Family .....	\$25.00

It's good to remember that the Prairie Astronomy Club still has one of the lowest membership dues rates in the midwest. These increases will help us better cover the newsletter costs as well as prepare us for the possible increase in Sky & Telescope magazine.

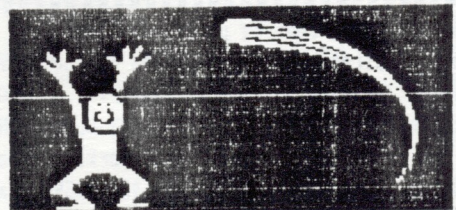
Of course the main event at the November meeting was election of club officers. After some close (and not so close) races, here are the results...

## PAC OFFICERS FOR 1986

President --	Andy Corkill
V. Pres --	Norma Coufal
Secretary --	John Lortz
Treasurer --	Lee Thomas
Prog. Ch. --	Dan Neville

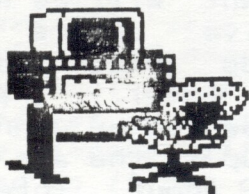
These officers will assume duties starting with the December meeting. The positions of Observing Chairman, Newsletter Editor, Librarian, and Recording Secretary are all appointed positions. It was mentioned that a new Public Relations post may be created in the near future to handle radio and newspaper correspondence.

Earl Moser furnished the club with some outstanding pictures of past comets, as well as a description of how the photo's were taken. Earl also brought along a new portable camera clock drive which he plans to use on his trip to South America this spring. I'm sure he will be bringing back some more great comet slides to add to his collection. The meeting ended with refreshments furnished by Doc Manthey.





## FROM THE EDITOR



For those interested in listening to a telephone update on Halley's Comet, there are two different lines you can phone for only 50 cents each. One is called the ABC News/Planetary Society Halley's Comet Information Line. In this case, the lines title is almost as long as the "update" you get. Carl Sagon is on the line for about a minute giving us a brief update of where the comet generally is, and then making a plug for the Planetary Society. You may want to call this number just once to find what you're not missing.

The second place you can call is the Naval Observatory Halley Hot Line in Washington D.C. I found this call to be much more informative. With the "Comet Rag" playing in the back ground, a short background of the comet is given and then it's location is furnished both for the naked eye observer and then in sky coordinates for telescope users. The recordings are updated on a weekly basis.

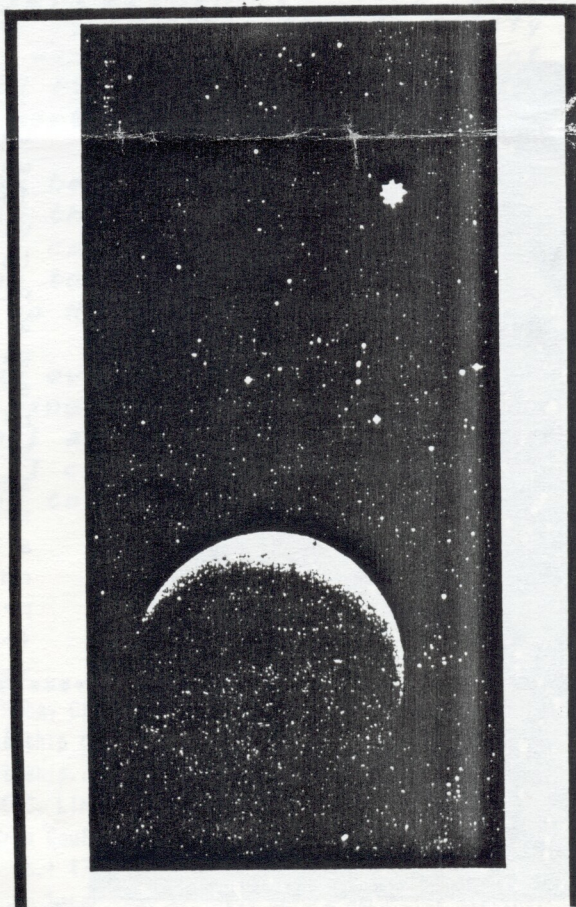
As I said, both calls are only 50 cents, so you might want to give them a try.

ABC/Planetary Society Halley's  
Comet Information Line...

1-900-410-7827

Navel Observatory Halley's  
Hot Line...

1-900-410-8766







## THIS MONTH'S PROGRAM



This month's meeting will be on Thursday, December 26th at the regular time and place (7:30pm, Hyde Observatory). Norma will be heading up the meeting as our new president will be exercising his executive powers skiing in Colorado (watch out for those lifts, Andy). The program will be presented by John Lortz who is still up in the air on whether to talk about interactive CED players and the shuttle, or about the current slide films available for catching Halley's Comet on film.

## DEFINING ASTRONOMY

### PLANETARY NEBULA

Compact round or oval regions of nebulosity which when seen through a telescope under low magnification look not unlike the visible discs of planets; it is because of this appearance that they are referred to as planetary nebulae. Such a nebula represents a roughly spherical or ellipsoidal shell of gas round a central star, usually of spectral type O or W with a temp. of between 30000 K and over 1000000 K. Such a star emits most of its radiation in the short wave ultra violet part of the spectrum, and the gas in the shell shines as a result of absorbing this radiation and re-emitting it as visible light. The nebula probably represents a shell of gas expelled from the central star which is itself approaching the end of its life cycle, and spectroscopic evidence suggests that planetary nebulae are expanding while their central stars are in the process of evolving into White Dwarfs.

(from Dictionary Of Astronomy by Iain Nicolson)



# OBSERVING CHAIRMAN'S REPORT

Star parties for January are on the 3rd and 10th at Earl's. If you can possibly pull yourself away from observing comet Halley, you might find some interesting things to look at in the winter sky. In Camelopardalis lies one of the brightest galaxies in the northern sky, NGC 2403. Located about a degree west of the faint star 51 Camelopardali, this object is visible in a pair of 7x50 binoculars and shows some patchy detail in an eight or ten inch reflector.

Gemini offers several planetary nebulae (SEE DEFINING ASTRONOMY), among them NGC 2371-2, located two degrees west and two and one half degrees south of alpha Geminorum. It can be seen in a six inch as a pair of very faint fuzzy patches with a 12th magnitude star in the north one. A somewhat easier planetary is NGC 2392, also known as the "Eskimo Nebula". It can be found about a degree south-east of the multiple star 63 Geminorum and shows an inner disk with a 10th magnitude central star with a faint outer ring when observed with six inch or larger telescopes.

For those with moderate sized or small telescopes NGC 2264 in Monoceros is a good catch. It surrounds the star 15 Monocerotis and consists of about 20 or so bright stars in a pretty grouping that reminds me of a Christmas tree. There is also a bit of faint nebulosity in this group that can be seen in eight or ten inch instruments. About one degree south and a bit west of



by David Knisley

NGC 2264 is Hubble's Variable NGC 2261. It shows as a small comet shaped fuzzy patch with faint star near one end and can be seen in a six inch under good conditions. Two and one half degrees south of alpha Monocerotis is the cluster NGC 2244 and the gaseous nebula NGC 2237, the Rosette Nebula. The cluster is at the center of a large and rather faint ring of soft nebulosity which can be seen vaguely in binoculars. With the use of the Lumicon UHC Nebular filter and an eight inch telescope, the nebula becomes a spectacular sight with much light and dark detail rivaling portions of the Orion Nebula.

I have a small request to make: please set up your telescopes at Hyde Observatory on Saturdays and Sundays in late December and early January at about 6:30pm when the sky is clear. They are desperate for help during "Halley Season", as the overflow crowds cannot be handled by Hyde's instruments alone. You may be helping find new members for the club this way, and besides, it's a lot of fun!



# Merry Christmas 1985



THE PRAIRIE ASTRONOMER  
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