

THE PRAIRIE ASTRONOMER

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ASTRONOMERS SAY GALAXY MAY CONTAIN MASSIVE BLACK HOLE

Astronomers have found what they believe may be a black hole containing five billion times more materials than that forming the sun. It is in the core of the galaxy known as Messier 87, or M87, an assemblage of several hundred billion stars in the constellation Virgo.

This would be the first observational evidence for so massive a black hole. Such objects were originally postulated on a far smaller scale as the remnants of stars that, having exhausted their nuclear fuel, have collapsed to an ultimate extreme of density.

Such an object would generate gravity so strong that nothing could escape it or pass close by, not even light waves. Within it, according to present theory, time would virtually come to a halt and space would become infinitely curved.

The black holes that have purportedly been detected in recent years, notably Cygnus X-1, are only a few times more massive than the sun, but it has been suggested that far more massive holes may exist in the cores of some, if not all, galaxies. This has been suggested, for example, to explain the catastrophic events evident in some galaxies such as M87 and the more distant quasars.

M87 is a giant elliptical galaxy so massive that its gravity seems to play a major role in holding together the cluster of 130 galaxies in the constellation Virgo. Although it is 50 million light years away, it emits radio waves and X-rays that, even after covering so great a distance, are still extremely powerful.

In photographic exposures that emphasize the central, most brilliant region of M87, a jet is evident extending out 5,000 light years from

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APRIL MEETING NOTICE

The regular meeting of the Prairie Astronomy Club will be held at Hyde Observatory Tuesday evening, April 25, at 7:30 p.m.

HYDE OBSERVATORY SCHEDULE FOR MAY

During the upcoming month of May, Hyde Observatory public nights will continue to be held every Saturday evening. With progressively later sunsets and daylight savings time in effect as of next Sunday (April 30), the Observatory will open at sunset during May, and remain open until 11:00 p.m.

Slide shows for May: "Star For-
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THE PRESIDENT'S REPORT:

Between April showers that were and Northern Lights that weren't, it's been a lousy month for observing. The showers have disclosed a bad leak in the observatory's roof. No! The telescope room is dry, it's the classroom that has turned into a wading pool. The leak seems to be at the base of the solar panels. Hopefully, it will be fixed soon.

The Northern Lights were expected due to a large solar flare. Somehow, the main part of the storm seems to have missed us. At least, I saw no Northern Lights and only got a faint radio indication from them late in the afternoon of the 14th. If any Northern Lights did develop, they did so during the daylight hours when I was at work.

The open house-sky show night at Mead Observatory has been changed to May 5. Last time, the prize for best homemade telescope went begging, since none was on hand. If they are still offering that prize this year, you can probably claim it just by showing up with your homemade telescope. Last time we made a good showing compared to the Omaha club--let's do it again this year.

The Solar Telescope project is ready to start in earnest as soon as we get the cash in hand from the Junior League. Proposed completion date is prior to the start of the public schools in the fall. Assuming the money is forthcoming, the construction should start rather soon.

I had an irreplaceable transistor go out in my homemade telescope inverter. Necessity being the mother of invention, I came up with a simple circuit using parts I had on hand. It is based on the NE555V timing circuit, but the oscillator section is cheaper and draws 80% less current than the oscillator section of the more typical NE555V circuit that appeared in Sky & Telescope magazine some years ago. Its accuracy is the same as the original circuit. If anyone is interested in the circuit, I can have some schematic drawings made available.

See you Tuesday night.

-- Rick Johnson

THE PRAIRIE ASTRONOMER is published monthly by the Prairie Astronomy Club, and is free to club members. Yearly subscription without club membership is \$4.00. Regular membership (includes one-year subscription to Sky 7 Telescope, club newsletter, and four quarterly issues of the Astronomical League newsletter), is \$12.00. Family membership (includes all regular privileges, plus one additional vote in club elections) is \$14.00. Newsletter Editor, Lee Thomas (489-3855). Address all correspondence to P.O. Box 80553, Lincoln, Nebraska 68501.

MIDSTATES ASTRONOMICAL LEAGUE CONVENTION SCHEDULED FOR TULSA

The 28th Annual Convention of the Mid-States Region of the Astronomical League will be hosted by the Astronomy Club of Tulsa June 9-11, 1978, at the University of Tulsa. All amateur astronomers and their friends are invited to attend.

The featured speaker for the Saturday evening banquet will be Dr. James A. Westphal. He is an alumnus of the Tulsa club and the Midstates Region whom the really old-timer will remember as the Regional Chairman when the convention was in Tulsa in 1959, and speaker for the 1963 convention in Fayette. He is now Professor of Planetary Science and Astronomy at Cal Tech, and a member of the staff at Palomar. Westphal will be discussing the current research projects in which he is engaged.

The University of Tulsa is reserving the lecture room of Lorton Hall, the air-conditioned dormitory rooms of Lottie Jane Mabee Hall, and dining space in the Twin Towers cafeteria, all conveniently located together in the south west part of the main campus. The room and board cost will be \$26 per person for 2 night's lodging and 6 meals, banquet included from Friday evening through Sunday noon. Bed sheets and towels are not included.

Besides the banquet, the program will include papers, seminars, exhibits, and star parties.

For the benefit of the Convention Planning Committee in estimating attendance and program needs, advance registration is urgently requested. For pre-registrations received prior to June 1, the fee will be \$4.00 for an individual or \$5.00 for a family. Thereafter, it will be \$1.00 more, i.e., \$5.00 individual, \$6.00 family. Payment for room, board, and key deposit is to be made when you check in at the registration desk on June 9 or 10.

For further information on the Midstates Convention, check with Earl Moser at the April meeting.

...AND NATIONAL CONVENTION FOLLOWS
CLOSELY AT MADISON JUNE 29!!!

The Madison Astronomical Society will play host to the National Convention on June 29, 30 and July 1, 1978, at Madison, Wisconsin, on the occasion of the centennial celebration of the Washburn Observatory. The observatory houses the original 15.6 inch Alvan Clark refractor, once the fourth largest refractor in the U.S. The related Pine Bluff facility has a 36-inch Ritchey-Chretien reflector and both facilities will host tours.

The Sheraton Inn in Madison will be the convention site. Further information is included in the February issue of THE REFLECTOR, which you should have received from the Astronomical League last month.

HELPFUL HINTS ON WHAT TO LOOK FOR IN AN EYEPIECE (PART TWO)

(Editor's note: This is the second part of an article on how to judge the quality and usefulness of telescope eyepieces by club president Rick Johnson. For Part 1, see The Prairie Astronomer, Volume 18, Number 4, March 28, 1978.)

A quick way to determine the approximate size of your own exit pupil is to rack the focus a bit inside of proper focus and look at the out-of-focus star image that results. If you see all the image at one time the entire exit pupil is getting through your eye's pupil. If you find that part of the round out of focus image is "eclipsed" or the image is out of round, then the exit pupil is larger than your eye can accept and light is being wasted. This test unfortunately requires you have a set of eyepieces to start with, or at least access to a set such as with the club's scope at the observatory.

Field Of View: This is usually stated in degrees. To obtain the actual field of view divide the stated field by the magnification. Thus, an eyepiece with a 45° field of view when used at 45 power has an actual field of about one degree. A wide field of view is especially desirable at low powers to avoid the feeling of looking down a tube or tunnel. Usually, the wider the field of view the more expensive the eyepiece. Unfortunately some eyepieces achieve a wide field of view by removing the field stop. This is a ring set at the focal plane of the eyepiece to restrict the field of view to that portion in the center which is most

perfectly focused. Removing the ring does widen the field of view quite a bit but this portion of the field is out of focus and usually full of coma so as to be unusable in the first place. Fortunately such tactics are rarely used today, but some old eyepieces of this type are found up for sale at conventions and in want ads and should be avoided. While all types of eyepieces can be over extended in this way, usually only Kellners are found with the field stops removed.

Eye Relief: This refers to the distance between the eye lens (the lens closest to the viewer's eye) and the exit pupil. In some cases this distance is so short that the viewer must put his eye right up to the eyepiece to see the entire field of view. In other cases it will be so far behind the eyepiece the viewer will have a hard time finding the right spot to look. Most ads claim the eyepiece has "good" eye relief. I guess that means that the eye position is comfortable. Unfortunately, this concept of "good" depends on the observer. If you have astigmatism and must therefore wear your glasses you will prefer an eyepiece with very long eye relief so you can view with your glasses on. Thus, many of my eyepieces have eye relief that is too

long for those who do not wear glasses. Usually the longer the eye relief, the more costly the eyepiece.

Para-focal: This term only means that the focal plane of the eyepiece is in the same relative position as it is in all other eyepieces in that series. Thus, in theory anyway, you can change to a different eyepiece and not have to refocus the telescope. Unfortunately, I have never seen a set of eyepieces that was exactly para-focal. All seem to require a slight refocusing, though when a set is advertised as para-focal this change is usually very small. This is only a convenience feature that does cost a bit of money, more than it is worth, in my opinion.

Fully Corrected: This is purely an advertising term. There is no such thing as a fully corrected eyepiece. The wave theory of light makes this impossible. Each type of eyepiece has its own flaws and strong points. Any competently-made symmetrical is just as "fully corrected" as another symmetrical. But when compared to another type of eyepiece, say the plossl, then it has flaws the plossl doesn't and vice versa. In short, ignore such claims as they are meaningless.

Jaegers give you the opportunity to buy uncoated or coated eyepieces. You definitely should always buy coated to reduce internal reflections and increase contrast. Now the manufacturers are pushing "multi" coated

eyepieces. These multi coatings cost a bit more and have only a very minor effect on overall performance. Eyepiece design, accuracy of the lenses etc., far exceed the importance of multicoatings versus standard coatings for eyepieces.

(To be continued next month)

BEHLEN OBSERVATORY AMATEUR NIGHT

As in the past couple of years, Behlen Observatory is inviting amateur astronomers to its facilities near Mead again this spring. The date announced at the last meeting, April 28, has been moved to one week later: Friday night, May 5, 7-10:00 p.m.

Amateurs (which include members of the Lincoln and Omaha clubs) will set up their telescopes on the "lawn" outside the observatory. In the event of cloudy weather, amateurs are still invited, according to Dr. Ed Schmidt, since there is enough room inside for most of the telescopes to be set up.

Small prizes or certificates will be awarded in several categories.

Last year, the Prairie Astronomy Club was well represented, apparently outnumbering the Omaha Astronomical Society which lists a considerably larger membership. Word is out that the folks from River City will be appearing en masse this year, so let us not be outdone. Plan on an appearance at Mead Friday, May 5. Directions are available in the Behlen Observatory brochures at Hyde.

OBSERVING CHAIRMAN'S REPORT:IF YOU DON'T LIKE GALAXY-WATCHING, MAY IS NOT YOUR MONTH

This month you have little choice of what to look at since we are presently faced with bunches and bunches of galaxies littering the skies. Starting in Ursa Major, look about $3/4$ degree southeast of Gamma Ursa Majoris for M109, a faint spiral galaxy which should be just visible with a four inch telescope.

Then look $3/4$ degree south and $8 3/4$ degrees east of Xi Ursa Majoris for a somewhat brighter spiral, M106. It is of the 9th magnitude and shows some slight detail in an 8-inch telescope. Those with larger instruments should be careful, as there is a profusion of galaxies in this region.

Moving slightly eastward, we run into the famous Whirlpool Galaxy, M51 located two degrees south and $4 1/2$ degrees west of Eta Ursa Majoris. It can be seen with a 2.4-inch refractor as a small patch of light with a small patch right next to it. This fainter patch is its companion galaxy. Larger telescopes begin to reveal detail in this object, with the spiral structure being seen clearly in a 10- or 12-inch telescope.

In Coma Berenices, look $3 1/2$ degrees east of the star 13 Comae Berenices for the faint edge-on spiral galaxy NGC 4565. It is beautiful in an 8- or 10-inch telescope, as it shows the egg-shaped nucleus with a dark lane down the center.

For a change in diet, look at M3,

a fine globular cluster located $7 1/2$ degrees east of Beta Comae Berenices. It can be seen as a small fuzzy spot in binoculars and a six inch telescope should show stars at least at the edges of the cluster. Those of you who still want more galaxies can look 3 degrees north and 3 degrees west of Rho Virginis. Make sure you have at least a 6- or 8-inch telescope and a one degree field before you try this. I have counted 11 galaxies in this area that fit into a one-degree field.

One last galaxy to look at is M104, the Sombrero Galaxy, located about 5 degrees north and $2 1/2$ degrees east of Delta Corvi. It can be glimpsed with a 2.4-inch refractor at low power, but a six-inch telescope is required in order to see the dark lane that gives this galaxy its name.

In Corvus, those with moderate-sized telescopes should look at the planetary nebula NGC 4361, located $2 1/2$ degrees south of Delta Corvi and $1 1/2$ degrees west of that star. The object is large and a bit irregular in form, so be sure to use low power.

--David Knisely

REMINDER TO OBSERVATORY SUPERVISORS:

The regular monthly meeting of Hyde Observatory Supervisors will take place at 6:30 p.m., one hour before Prairie Astronomy Club monthly meeting.

POSSIBLE MONSTER BLACK HOLE IS DETECTED IN GALAXY M87

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the core. Such jets, seen in several galaxies and quasars, apparently manifest great explosions from the core.

The new observations of M87 have been a coordinated effort by astronomers using two of the world's most powerful telescopes: the 200-inch reflector of the Hale Observatories on Mount Palomar in California and the 157-inch instrument of the Kitt Peak National Observatory in Arizona.

The Kitt Peak observers recorded the extent to which very rapid motions of stars near the core of the galaxy broaden spectral lines emitted by those stars. On Mount Palomar, electric scanners were swept across the central region of the galaxy to record variations in light intensity with a precision newly made possible by such devices.

As explained in a telephone interview by one of the astronomers, Dr. Jerome Kristian of the California Institute of Technology, this disclosed an extremely bright point of light in the center and a halo less bright but still very brilliant extending out 15 to 20 arc seconds from the center. That is roughly the angular width of the planet Mars as seen when it is relatively close.

The stars proved to be in such wild motion that an extreme concentration of mass in the core seemed necessary to provide the gravity

holding them captive. Despite the brilliance of the core region, it did not indicate the presence, by a wide margin, of sufficient stars or other conventional matter to do the job, and so it is suspected that a super-massive black hole exists, perhaps hidden within the brilliant core.

To provide the comparative data in assessing the deficiency of observable matter near the core, the astronomers conducted a similar scan of the more quiescent galaxy, NGC 3379.

One reason that some have suspected black holes in the cores of galaxies is that they might provide the additional gravity needed to hold together the clusters and superclusters into which galaxies are grouped. The galaxies are moving fast enough to have dispersed long ago unless there is some form of invisible mass providing the gravity needed to hold them in thrall.

The galaxies should have 10 to 30 times more mass than can be seen. The suspected black hole would provide only a fraction of that. The rest, many astronomers suspect, may lie in a halo of invisible stars surrounding each galaxy.

Reports on the M87 observations appear in the April 1 and May 1 issues of the Astrophysical Journal.

(--New York Times Service)

HYDE OBSERVATORY SCHEDULE
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ation" (new) and "The Taurus Incident".

Supervisor schedule for May:

- May 6 -- Carroll Moore
- 13 -- Rick Johnson
- 20 -- Ed Schmidt
- 27 -- Merton Sprengle

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