the focal point

Monthly Notices of the Atlanta Astronomy Club, Inc.

Vol. VI No. 9 — May, 1994

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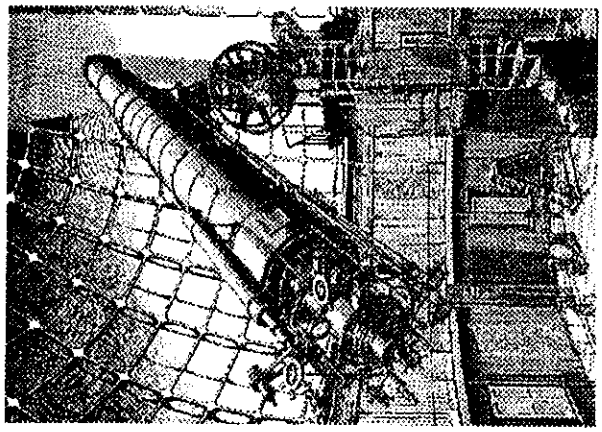

Why is this telescope famous?
See page 10

NEXT MEETING – MAY 20

BANQUET AT STEAK & ALE

MEETING NOTICE ON PAGE 18

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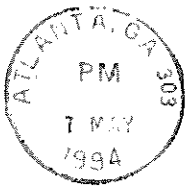

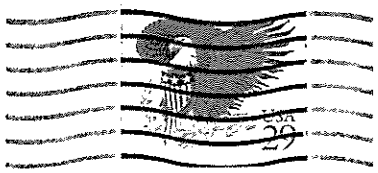

FROM:
Leonard B. Abbey, Editor
1002 Citadel Drive
Atlanta, Georgia 30324

First Class

The Atlanta Astronomy Club Inc., the South's largest and oldest astronomical society, meets at 8:00 p.m. on the third Friday of each month at Agnes Scott College's Bradley Observatory. Occasional meetings are held at other locations (check the hot line for details). Membership is open to all. Annual dues are $20 ($10 for students). Discounted subscriptions to *Astronomy* ($18), and *Sky & Telescope* ($20) magazines are available. Send dues to: **Clay McHann, Treasurer, 3450 Jones Mill Rd., #708, Norcross, Ga. 30092**

Hot Line: Timely information on the night sky and astronomy in the Atlanta area is available on a twenty-four hour basis on the Atlanta Astronomy Club hot line: 621-2661.

BBS: The Atlanta Astronomy Club operates a computer bulletin board at 455-3089. The BBS, which is free and open to the public, provides contact with both amateur and professional astronomers around the world.

9410

W. Tom Buchanan
105 Carriage Station Circle
Roswell, Georgia 30075

CHOOSING EYEPIECES
A Buyer's Guide
by Alan Dyer, *Astronomy* Magazine

Can't tell an Ortho from an Erfle? Not to worry. We'll guide you through the marketplace of eyepieces and help you pick a set that's right for you.

Happiness is a sparkling new eyepiece. Or better yet, a matching set of them. Eyepieces are the most important accessories you'll ever buy for your telescope. Although it is the main lens or mirror of your telescope which forms the image, it is the eyepiece which magnifies the image. A good eyepiece does so without adding to or subtracting from the image. With a set of fine eyepieces you'll be able to resolve all the celestials wonders your telescope is capable of revealing.

Happiness is a sparkling new eyepiece... Or better yet, a matching set of them.

The Myth of High Power

To get the most out of your telescope you should have three or four different eyepieces because on an astronomical telescope you switch magnification by switching eyepieces. You need to change magnification because celestial targets come in various sizes and brightnesses. A big object such as a sprawling cluster of stars is best framed with a low-power (25X to 50X) eyepiece. Inspecting details on a planet's tiny disk calls for a high-power (150X to 200X) eyepiece. Hunting galaxies or planetary nebulae might be best with a medium-power (80X to 120X) eyepiece.

The chief mistake new telescope owners make is to immediately insert the highest-power eyepiece they have in their arsenal. High-power eyepieces "see" only a tiny section of sky, making it frustrating to find even the Moon. Although newcomers sometimes feel compelled to buy an ultra-high-power model as their first extra eyepiece, a good low-power model is often a far wiser addition.

In fact, many entry-level telescopes sold through department and camera stores come with eyepieces that provide far too much magnification. How can you tell? If yours is one of the many imported 60-mm refractors or 4.5-inch reflectors, chances are you'll find the tops of the eyepieces marked with designations such as AH20, HM9, HM6, or SR4. The numbers indicate the focal length of the eyepiece in millimeters. The smaller the number the higher the power that eyepiece provides.

To determine the magnification an eyepiece produces on your telescope, first look for the focal length of the telescope. It will be a number between 500 mm and 1,500 mm marked on the tube or in the manual. Take this number and divide it by the focal length of the eyepiece. For example, a 4-mm eyepiece on a 900-mm focal-length telescope gives 225 power (900 / 4), or 225X for short. That same eyepiece on a 1,500-mm focal-length scope will give 375X.

A figure of 375X sounds terrific. It's not. Although your import telescope may boast three or four eyepieces, the 6-mm and 4-mm models produce so much magnification that images through them look faint and fuzzy. Under the best conditions (using good optics in a steady atmosphere), the

WHAT'S UP

	SUN				MOON				
Date	Rise	Azi	Set	Azi	Rise	Azi	Set	Azi	Age
5/15/94	6:36	66.4	20:31	293.6	10:37	68.6	-----	-----	5.0
5/16/94	6:36	66.1	20:32	293.9	11:35	72.2	0:38	289.5	6.0
5/17/94	6:35	65.9	20:33	294.2	12:36	76.8	1:17	285.3	7.0
5/18/94	6:34	65.6	20:34	294.5	13:37	82.3	1:54	280.4	8.0
5/19/94	6:34	65.3	20:34	294.7	14:41	88.3	2:30	274.7	9.1
5/20/94	6:33	65.1	20:35	295.0	15:46	94.5	3:06	268.5	10.2
5/21/94	6:33	64.8	20:36	295.3	16:54	100.7	3:43	262.5	11.3
5/22/94	6:32	64.5	20:37	295.5	18:04	106.5	4:24	256.5	12.5
5/23/94	6:31	64.3	20:37	295.7	19:14	111.1	5:08	251.3	13.6
5/24/94	6:31	64.1	20:38	296.0	20:24	114.2	5:59	247.4	14.8
5/25/94	6:30	63.8	20:39	296.2	21:29	115.4	6:55	245.1	15.9
5/26/94	6:30	63.6	20:39	296.4	22:28	114.6	7:56	244.7	17.0
5/27/94	6:29	63.4	20:40	296.6	23:20	112.1	9:00	246.2	18.1
5/28/94	6:29	63.2	20:41	296.8	-----	-----	10:05	249.4	19.2
5/29/94	6:29	63.0	20:41	297.0	0:05	108.3	11:08	253.7	20.2
5/30/94	6:28	62.8	20:42	297.2	0:44	103.7	12:09	258.7	21.2
5/31/94	6:28	62.6	20:42	297.4	1:19	98.5	13:07	264.1	22.1
6/1/94	6:28	62.4	20:43	297.6	1:51	93.2	14:03	269.5	23.1
6/2/94	6:27	62.3	20:44	297.7	2:21	87.8	14:58	274.8	24.0
6/3/94	6:27	62.1	20:44	297.9	2:52	82.8	15:52	279.8	24.9
6/4/94	6:27	62.0	20:45	298.0	3:23	77.9	16:46	284.5	25.8
6/5/94	6:27	61.8	20:45	298.2	3:56	73.7	17:40	288.5	26.6
6/6/94	6:27	61.7	20:46	298.3	4:32	70.0	18:34	291.8	27.5
6/7/94	6:26	61.6	20:46	298.4	5:11	67.1	19:27	294.0	28.4
6/8/94	6:26	61.5	20:47	298.5	5:55	65.4	20:19	295.1	29.4
6/9/94	6:26	61.3	20:47	298.6	6:43	64.8	21:09	294.9	0.8
6/10/94	6:26	61.2	20:48	298.7	7:36	65.5	21:55	293.5	1.7
6/11/94	6:26	61.1	20:48	298.8	8:31	67.6	22:38	290.7	2.7
6/12/94	6:26	61.1	20:49	298.9	9:30	70.9	23:18	286.8	3.6
6/13/94	6:26	61.0	20:49	299.0	10:30	75.3	23:56	282.1	4.6
6/14/94	6:26	60.9	20:49	299.0	11:31	80.5	-----	-----	5.6
6/15/94	6:26	60.9	20:50	299.1	12:33	86.2	0:31	276.6	6.7

OFFICERS AND OTHER DIGNITARIES

President:	Steve Gilbreath	409-1915
First Vice-President: (Program)	Hal Crawford	242-9995
Second Vice-President: (Observing)	Alex Langoussis	429-8384
Recording Secretary:	Terry McHann	441-9097
Corresponding Secretary:	Leonard Abbey	634-1222
Treasurer:	Clay McHann	441-9097
BBS:	Doug Chesser	457-5743
Edibles:	Terry McHann	441-9097
Facilities	Leonard Abbey	634-1222
Light Pollution:	Tom Buchanan	587-0774
Membership:	Terry McHann	441-9097

AAC ACTIVITIES

May Meeting

The **May** meeting will be our **annual banquet**. It will be held on **May 20**, at the **Steak & Ale Restaurant at Northlake Parkway and LaVista Road**. There will be a choice of several meals and the charge of $17 covers everything including the gratuity. On the agenda is the election of new officers. All members and guests are invited to attend. You need NOT purchase anything in order to cast your vote. Please phone Hal Crawford at 242-9995 by May 14 to confirm your place.

OBSERVATORY REPORT

by Alex Langoussis

It's getting busy out at Villa Rica!

Our next observing session is Saturday, May 7. Employees from the four Nature Company stores will be bringing out telescopes. We also expect invitees from Fernbank's Super Science Saturday. We can use plenty of volunteers to help out. Please join us in sharing the fun of astronomy.

May 10 is the solar eclipse. The club will be helping at Fernbank. Let me know if you're interested. First contact is at 11:16 a.m. Mid-eclipse will be at 1:01, when 70% of the Sun will be covered by the Moon. The eclipse ends at 2:54 p.m.

Two weeks later, on the evening of May 24, we have a partial lunar eclipse. The Moon enters the Earth's umbra at 10:37 p.m., and exits at 12:23 a.m. Mid-eclipse, when the umbra covers about 25% of the Moon, will be at 11:30 p.m.

On June 4, if the grass is not up over the telescope, we will have another observing session. If anyone can help get a mower out to the observatory, please call me! I can do the cutting, but I need a mower out there first!

Finally, on the morning of June 9, comets McNaught-Russell and Takamizawa-Levy should be within a quarter of a degree from each other. Two comets will be in the same medium-power eyepiece field!

So, come on out and enjoy the last few weeks of good skies before the summer haze sets in!

highest power you can usually employ on any telescope is about 50X to 60X per inch of aperture. For a 60-mm (2.4-inch) telescope this works out to a maximum power of 120X to 150X. On typical 60-mm aperture refractors with focal lengths of 700-mm to 900-mm, a 4-mm eyepiece gives an excessive power of 175X to 225X. A 6-mm eyepiece produces 120X to 150X, right at the upper limit. Under most conditions, you'll find these eyepieces of little use.

Compounding the problem is that many entry-level telescopes come with eyepieces of poor quality. Even the lower-power 20-mm and 12-mm eyepieces often provide poor images. The worst offenders are the ones marked AH, HM, or SR. These letters refer to the optical design of the eyepiece (AH = Achromatic Huygenian, HM = Huygenian Mittenzwey, SR = Symmetric Ramsden). All are simple two- or three-element designs that add fringes of false color around images of bright objects and have narrow, tunnel-like fields of view. Far better are the Kellner, Modified Achromat, and Orthoscopic eyepieces that manufacturers such as Celestron, Meade, Orion, and Parks are now supplying with their entry-level telescopes.

Eyepiece Designs

We recommend replacing poor eyepieces as a first step to improving your telescope. But choosing eyepieces involves more than simply picking ones with suitable focal lengths. Eyepieces also come in various optical designs. "Design" means the number of lens elements, the type of lenses, and their arrangement.

The most economical eyepiece designs of good quality are the 3-element Kellners (a classic design sold by several manufacturers), Meade's Modified Achromats, and Edmund's RKE line. These affordable eyepieces are the very minimum you should consider when choosing a budget set.

The next step up is to an orthoscopic. Although "orthoscopic" can mean any highly-corrected eyepiece, the term usually refers to a specific design invented in 1880 by Ernst Abbe, an optician with Zeiss in Jena, Germany. Orthos contain four elements and correct optical aberrations better than 3-element designs do. Orthos are fine eyepieces for viewing the planets.

In recent years, the 4-element Plössl has become very popular. It boasts a slightly wider field than most Orthos and a similar freedom from aberrations such as false color. It is a good general-purpose eyepiece capable of providing high-contrast planetary views.

Although not an officially sanctioned term, Modified Plössls is our name for a new family of eyepieces which adds a fifth element between the Plössl's two pairs of lenses. Examples include Celestron's Ultima line, Meade's Super Plössls, Orion's Ultrascopics, and both Parks' and Roger Tuthill's premium Plössl series. All provide superb color correction, sharp on-axis images, and excellent suppression of ghost images, the term for annoying internal reflections of bright stars and planets.

The new Vixen Lanthanum LV design has a 5-element Modified Plössl at its heart, but adds a 1-, 2-, or 3-element lens called a Barlow ahead of the main group. The advantage is that all LV models share a valuable characteristic – long eye relief. Eye relief is the distance your eye needs to be from the top of the eyepiece in order to see the entire field of view. Short focal-length eyepieces usually have short eye reliefs; you have to place your eye uncomfortably close to the eyepieces to look through them. But each LV eyepiece boasts a generous eye relief of 20 mm.

Wide-Angle Eyepieces

All the eyepieces described so far provide a "standard" field of view. There is another group of eyepiece designs that provide wide fields of view.

To understand field of view, hold an eyepiece up to your eye and aim it at the sky or at a window. You'll see a circle of light. The angular diameter of that circle is

the eyepiece's apparent field. Standard-field eyepieces have apparent fields of 40° to 50°. Wide-angle models have apparent fields of 60° to 70°. A new generation of eyepieces we've dubbed "extra-wide-angle" models have apparent fields around 80° across.

But a number such as 80° doesn't mean you see 80° of sky when you look through that eyepiece on your telescope. How much sky you do see is called the "actual field of view." To determine the approximate actual field of an eyepiece, divide its apparent field by the magnification that eyepiece provides on your telescope. For example, an eyepiece with a 50° apparent field which produces 50X will show you 50 / 50 = 1° of sky. An 80° apparent-field eyepiece that also produces 50X on your scope will show you 80 / 50 = 1.6°. The magnification hasn't changed, but with the 80° eyepiece you see more of the sky.

Wide-angle eyepieces provide impressive picture-window views of starfields, deep-sky objects, and lunar vistas. For many years, the most popular wide-angle eyepieces were the Koenigs (a 3- or 4- element design) and Erfles (a 5- or 6-element design). The Koenig provides a wide apparent field of about 60° to 65° at a relatively affordable price. University Optics offers a fine series of Koenigs in a wide range of focal lengths. Erfles are available from a few suppliers but this economical design has now been overshadowed by newer eyepieces carrying the trade names of various manufacturers. The new designs provide improved image quality toward the edge of the field and few or no ghost images.

For example, Tele Vue's Wide Field and Meade's Super Wide Angle eyepieces are both 6-element designs with apparent fields of 65° to 67°. Both series offer low- to medium-power focal lengths and are excellent choices for deep-sky and general-purpose viewing, especially with f/6 to f/15 telescopes. Another wide-angle variation, Orion's MegaVista, is a 7-element eyepiece available in focal lengths from 40- to 10.5-mm. It provides freedom from ghost images and a 67° to 70° field at an economical price.

Although superb performers, all of these wide-angle designs still exhibit some traces of an aberration called astigmatism, which turns stars at the edge of the field from ideal pinpoints into fuzzy elongated streaks. All eyepieces exhibit more astigmatism when used on fast telescopes, ones with f/ratios of f/4 to f/6. However, in the last few years, designers have created eyepieces that produce almost pinpoint stars edge-to-edge even when used on fast telescopes.

For example, Tele Vue's 6-element Panoptic models provide a 68° field with ghost images completely gone, generous eye relief, and only a trace of astigmatism even at the edge. Even more remarkable are the new generation of extra-wide-angle eyepieces. The most popular are the Ultra Wide Angle models from Meade and Nagler and Nagler II series made by Tele Vue. All provide pinpoint stars virtually right to the edge of an amazing 82° to 84° field. All work well on f/4 to f/6 telescopes and have long, comfortable eye reliefs for their focal lengths.

Other Eyepiece Features

Besides optical design and field of view, you should consider several other factors when selecting eyepieces.

Barrel Diameter. Some entry-level telescopes accept eyepieces with only the smaller 0.965-inch-diameter barrels. However, the majority of telescopes on the market now accept 1.25-inch eyepieces. In this larger barrel size, the selection of eyepieces is much greater and includes many wide-angle and extra-wide-angle models. For eyepieces that combine long focal length (yielding low power) and wide field, you need to turn to models with 2-inch diameter barrels. These require telescopes with giant 2-inch focusers. A few eyepieces have barrels that can fit both 2-inch and 1.25-inch focusers.

Hal then introduced Ken Poshedly who chaired and organized the 1994 Peach State Star Gaze. The successful event was held April 7 through 10 at the FFA campground outside Covington, and drew between 40 and 50 persons from across the southeastern U.S. After accepting a engraved plaque from Hal and the AAC for his PSSG work, Ken presented a short series of slides from the star gaze. (See review of the PSSG also in this *Focal Point*.)

The featured speakers of the evening, Jerry Armstrong and Tim Puckett, were received with great and prolonged acclaim. Their discovery of supernova SN1994I in the Whirlpool Galaxy (M51) has drawn worldwide attention. The pair took a number of questions from the audience and explained how it was that they happened upon the April 1 discovery. They were featured in a huge photostory in the April 6 edition of the *Atlanta Journal-Constitution*. (For a reprint, contact Ken Poshedly at 979-9842.)

According to both Tim and Jerry, a number of reports about the supernova were received by Brian Marsden of the International Astronomical Union, but Tim and Jerry were the first.

Following the formal program, the meeting was adjourned for snacks and treats, including a huge sheet cake with a depiction in icing of the Whirlpool Galaxy and its supernova. Afterwards, the festivities moved to Everybody's Pizza.

A Note From Tim and Jerry

Tim and I just wanted to say thanks to all who were at the April meeting. I had no idea of what was going to happen and believe me I was speechless (which isn't very often).

I especially wanted to thank Ken Poshedly for his publicity of our discovery. Without his contact with the Atlanta papers we might not have gotten the eleven new members that night.

Terry McHann: thank you for the wonderful cake at the meeting, I just wish someone would have had a camera! In a sense I guess we shared the nova with everyone, by the way I ate the nova the next day, ha!

Steve Gilbreath: thanks for the certificate, I have hung it in my office next to the computer where it serves as a reminder not only for the discovery but more important as a reminder of the Atlanta Astronomy Club and the people that attend the meetings for the fellowship it brings.

Again, Thanks folks, it means a lot to us after all the hard work we have put into observing over the years to have it really pay off.

Jerry Armstrong
Tim Puckett

scrapyard manager (you never know when you'll need a pier for that scope and $10 is all you've got to spare -- Jim did it and so can you).

- In his talk "Choosing the Right Astrophoto Film," Michael Covington's gave us all a verbal update to his book "Astrophotography for the Amateur." Did you know that Michael is strictly a slide film buff, he just doesn't care for negative (print) film. But he did ask for all interested parties to provide him with their own test results of any of the available negative film out there.

- Jerry Armstrong along with cohort Tim Puckett ran through a great set of CCD images on "Comet Hunting."

- And after dinner, Tim and Jerry returned for a great presentation on CCD Imaging, including some great shots of their now-famous discovery of the supernova in M51 (Whirlpool Galaxy).

In his introduction to Tim, Doug Chesser told the crowd that when Brian Marsden of the IAU told former Astronomy magazine editor-in-chief and now noted consultant Richard Berry that he (Berry) was a little late (about 45 minutes) with his own report of the discovery because some guy from Georgia beat him, Berry remarked, "Damn! I'll bet it was that darn Tim Puckett!"

The Atlanta Astronomy Club would like to thank all the sponsors who donated door-prizes for the event. The quantity of merchandise donated enabled almost all the participants to walk away with something new in hand. Among the prizes distributed were "The_SKY" for DOS, "The_SKY" for Windows, tee-shirts and the hardcover book "Star Hopping" from Sky Publishing, as well as lens cases and "fanny packs" from Canon USA, a subscription to Astronomy magazine, and gift certificates from several astronomy equipment vendors and manufacturers.

The AAC also thanks the Future Farmers of America for their hospitality and gracious accommodations; great and plentiful food and a pleasant staff.

LAST MONTH'S MEETING

by Ken Poshedly

On April 15 . . .

The April meeting was one of the most popular meetings in recent memory. Bradley Observatory was packed, with almost 60 people counted during the talks. And we welcomed a record number of new members – 12!

Hal Crawford, who is Program Chairman and Chairman of the Nominating Committee, announced that the May 20 meeting would be a club banquet at the Steak & Ale Restaurant (Northlake Parkway and LaVista Road). There will be a choice of several meals and the $17 charge covers everything including the gratuity. In addition to a popular speaker, the agenda calls for the annual election of new officers. All members and guests are invited to attend, though you need NOT purchase anything in order to cast your vote. A show of hands indicated that an overwhelming majority of those present plan to attend. Please phone Hal at 242-9995 by May 14 to confirm your attendance (the restaurant requires a minimum of 40 persons for the room reservation).

Coatings. Most eyepieces have optics coated with at least a single layer of magnesium fluoride on all air-to-glass surfaces. These coatings (which give the glass a bluish tint) help increase light transmission and reduce the internal reflections that create ghost images. Many eyepieces offer multicoated optics. Good multicoatings, which can look yellow, red, green, deep blue, or purple, offer even better contrast and light transmission and are a necessity on complex 6- to 8-element eyepieces. However, the effectiveness of any coating depends on how well it is applied. An eyepiece with superb single-layer coatings can be better than an eyepiece with poor multicoatings.

Filter Threads. Most eyepieces have barrels that are threaded to accept standard filters. Exceptions are the Clave Plössls and the Zeiss Jena Orthoscopics – their barrels are not threaded. The VernonScope Brandons are threaded but accept only special VernonScope filters

Eye Cups. More manufacturers are offering eyepieces with rubber eye cups as standard fittings. These help block stray light.

Parfocal. Parfocal eyepieces are part of a series designed to focus at nearly the same point. When you switch eyepieces you do not need to refocus.

Price. Eyepieces retailing for $60 and under are considered "Economy Eyepieces." There is a good selection here, but to buy a wide-angle eyepiece, you'll need a budget of at least $75 to $100.

Choosing a Core Set

With so many types of eyepieces to pick from, selecting a set that's right for you seems difficult. These recommendations may help you narrow your choice:

0.965-Inch. A good core set for a typical department-store telescope would be a 40-mm, a 25-mm, a 12-mm, and a 9-mm or 7-mm, either Kellners, Modified Achromats, or Orthoscopics.

1.25-Inch. A set of four eyepieces with 28- to 24-mm, 20- to 15-mm, 13- to 10-mm, and 9- to 7-mm focal lengths will provide magnifications to handle just about all observing situations with most telescopes. You could also restrict your choice to as few as two, a 28- to 24-mm low-power and a moderate- to high-power 12- to 9-mm, and add others later. All designs will work well, but Orthos and Plössls are better for high-power use.

Expanding the Core Set

In 0.965-inch barrel sizes there are no wide-angle eyepieces available. You can choose from some superb standard-field models from Takahasi and Zeiss but at over $100 each, these eyepieces are for the planet-observing aficionado and are likely to be beyond the budget of most owners of entry-level telescopes. But in the 1.25-inch size, you have several choices for expanding your core set.

An Ultra-Low-Power Eyepiece. A 35-mm to 40-mm Plössl or Modified Plössl will show you as much sky as you can get out of any 1.25-inch-diameter eyepiece. If you enjoy deep-sky observing, an eyepiece in this range is an excellent choice as your first additional eyepiece beyond the core set, with one proviso – avoid any eyepiece that provides too low a power.

At too low a power, the eyepiece puts out a cone of light wider than the diameter of the pupil in your dark-adapted eye. Some of the light coming from the telescope will not make it into your eye. In this situation, with reflector telescopes you see the dark shadow of the secondary mirror floating in the center of the field.

A good rule of thumb for determining the longest focal-length (or lowest power) eyepiece you can use is to take the f/ratio of your telescope and multiply it by 7. For example, on any f/4 telescope, the longest eyepiece you should use is a 7 x 4 = 28-mm eyepiece. This rule applies for people whose pupils can open as wide as 7-mm when fully dark adapted. When you get past age 30, your eyes lose about 1-mm of

aperture every 10 years. For people age 40, 6mm is a more likely figure for their dark-adapted pupils. In this case, a 24-mm eyepiece (6 X 4) is a better choice as the lowest power model with an f/4 reflector.

An Ultra-High-Power Eyepiece. You might wish to add a 6-mm to 2.5-mm eyepiece, provided such an eyepiece does not give you much more than 50X to 60X per inch of aperture with your telescope. For example, if you have a 4-inch telescope with a focal length of only 500-mm, a 2.5-mm eyepiece will give you 200X, a magnification at the upper limit but usable on nights with steady seeing conditions.

Wide-Angle Eyepieces. For spectacular deep space views, consider replacing the low- and medium-power "core set" eyepieces with wide-angle models. A good first choice would be purchasing a 24- to 22-mm wide angle instead of the 28- to 24-mm standard-field model. A second choice would be purchasing a 19-mm to 15-mm wide angle in place of the 18- to 15-mm standard-field eyepiece.

Extra-Wide-Angle Eyepieces. If your budget will allow it, you could select extra-wide-angle eyepieces in the 14- to 4.8-mm range for all your moderate- to high-power eyepieces. All will fit 1.25-inch focusers. Extra-wides are especially recommended for owners of fast f/ratio telescopes or for observers keen on deep-sky observing. However, purists who shun multi-element eyepieces often like to retain less complex Plössls or premium Orthoscopics for high-power planetary use.

Giant Two-Inch Eyepieces. The next step in expanding your viewing choices is, if possible, to outfit your telescope with a focuser or star diagonal that accepts 2-inch-diameter eyepieces. These jumbo models offer wider fields and lower powers than are possible with restrictive 1.25-inch barrels.

2-Inch Wide-Angle Eyepieces. A 32-mm to 40-mm eyepiece can provide spectacular wide-field vistas of Milky Way starfields. But watch the low-power limit. These models aren't recommended for reflectors faster than f/5.

2-Inch Ultra-Low-Power Eyepieces. The tables list a class of 2-inch eyepieces that have focal lengths of 35-mm to as long as 80-mm. All provide low power but within this class, don't think the longer the eyepiece the more sky you'll see. All models in this class have apparent fields of no more than 50°. In models longer than 55-mm, the apparent fields are limited by the size of the barrel and can actually shrink to as little as 35°. A 55-mm Plössl will show you as much sky as is physically possible with a 2-inch-barrel eyepiece. But surprisingly, a 40-mm wide angle, despite its higher power, will show you nearly as much sky on any telescope. This is because it has a wider apparent field - 65°, versus the 50° field of the 55-mm Plössl.

Eyepieces are Forever

Like a fine diamond, a sparkling new eyepiece is a long-term investment. With care, an eyepiece will never wear out and can be used on any telescope you will ever own. Eyepieces are available for every budget and observing interest. A core set is all you need to get started, but few backyard astronomers stop there. Chances are you won't either. After all, happiness is a new eyepiece.

This article is reprinted from the June, 1993, issue of *Astronomy* magazine. (C) 1993 Kalmbach Publishing Co. The original article contains a 4-page table listing specifications and prices for all of the eyepieces offered by manufacturers in North America as of early 1993. Back issues of *Astronomy* can be ordered by calling 800-533-6644. Club members can subscribe to *Astronomy* at a discount. See back cover for details.

The 1994 Peach State Star Gaze Report

by Ken Poshedly

The 1994 Peach State Star Gaze was a big hit with calls for another one next year! The event was held at the Future Farmers of America campground near Covington, Georgia, and drew nearly 50 folks from Georgia, Florida, North Carolina, South Carolina, Alabama, Tennessee, and Virginia.

The weather was great throughout Thursday and Friday nights. Saturday evening clouds threatened, but miraculously were blown away around midnight. And according to most, the skies were more than acceptable, so it was a great chance for some serious ("Sirius"?) observing.

With ALL lights doused anywhere near the observing field, the scope population consisted of everything from a 7-inch refractor, to large Schmidt-Cassegrains, huge binoculars, Tektron Dobsonians, and various reflectors (at least two RV-6 Dynascopes!).

The Saturday night curiosity of dozens of university coeds also at the FFA camp for the weekend made many a male observer a true expert at pointing out just about every star he could think of.

An impressive demonstration of using a combination personal computer-controlled Meade LX200 8-inch SCT equipped with an ST-6 CCD imaging system was also given during all nights of the event. The power of both CCD-controlled auto-tracking/imaging coupled with PC-controlled pointing enabled SN 1994I discoverers Tim Puckett and Jerry Armstrong, as well as Mike Marcus and Atlanta Astronomy Club computer BBS sysop Doug Chesser to zip through dozens of objects in a single night, reaching and electronically recording very faint sights.

Besides the great observing, all had a chance to pick up bits and pieces throughout the day from the list of topnotch speakers:

- Computer bulletin board sysop Doug Chesser covered the in's and out's of several different astronomy software programs.
- Equipped with little more than his handy-dandy pad, pencil and eraser, Rich Jakiel demonstrated some surprisingly simple techniques for sketching at the eyepiece (galactic dust lanes are easy once you get the hang of smudging).
- The good's and bad's of outdoor lighting fixtures are known only too well by those who caught Hal Crawford's talk on light pollution.
- At first rather a cloudy topic, "frame-grabbing" became crystal clear when Doug Gegen showed how it can be used to minimize atmospheric disturbances; simply put, a film exposure provides an image obtained over a period of time when seeing and transparency varied. Frame-grabbing allows one to scan a videotape of an object and then, when the conditions are just right, reach out and TAKE that frame, store it on computer disk and enhance it with one of several graphics programs.
- Jim Rouse, a familiar face to Atlanta amateur astronomers, shared the travails of his "Building a Backyard Observatory" in suburban Snellville, Georgia, and the advantages of staying on good terms with your local

THE COMET WATCH

by Jerry Armstrong

Beginning with this month's issue of The Focal Point we introduce what I hope will become a monthly feature. As most of you already know when a bright comet is discovered or a return of a bright periodic comet occurs, usually the top two magazines fail to notify us in time to observe the object. The case in point is the recent comet McNaught-Russell 1993v. About the only place you could find an accurate path of it was either in the IAU Circulars or on the Atlanta BBS. As most members do not subscribe to the IAU Circulars (very EXPENSIVE), and some do not have a modem on their computer, there is no reason to deny these folks from seeing a bright comet. So, hopefully I can remedy the situation by placing the known comets here well in advance of their apparition.

In order to satisfy the thirst of some members for the faint "wee beasties" I plan to include comets down to magnitude 12. Unfortunately there may be months when there are no comets brighter than this, if this is the case I will give some other little known fact about comets such as John Bortle does with Comet Digest in Sky & Telescope.

P/Tempel 1 1993c

date	*h*	*m*	°	′	*delta*	*r*	*elong*	*mag*
1994 May 8	12	59.5	+09	45	0.686	1.597	140.1	9.3
18	12	57.2	+07	11	0.695	1.565	132.2	9.1
28	12	59.1	+04	00	0.715	1.539	124.9	8.9

P/Schwassmann-Wachmann 2

1994 May 8	09	17.7	+18	24	1.986	2.210	88.9	12.5
18	09	33.2	+17	15	2.119	2.237	83.1	12.7
28	09	49.3	+15	57	2.254	2.265	77.6	12.9

McNaught-Russell 1993v

1994 May 8	09	20.7	+76	03	1.103	0.783	75.0	7.6
18	11	39.2	+76	05	1.216	0.919	78.0	8.2
28	13	07.7	+72	47	1.337	1.053	81.0	8.6

Takamizawa-Levy 1994f

1994 May 8	20	57.7	+29	36	1.084	1.375	82	8.6
18	20	18.8	+47	26	0.937	1.360	88	8.2
28	18	29.3	+65	28	0.914	1.360	90	8.1

OVERHEARD ON THE **INTERNET**

PLANETARY SYSTEMS WITHOUT STARS?

When a planetary system forms, is it possible for NONE of the bodies to have sufficient mass to become stars? If so, are there ways of predicting how many such systems might exist, and thus, what fraction of the mass of the universe they might represent? How could such starless systems be detected?

I hope this isn't an incredibly stupid question.

Rick Morneau
ram@eskimo.com

JAMES TAPPIN REPLIES

This is more or less guesswork from a Solar-wind specialist.

I would think that it would be very difficult to get a small enough gas cloud to collapse under its own gravity (it shouldn't be that hard to calculate but I don't have the numbers to hand right now). However I suspect that a system could be disrupted to produce a free planet-moons system (for example it might be possible to disrupt the solar system so that Jupiter kept some of its moons (or maybe Pluto-Charon).

Probably some real planetary dynamicist will say I've got all this wrong, but it's my three-ha'pworth for starters.

James Tappin
University of Birmingham
sjt@xun8.sr.bham.ac.uk

ETHAN BRADFORD ADDS

In fact this is an active research question. It bears on whether the missing mass in the galaxy can be baryonic matter in failed stars (known as "brown dwarfs" in the astronomical parlance). The number of stars formed at a given mass is known as the "mass function"; since no brown dwarfs have been measured, it must either be extrapolated from observations or derived from theory and both are very uncertain.

Brown dwarfs might be detected in the infrared, but they are more likely to be detected (or have already been detected) in the "MACHO" searches that look for gravitational lensing of bright stars in the Magellanic Clouds or the galactic bulge.

Ethan Bradford
ethanb@ptolemy.phys.washington.edu

DAVE CLEMENTS ADDS

This is almost the same concpt as the sub-stellar brown dwarfs that many people are hoping to discover. A brown dwarf is a 'failed' star, 0.1 solar mass or less in size, that is unable to generate densities in its core sufficient to trigger Hydrogen fusion. They will be warm, around 300K in temperature, and so may be detected by infrared observations or optically as very red stellar objects. Since these objects will be baryonic (ie. made up of neutrons and protons like the rest of us) their total contribution to the mass of the universe cannot be beyond the baryonic mass limit inferred from primordial nucleosynthesis ie. ie. about 1 percent of what is needed to close the universe.

The question of planets around such objects is a tougher one, since we don't know much about brown dwarfs or planets around normal stars yet, but I guess its possible...

To find more and better answers, search the INSPECT catalog on any of the keywords I've given in quotes.

Dave Clements
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Cheap Trick: A Low-Tech Focusing Mount

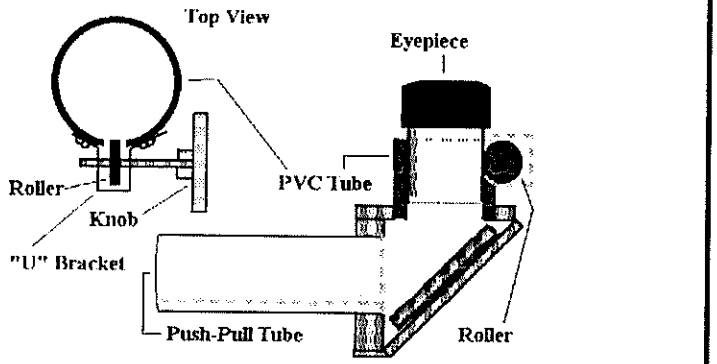
by Jack Kramer, Libertyville, Illinois

Several years ago when I made my current copyscope, to save money I decided to forego a rack-and-pinion focusing mount in favor of a simple push-pull tube attached to the homemade right-angle adapter. This minimalist approach has served adequately, but requires considerable effort to adjust the focus. It's especially bothersome when other observers are looking through your scope and need to re-focus for their own eyes. The problem is that the push-pull tube has to fit quite snugly into the tail-piece of the telescope so as not to slide out when the telescope is aimed overhead. I recalled the slick Crayford focuser that Rich Burns made for one of his scopes and felt the same principle might be applied in a scaled-down way for those of us without the wherewithall to do our own machining. After some playing-around with parts found in my junk drawers, the following creation was hatched.

PVC tubing provides some very useful parts for the telescope maker. Upon finding a piece with an inside diameter of 1¼", it appeared that once the rough focusing range had been achieved with the old push-

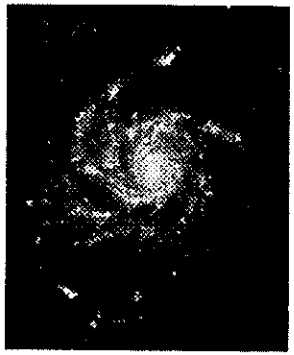
PVC tubing provides some very useful parts for the telescope maker.

pull tube, fine focusing might be accomplished by moving just the eyepiece through a short distance. The PVC tube diameter was on the generous side, so the eyepieces seated very loosely. Now how do we tighten up the eyepiece so that it'll stay where you set it, yet allow it to move freely to re-focus? The Crayford design relies on metal rollers that bear against a focusing tube. Using the same principle, a roller could bear directly against the eyepiece barrel. The "plumbing junk" drawer supplied a circular rubber grommet with a small center hole. I found that the rubber



The Cheap Trick.

NGC 3631 Large and impressive, this galaxy is roughly circular and 5' in diameter. The core is about 1' in diameter and has a stellar nucleus. Averted vision shows arms spiraling from the north to the east.



M101. Face-on Spiral in Ursa Major.

VIRGO

The constellation of Virgo is the center of the closest large cluster of galaxies, and can easily take up several evenings of observing time. While the galaxies in Ursa Major are 10 - 40 million light years away, the galaxies of Virgo are about twice as distant at about 70 million light years. As such, these galaxies show a lot less detail. But what they lack in quality, they make up in quantity. In some areas, it is difficult to move a whole telescopic field of view without seeing one or more galaxies.

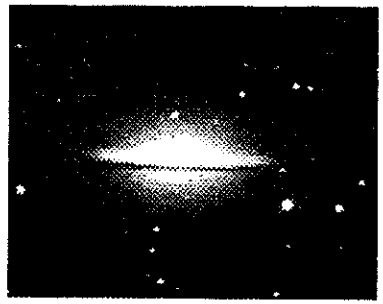
A good star atlas is a must in this region for identifying all the galaxies visible in a telescope of moderate aperture. While I'm only going to be describing some of the brighter members here, I encourage all to try navigating this area. It would be hard not to improve your observing skills by meeting this challenge head-on.

M58 With dimensions of about 5' X 2', this is one of the larger galaxies in this region. It is spindle-shaped, oriented NE - SW, and has a broadly concentrated center. There is a relatively bright star nearby to the west.

M61 This galaxy is a face-on spiral, about 6 X 4', oriented NNE - SSW. It is fairly even in brightness except for a stellar nucleus and some faint mottlings on its eastern and western sides.

M84, M86 These relatively bright galaxies are very similar in appearance, and are visible in the same low-power field of view. M84 is round, about 3' in diameter, has a large 1' diameter core, and a stellar nucleus. M86 is larger (about 4' in diameter), and fainter, and also has a stellar nucleus.

M87 This is a very bright galaxy, about

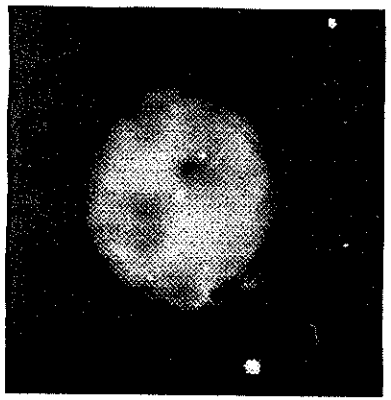


M104. Spiral Galaxy in Virgo.

4' in diameter, with a large core and non-stellar nucleus.

M104 The Sombrero Galaxy. This is one of the finest showpiece objects in the sky. This beautiful edge-on galaxy is 10 X 2', oriented E - W, and has an obvious central bulge, with a distinct dark lane running the length of the galaxy. This is an object which should not be missed.

Wolf 359 This is a faint red dwarf star that would be unremarkable except that it is one of our closest neighbors in space. Only Alpha Centauri and Barnard's star are closer. It is one of the least luminous stars known, shining with the luminosity of about 1/63,000 that of the Sun. It has only about 8% the mass of the Sun and is approximately the size of Jupiter. To find it, use a chart such as that in Burnham's Celestial Handbook, and be patient: it shines at a magnitude of 13.6.



M97. The Owl Nebula.

URSA MAJOR

Ursa Major is one of the most well known constellations in the heavens. It contains the famous grouping of stars known as the Big Dipper, which is often the first group of stars learned by people in the Northern hemisphere. Several other "firsts" are associated with this constellation; the star Mizar was the first double star to be discovered through a telescope (1662), the first star to be photographed (1857), and the first star to be identified as a spectroscopic binary (1889). Also, the star Xi UMa was the first binary star to have its orbit calculated (1828).

As Ursa Major lies away from the obscuring dust of the Milky Way, many galaxies are visible in its confines, and several of these are large and bright in amateur instruments due to their relative closeness. A whole night's observing can easily be spent in this large constellation.

M81 This is a large and beautiful spiral galaxy, 10' long and 4' wide, oriented NNW - SSE. It has a bright core with a stellar nucleus, and spiral arms can be seen, especially with averted vision.

M82 One of my favorite objects! This peculiar galaxy is 10' X 3', oriented NE - SW. It has slightly tapering ends, and a great amount of mottling across its length can be seen. The southern edge appears flatter, and it seems to be "pinched" near the center on this side. Fascinating.

M97 The Owl Nebula. This large planetary nebula is almost 3' in diameter, and appears as a gray puff of light, slightly brighter in the center. At times, especially with averted vision, the "eyes" of the owl can be seen as two slightly darker spots.

M101 A large face-on spiral galaxy with low surface brightness. It is about 7' in diameter, with a brighter core surrounded by an envelope which sometimes can be seen to be spiral arms.

M108 Large, about 10' X 3' extended ENE - WSW. This galaxy has an evident central bulge, a stellar nucleus, and tapering ends. The western end appears to be tapered more than the eastern end, and dark markings are seen along its northern edge.

M109 8' X 4', oriented ENE - WSW, with a faint stellar nucleus. Spiral arms can be seen leading to the north and south.

NGC 2841 A very pretty galaxy. 7 X 3', oriented NNE - SSW, with a sharply brighter core and stellar nucleus. Dark markings can be seen, especially east of the nucleus.

NGC 3079 Fascinating. 6' X 2' with an obvious central bulge and extended N - S. Broadly concentrated to the center with pointed ends. At times, the ends appear curled: the north end to the west, and the south end to the east. Very pretty.

had just enough give to provide an easy tension against the eyepiece. A notch cut out of the PVC tube allowed access to the eyepiece barrel. Now how do we hold it in place?

One of the great toys of bygone years was the Erector set. Since I have two daughters, the set I enjoyed as a kid was gathering dust without an heir apparent. So bit by bit, I've been using it for different projects; the handy thing about Erector parts is that they have all those pre-drilled holes. Those of you who had a set will notice some familiar pieces if you look at the spider on my 10" reflector. This time, the Erector set yielded up a "U" bracket, a short axle, and a wheel to use as a knob. The bracket had to be re-bent somewhat in order to properly position the grommet against an eyepiece barrel.

The PVC tube is just smooth enough so that the eyepiece barrel moves freely by hand, yet with enough friction that it stays in place after it's in the desired position. Tension can be reduced as needed by loosening the short screws that hold the "U" bracket to the PVC tube. In order to allow the screws enough material to grab, the PVC tube wall should be no thinner than 1/8", but preferably thicker. The roller is held in place on the axle with a few drops of Super Glue.

My intent was to be able to fine-focus by turning the knob as on a rack-and-pinion mount. However, I found that if the roller tension was adequate to move the eyepiece up and down in the tube, then the effort needed to turn the roller with the knob was so great that the grommet (roller) eventually broke free from the axle. Lessening the tension caused the roller to slip against the eyepiece barrel rather than move it. Spraying the inside of the PVC tube with a silicon lubricant helped. That made the PVC barrel just slick enough for the eyepiece to move fairly smoothly by turning the knob. However, the silicon has to be re-applied periodically. Nonetheless, in the cold weather the roller still broke free. The glue tended to stick more to the roller than to the metal axle, so I ground a flat spot on the axle to allow the Super Glue to "wedge-in". So far, this seems to have solved the problem.

This focuser works because it's moving the eyepiece only a small distance. If the eyepiece extends too far out of the PVC tube, it'll tip as you try to focus, so it's best to begin by placing the eyepiece pretty far into the tube before rough-focusing. Although you can adjust the eyepiece with your fingers, fine focus is easier to achieve using the knob. Either way, it's a lot less of a struggle than using just the push-pull method. The concept seems to have merit and could be finessed somewhat. For example, if the PVC tube were lined with Teflon, that might produce just the right combination of tension versus free movement. Or two guide rollers might be added. The present setup isn't very elegant, but it works just fine.

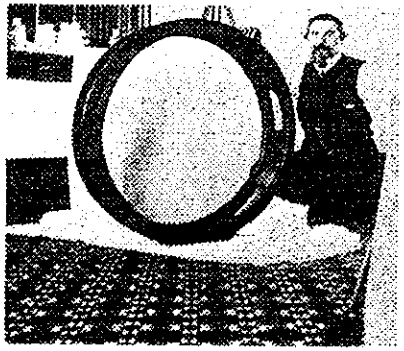
THE "GREAT REFRACTOR" COMES OF AGE
The Lick Telescope
by Lenny Abbey

Five successive times the New England firm of Alvan Clark and Sons made the world's largest telescope. Beginning with the 18½" refractor at Dearborn Observatory in 1862 and ending with the 40" at Yerkes in 1897. But there was something special about the 36" telescope which they made for Lick Observatory. For the first time an observatory and its telescope were located in a remote location which was known to have excellent astronomical seeing – but not much else in the way of creature comforts.

Little is known about James Lick's motive in leaving a moderate fortune for the construction of "...an instrument...that shall surpass in power anything yet attempted." However, he was fortunate in obtaining the services of Richard S. Floyd, a former captain in the Confederate Navy and a native of Georgia, as trustee of his estate.

Floyd set to work shortly before Lick's death in 1876. He knew nothing about telescopes, but he learned as he went. He made trips to large observatories, and journeyed to Europe several times. He finally awarded the contract for the optics to the Clarks, and ordered the mounting from Warner & Swasey. This was Warner & Swasey's first big astronomical contract, and it launched them on a telescope-building career which lasted into the middle of this century.

Floyd was an amazing person. As new challenges appeared (and on such a project there were many), he investigated the problem in a logical, methodical manner. And each time he found a practical solution which could be easily afforded.



Richard Floyd and the 36" Lens

The telescope, with its yard-wide objective lens, finally went into service in 1888. Sadly, Floyd's health began to fail shortly before the christening of the telescope, and he died soon thereafter.

Unlike the ungainly monsters constructed by the Herschels and Lord Rosse, the Lick telescope was an all-round telescope suited equally well for the emerging techniques of astronomical photography and spectroscopy, micrometric measures, deep-sky visual observing, and high-power views of the Moon and planets.

One interesting sidelight is that the original staff of the observatory included a preponderance of amateur astronomers. S. W. Burnham, a Chicago court reporter studied double stars. E.E. Barnard began his photographic atlas of the Milky Way.

In the century following its opening, Lick Observatory has thrived. It now has many more telescopes, including the 120" Mayall reflector. The 36" is still in operation, its mounting firm, and its optics clear and precise.

CONSTELLATION OF THE MONTH
by Rick Raasch, Dallas

LEO

In past months, we have been surveying constellations that lie along or close the Milky Way and offers many bright open clusters, planetary nebulae, and diffuse nebulae. In contrast to those constellations, Leo lies far enough away from the Milky Way to let us peer into extragalactic space. We will no longer be looking at objects that are "merely" a few hundred or thousand light years away; the distance to the galaxies of Leo is on the order of twenty to thirty *million* light years. Thus, these objects are in general not flashy and splashy, but rather yield their detail in subtle ways.

Besides adequate dark adaptation of one's eyes, the most useful technique for coaxing details out of galaxies is averted vision. By looking slightly away from your target while keeping your attention on it, features such as spiral arms and subtle mottling can become apparent where none was before. Galaxies force you to make observations the old fashioned way: you *earn* them!

M65 This galaxy is relatively large and bright, with a bright center and a stellar core. It is elongated in the north-south direction, and appears about 8' X 2' in extent. It is in the same low power field of view as the next two objects.

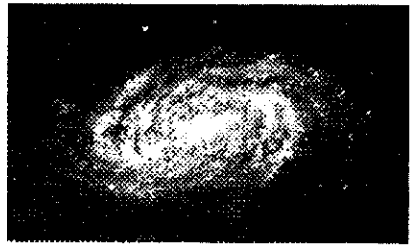
M66 Smaller than M65, this galaxy is wider, about 6' X 3', and brighter. It also has a bright core, and is extended in the southeastern direction. Averted vision at reveals some mottling and indications of spiral structure.

NGC 3628 Large, 10' X 2', and oriented northwest-southeast, this object is faint overall, but averted vision shows a spindle-like shape with hints of a dust lane on the southwest side. A very interesting galaxy.

M95 Round, about 3' in diameter with a bright core surrounded by a faint halo. This is a barred spiral, but on a recent less-than-perfect night in Oklahoma, I failed to see this structure.

M96 This galaxy is ovoid, 4' X 3', extended north-south with a bright core. Its core is large and non-stellar, about 1' in diameter.

M105 An elliptical galaxy, this object is relatively bright and appears round, about 3' in diameter, and has a bright central core.



NGC 2903. Spiral Galaxy in Leo.

NGC 2903 Large and relatively bright, this galaxy appears to be about 8' X 4', extended NNE - SSW, with a large, 1' X 1' core. Some mottling is noticeable, and a darker area was noted on the western side.

γ This is a fine double star, although medium powers may be needed to split it. It shows a pretty pair of almost equally bright yellow stars.