the focal point

Monthly Notices of the Atlanta Astronomy Club, Inc.

Vol. VII No. 6 **November, 1994**

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NEXT MEETING – NOVEMBER 18, AT WHITE HALL

MEETING NOTICE ON PAGE 18

the focal point

Monthly Notices of the Atlanta Astronomy Club, Inc.

FROM:

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

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: **Alex Langoussis**, Treasurer, **3595 Canton Road, Suite A9-305, Marietta, Ga. 30066**

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.

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

First Class

"Choosing Eyepieces" Revisited

by Rick Blakley

Paul Dickson has asked me to look at Mr. Dyer's article and offer comment so as to better advise the committed amateur. While part of this review will cover myths and misconceptions, I am not intending to make a criticism of Mr. Dyer's text, and I must say in his defense that he has not claimed to be an expert on the subject. His knowledge comes from his active participation as an amateur with amateurs, and I thank Mr. Dyer for his efforts.

Paragraphs from Mr. Dyer's article will be shown indented. My comments will follow each of his paragraphs. Let us begin.

> 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 celestial wonders your telescope is capable of revealing.

Actually, both the objective, the "main" lens or mirror, and the eyepiece magnify. Magnification for any optical focusing element is a function of the distance of the object from the element and the element's focal length. The objective of a telescope, the eyepiece, and the eye, all are optical focusing elements. Of course, only the eye has a detector array, the retina, which presents the brain with the image information that the brain requires to build a model of the space observed. The size of the image

This article refers to Alan Dyer's article in the May '94 Focal Point. I asked Rick Blakley for comments on Alan's article with more depth for more serious amateur astronomers. It resulted in this article, published in the October issue of SACNEWS.
-Paul Dickson

Saguaro Astronomy Club
newsletter editor.
p.dickson@az05.bull.com

Our Cover . . .

Mercury, messenger of the Gods is portrayed on our cover this month. Mercury is perhaps the least often observed planet. Like Pluto, it is a planet of mystery. This drawing, depicting the Mercury of fact and the Mercury of myth, is by Bill Close. It appeared on the cover of the November, 1951 issue of *The Atlanta Astronomers' Report*

WHAT'S UP

Date	Rise	Azi	Set	Azi	Rise	Azi	Set	Azi	Age
11/15/94	7:09	111.8	17:34	248.0	16:05	75.5	4:45	282.4	12.9
11/16/94	7:10	112.1	17:34	247.7	16:41	71.8	5:39	286.6	13.8
11/17/94	7:11	112.4	17:33	247.4	17:19	68.8	6:33	290.0	14.7
11/18/94	7:12	112.7	17:33	247.1	18:01	66.7	7:26	292.5	15.6
11/19/94	7:13	113.0	17:32	246.8	18:46	65.8	8:17	293.9	16.5
11/20/94	7:14	113.3	17:32	246.5	19:35	66.0	9:06	294.2	17.4
11/21/94	7:15	113.6	17:31	246.2	20:27	67.4	9:52	293.3	18.3
11/22/94	7:16	113.8	17:31	246.0	21:21	69.9	10:34	291.3	19.2
11/23/94	7:17	114.1	17:30	245.7	22:17	73.5	11:14	288.2	20.1
11/24/94	7:18	114.3	17:30	245.5	23:15	77.9	11:52	284.3	21.1
11/25/94	7:19	114.6	17:30	245.2	-----	-----	12:28	279.5	22.1
11/26/94	7:20	114.8	17:30	245.0	0:15	83.1	13:03	274.0	23.1
11/27/94	7:21	115.1	17:29	244.7	1:16	88.7	13:39	268.4	24.1
11/28/94	7:21	115.3	17:29	244.5	2:19	94.6	14:16	262.5	25.2
11/29/94	7:22	115.5	17:29	244.3	3:25	100.5	14:56	257.0	26.3
11/30/94	7:23	115.7	17:29	244.1	4:33	105.9	15:41	252.0	27.5
12/1/94	7:24	115.9	17:29	243.9	5:43	110.3	16:31	248.2	28.6
12/2/94	7:25	116.1	17:29	243.7	6:52	113.3	17:28	245.9	0.2
12/3/94	7:26	116.3	17:28	243.6	7:59	114.5	18:30	245.6	1.4
12/4/94	7:27	116.4	17:28	243.4	8:59	113.8	19:36	247.1	2.5
12/5/94	7:27	116.6	17:28	243.2	9:53	111.2	20:43	250.3	3.6
12/6/94	7:28	116.7	17:28	243.1	10:39	107.3	21:48	254.7	4.7
12/7/94	7:29	116.9	17:29	242.9	11:20	102.5	22:51	259.8	5.7
12/8/94	7:30	117.0	17:29	242.8	11:56	97.4	23:51	265.2	6.7
12/9/94	7:31	117.2	17:29	242.7	12:30	91.9	-----	-----	7.7
12/10/94	7:31	117.3	17:29	242.6	13:02	86.6	0:49	270.7	8.6
12/11/94	7:32	117.4	17:29	242.5	13:34	81.6	1:45	276.0	9.5
12/12/94	7:33	117.5	17:29	242.4	14:07	77.0	2:40	280.9	10.4
12/13/94	7:34	117.6	17:30	242.3	14:42	73.1	3:34	285.2	11.3
12/14/94	7:34	117.6	17:30	242.2	15:19	69.7	4:28	288.9	12.2
12/15/94	7:35	117.7	17:30	242.2	15:59	67.4	5:21	291.8	13.1

OFFICERS AND OTHER DIGNITARIES

President:	Steve Gilbreath	409-1915
First Vice-President: (Program)	Jerry Armstrong	942-4249
Second Vice-President: (Observing)	Eric Shelton	664-2837
Recording Secretary:	Terry McHann	441-9097
Corresponding Secretary:	Leonard Abbey	634-1222
Treasurer:	Alex Langoussis	429-8384
Publicity:	Ken Poshedly	979-9842
Edibles:	Terry McHann	441-9097
Facilities:	Leonard Abbey	634-1222
Light Pollution:	Tom Buchanan	587-0774

The November Meeting

A rare treat is in store for us in November. Our speaker will be world-renowned planetary photographer **Don Parker**. The meeting will be held at **Emory University's White Hall** on **Friday, November 18**, at **8:00 p.m.** For directions to White Hall, see the map on page 15 of this issue. (Note: this is not an Emory-sponsored event, but a featured presentation by the Atlanta Astronomy Club)

Don was born in Urbana, Illinois, in 1939, and has produced images that have appeared for years in *Sky & Telescope* and *Astronomy* magazines, *The Journal of the British Astronomical Association*, and *The Strolling Astronomer*. He is currently Mars Recorder of the Association of Lunar and Planetary Observers.

Now the senior attending anesthesiologist at Miami's Mercy Hospital, Don began his career in astronomy when he was only a lad of seven and growing up in Chicago. It was then that he received his first telescope, what he calls "a terrible, 3-inch refractor," with a cheap eyepiece and a stovepipe tube. The optics were so poor that with it, he could see all the colors of the rainbow – instead of the Moon and planets.

Many telescopes later, he now owns a 16-inch Newtonian reflector that he uses to produce the film and CCD images that have made him famous in astrophotography circles, both amateur and professional.

Let us be specific and blunt. Don is *not* an excellent astrophotographer who happens to be an amateur. The truth is that Don is arguably the greatest planetary photographer of all time. His Jupiter images look as though they were made by the Hubble telescope. His pictures of Mars are likewise full of fine details which even the most accomplished visual observer cannot detect. He has successfully photographed Neptune's recently discovered (by Voyager) Dark Spot. These accomplishments sound difficult to believe. But *seeing is believing*. Come to the meeting and find out for yourself.

If you only come to one meeting this year, this should be the one. This will be the astronomical event of the year for our club, and for all other astronomers in the Atlanta area.

Last Month's Meeting

Over 60 people attended our last meeting. April Whitt, astronomer with Fernbank Science Center, showed that astronomy can be a daytime enjoyment – even when you have no choice. At the AAC's October 21 meeting, April's presentation detailed her stay at the South pole last Christmas, a time when the Midnight Sun was up, and stayed up (so there!).

While there were no fancy images of this or that object in the southern sky, we were treated to a truly interesting slice of life at the bottom of the world, including some folksy observations about mundane day-to-day chores that we take for granted, but which are much sought after down there. Try making a phone call, for instance! We hope to hear more from April in the future.

produced by the telescope objective is larger then that made by the eye's lens. But the eye can accommodate only relatively narrow object angles (thus, the average person of thirty years +/- can read comfortably at a minimum distance of about ten inches), and one sees only a blur when looking directly at the magnified image provided by the telescope objective. (Some of the early, incredibly long, simple refractors of the time of Christian Huygens produced magnified images that could be clearly viewed without eyepieces!) The most critical effect the eyepiece accomplishes for the observer is to alter the highly angular cone of rays produced by the objective to become a series of nearly parallel rays that the eye can comfortably receive. This *cannot* be done without modifying the image, but the best eyepieces do the least harm.

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.

"Many observers who have had long experience of planetary work...have been of the opinion that, with amateur instruments generally, from 200X to 400X is the best planetary magnification range, more or less irrespective of aperture", J.B. Sidgwick, page 102 of his *Observational Astronomy for Amateurs*. Also, on page 100, "...for regular planetary work in this country [Britain] less than 5 inches provides insufficient resolving power." I concur with this statement which fairly describes my own experience.

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 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.

For planets, 30 to 40 power per inch of aperture is appropriate. These figures result from considering 1/30" as the minimum exit pupil diameter, the diameter at which interference effects just begin to become significant. Closely spaced multiple stars may take as much as 60 power per inch, since interference effects take less of a toll on bright, high contrast objects.

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.

All of the eyepieces named perform well when used with telescopes having the appropriate focal ratios. The Huygens and the Huygens-Mittenzwey are the *only* old types that will not show "fringes of color" (read "lateral color") when properly executed. In fact, their correction in this regard is better than that of the Nagler! The Huygens works well on systems as fast as f/12. Ramsdens work well to about f/9. These designs can be used effectively on fast telescopes with good Barlows. They possess apparent fields of about 35° to 45° degrees. Many professional observatories still make use of their old, classic Huygens eyepieces, and I am hoping to construct a good Mittenzwey eyepiece some day (this design can produce a well-corrected apparent field of up to 50°. Unfortunately, most cheap telescope manufacturers simply assemble eyepieces out of any convenient lens set on hand and name them with no regard as to design. This is the primary reason these eyepiece types have bad names.

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.

"Orthoscopic" refers to the fact that the distortion aberration in the field is well corrected. The lines of brick walls in the field are rendered straight and square, rather than scalloped like the sides of a pin cushion or bowed like the walls of a barrel. The term means nothing in regards to general, overall correction. The Abbe "Orthoscopic" is an excellent eyepiece when well executed. But, like the Huygens, Mittenzweys, and Ramsdens, some poorly manufactured examples exist. Sophistication in "design" is *no* guarantee that the eyepiece fabrication is well executed.

@ Although not an officially sanctioned term, Modified Plössl 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.

One may consider the "modified Plössls" as pseudo-Erfles that have accepted slightly less apparent field coverage for better overall performance. The middle "fifth" lens

Report of the Dark Sky Committee

On November 3, 1994, the Zoning Staff of the City of Atlanta reported favorably to the Zoning Review Board on a proposed Ordinance to amend the City of Atlanta Sign Ordinance, Part 16, Chapter 28A, Section 16-28A.007, Paragraph 9, entitled "Sign Lighting" to require any sign or billboard erected subsequent to the effective date of this amendment "if lighted, shall be lighted from the top and light shall be directed downward onto the sign or billboard...."

The Zoning Review Board voted unanimously to recommend this ordinance to the Atlanta City Council. The Council will vote on November 21, 1994.

Here is the voting tally for a similar ordinance that did not pass:

Council Member	District	Vote
Vern McCarty	1	N
Debi Starnes	2	Y
Michael Bond	3	Abstain
Cleta Winslow	4	N
Davetta Johnson	5	N
Mary Davis	6	N
Lee Morris	7	Y
Clair Muller	8	Y
Jared Samples	9	Y
Clarence Martin	10	Did not vote
Jim Maddox	11	N
Gloria Tinubu	12	N
Robb Pitts	Post 13	Abstain
Carolyn Long Banks	Post 14	Did not vote
Sheila Brown	Post 15	N
Barbara Asher	Post 16	Did not vote
Doug Alexander	Post 17	Y
Pamela Alexander	Post 18	Y

ACTION NEEDED FOR TOUCHDOWN!

Obviously, more letters and phone calls are needed! Quickly! Short letters are fine.

Address:
Council Member ________
Atlanta City Council
55 Trinity Avenue, S. W.
Atlanta, Georgia 30335

Phone: 330-6030
Fax: 658-6454

From the Astro Almanac . . .

November 19 –	Apollo 12 lands on Moon surface in Oceanus Procellarum with three astronauts in 1969.
November 20 –	Pluto in conjunction with Sun, 3 p.m.
November 21 –	Leonids meteor shower ends.
November 25 –	North and South Taurid meteor showers both end.
November 25 –	Mars 8° north of the Moon.
November 27 –	A most astonishing meteor display in 1872; connected to Biela's Comet.
November 30 –	Venus 2° north of waning crescent Moon, 9 a.m.
December 1 –	Astronomical optician Bernhard Schmidt, inventor of the Schmidt telescope, dies in 1935.
December 2 –	Successful casting of the pyrex blank for the 200-inch Hale Telescope in 1934.
December 2 –	Hugo von Seeliger, pioneer in statistical studies of stars and director of the Munich Observatory, dies in 1924.
December 3 –	John Flamsteed discovers the planet Uranus in 1714.
December 4 –	Neptune 4° south of waxing crescent Moon, 7 p.m.
December 6 –	Transit of Venus across Sun is visible from the United States in 1882.
December 6 –	Vanguard I, the first American attempt at an artificial satellite, blows up during launch at Cape Canaveral in 1957.
December 7 –	Gerard P. Kuiper born in 1905.
December 7 –	Geminids meteor shower begins, radiant point 7 h 30 m +33 degrees.
December 8 –	Mars 2° north of Regulus, 3 a.m.
December 9 –	Saturn 7° south of Moon, midnight.
December 11 –	Apollo 17 lands on lunar surface in the Taurus-Littrow region with three astronauts in 1972.
December 14 –	Danish astronomer and mathematician Tycho Brahe is born in 1564.
December 14 –	Mariner 2 flies within 21,594 miles of the planet Venus.
December 14 –	Geminids meteor shower peaks.
December 15 –	Geminids meteor shower ends.

acts as a collecting lens for the eye lens which allows the field lens to transmit rays of greater angular extent that otherwise would have been lost. This is precisely Erfle's contribution in the design of the eyepiece that carries his name. The "Barlow" that is added to the front of the Vixen eyepiece mentioned, and to the Nagler and Pretoria as well, is actually called a "Smyth" lens.

Barlows are not designed to participate in the correction of the aberrations of the eyepieces they are intended for use with. Smyth lenses, by definition and practice, are.

@ 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.

An eyepiece with an apparent field of 80° will show you more of the sky, but you have to look around to see it. The healthy eye can accept a field of about 48° in extent, and this figure was, until the advent of the Nagler and the unguided Dobsonian, considered about the ideal for the observer. Every extra degree of apparent field above about 40° that one tries to design into an eyepiece requires extra measures, generally, to gain the excellent performance expected. Thus, lenses, stops, coatings, and other extras are added to make the gain.

However, modern amateurs forget that moderate field eyepieces of considerably less expense can be used very effectively on unguided telescopes, and simple eyepieces with small fields can show one something at high power if the telescope is guided. The very best view of Jupiter I have ever had was with an "antique" Tolles solid eyepiece, probably made in the late Nineteenth Century, with an apparent field of about 12°, used on a 6" Clark refractor. No Nagler can come close to providing the detail that was seen that evening.

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.

I have heard a very bad report on the manufacturing quality of the Orion MegaVista. My experience some years ago with Orion's brand name Kellner has convinced me not to purchase other eyepieces from them that carry their name. Again, quality of manufacture was the issue.

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.

All eyepieces, including the Naglers, show degradation in the quality of their images away from field center when working with instruments as fast as f/4. Most amateurs feel that as long as they don't "see" the smears of unwanted aberrations they need not be concerned with them. However, even undetected aberrations rob light from the image so that faint stars are progressively dimmed and finally "eliminated" as one peers further out toward the field edge. Practicality of transport usually drives the F/no. of the instrument an amateur will have, but as the f-number diminishes one should understand that he will have increasing difficulty with eyepieces. F/no.s falling in the f/4 to f/6 range will place the greatest demands on eyepieces, forcing most observers to either rely heavily on Barlows or paying large sums for the very expensive designs that better manage these f-numbers.

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.

Indeed, with all of the elements some modern eyepiece have, multicoatings is desirable. Sometimes, though, one can still notice a "light deficit" when comparing a design with a lot of elements that is multicoated with a simple design that has few elements. I have a beautiful Hastings triplet that has three cemented lenses with magnesium fluoride coatings on the air-exposed surfaces that offers brighter images than any Nagler of the same focal length. As to "reading" the color of coatings, allow me to relate an unfortunate story. Some years ago, a manufacturer of binoculars found that their sales volume for one of their products increased after they had mistakenly undercoated the lenses for that model's run. Apparently the public thought the new coating color they were seeing indicated a new coating technology of greater optical efficiency! If you wish to check the effectiveness of the coatings on an eyepiece you desire, observe the moon or Venus through one you have borrowed. Forget the old coating color rules! Something else to remember; it's not always necessary to coat *every* element in an eyepiece assembly to keep the reflections down.

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 Pössls are better for high-power use.

AAC ACTIVITIES

by Ken Poshedly

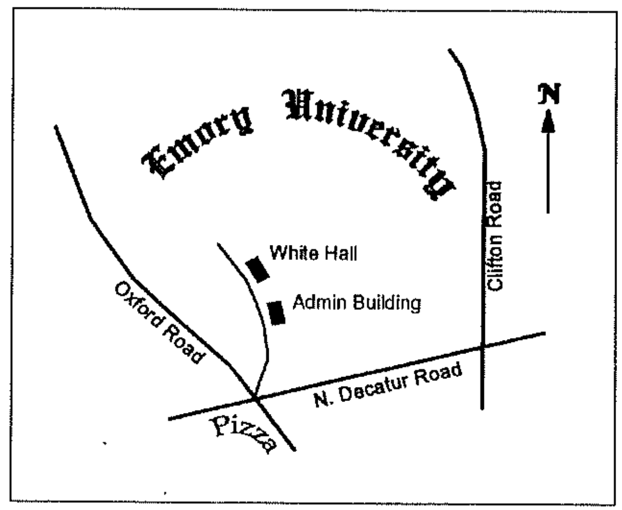
Help Please . . .

A reminder from our longtime refreshments chairperson, Terry McHann. Help. Yep, that's right, "HELP" as in "Hot, Enjoyable, Likable, Pastries." Terry's been handling the AAC's refreshment duties for quite a awhile now.

If you've got some "help", or at least the time to assist Terry in her efforts to make sure we find the meetings *most* palatable, please call her at 441-9097.

Our New Meeting Place

Beginning this month, Emory University's White Hall is added to the list of meeting sites for the Club. Accommodations here are spacious and luxuriant. The auditorium we will use (one of 4) will seat 120 comfortably in cushioned seats. Plenty of room here for expansion! For the next few months, our meeting site will rotate between Agnes Scott College, Fernbank Science Center, and White Hall.



find a friend with a light bucket you can borrow. I found its brighter members in my scope, but was unable to definitely identify all of them. I was, however, treated to a fine view of them through Keith Shank's 16" Newtonian at last year's club picnic. A truly impressive sight.

ANDROMEDA

M31 Truly one of the showpieces of the northern sky. Our nearest spiral neighbor in space, it extends over 3°, and is easily visible to the naked eye. It has two companions, M32 to the south, and M110 to the north, both of which are small elliptical galaxies. M31 itself is best seen at low powers, and one of the best views I've had was through Wally Frasher's 16X80 binoculars. The galaxy's full extent could be seen along with several dust lanes and its companion galaxies. Marvelous!

NGC404 Easily found right next to **β** Andromedae, this galaxy is only well seen when that star is out of the field of view. It is 4'x2-3', extended NNE-SSW, broadly concentrated to the center, and has a stellar nucleus.

NGC752 A large and splashy open cluster which is best seen in the iewfinder or binoculars. It is about 3/4° in size, with over 150 relatively bright stars arranged in many curving chains. Well detached from the background stars and very pretty.

NGC891 In photographs, one of the finest objects to be seen. Visually, however, it is large and faint, with little. It is 15'X3', oriented N-S, with faint dust lanes along its eastern side and through the center.

NGC7662 A fine, bright, bluish-green planetary nebula, about 30" in diameter which handles magnification well. No annularity was noted, but the SE edge appeared to be brighter than the NW side. Some observers do see annularity at very high powers.

NGC891 An Easy Edge-On Spiral. Image by Beniot Schillings.

NGC7686 A small, sparse open cluster surrounding a wide orange and blue double star. Not well detached from the background, I counted only about 15 relatively faint stars in the cluster.

π And A nice double star composed of a bright white primary and a fainter, dusky blue companion. Easily split.

γ And One of the finest double stars, it is easily split, and shows a yellowish-white and beautiful blue pair.

A Note About the Illustrations . . .

The images of NGC891 and NGC7662 reproduced here were made by Benoit Schillings with the Cookbook CCD camera and a Celestron C8. They are combinations of 9 images each, taken at f/10. These images are approximately equal to the famous photographs of these objects made by George Willys Ritchey with the 60" reflector at Mt. Wilson in the years 1908-10. An amazing feat for an 8" telescope!

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.

Generally, amateurs do not realize that the barrel sizes of eyepieces limit the size of the maximum apparent fields that they contain. Thus, the 40-mm and 25-mm focal length eyepieces in 0.965" barrels are limited to about 28° and 45° respectively, and the 40-mm, 35-mm, and 28-mm focal length eyepieces in the 1.25" barrel sizes are limited at around 36°, 42°, and 52° respectively. Barrels having expanded diameters like the Nagler can manage larger apparent fields although they can slip into 1.25" adapters.

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.

Restriction of the exit pupil alone does not explain why the secondary mirror's shadow appears within the eye's view. The true reason is more subtle. The secondary is imaged by an eyepiece at a point different from that of its exit pupil, which is itself the location of the imaging of the primary mirror. Eyepieces with long focal lengths image the secondary nearer their exit pupils than do those with short focal lengths. If the power used is so low that the diameter of the exit pupil is restricted closely around the image of the secondary, the secondary shadow is seen.

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.

I will always advocate the choice of a good Barlow with a moderate focal length eyepiece over the short focal length eyepiece for achieving high power. The eye relief is lengthened (something that is especially important for eyeglass wearers), and one obtains more power, and a range of more powers if one has more eyepieces, with less cost. Also, a good Barlow will actually improve the performance of a telescope at power.

Generally, one should avoid variable power Barlows *and* variable focal length eyepieces, for that matter.

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.

I have said all one needs to about the virtues of "simpler" eyepieces. For planetary use, I say these eyepieces are better suited for transferring visual detail than are the super sophisticated, multi-element Cadillacs that one can purchase. Planets are objects of small angular diameter, and most observation will take place at or near the field center. An excellent achromatic doublet will provide great imagery here, and is certainly more transparent than any design with more elements. Unfortunately, its field is so small (around 15°) that one will have difficulty using it on any telescope not accurately driven on the pole.

You may choose to spend on a fancy multi-element eyepiece for planetary viewing, but I bet I'll see as much or more than you with one of my "cheapies"!

Rick Blakley is a contributing editor to ATM Journal. He is a mathematics and optical specialist.

Hubble Views Titan

Observers using the Hubble Space Telescope showed remarkable views of Titan at the American Astronomical Society's Division for Planetary Sciences meeting in Maryland this week. The images disclosed what appears to be the surface of Saturn's largest satellite. Titan is enveloped in a dense haze that even the Voyager cameras could not peer through. But in the near infrared the haze becomes more transparent, and HST's pictures suggest that a huge bright "continent" exists on the hemisphere of Titan that faces forward in its orbit. The planet-size world is thought to have considerable liquid on its surface, or perhaps oceans, composed of liquid hydrocarbons. The new Hubble results do not prove that the seas exist, however, only that it has large bright and dark regions on its surface.

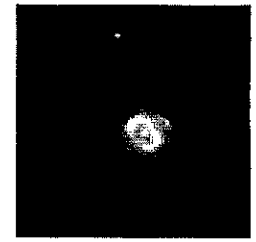
Sky & Telescope News Bulletin
November 4, 1994

CONSTELLATIONS OF THE MONTH

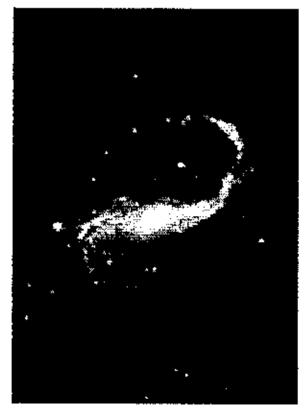
PEGASUS and ANDROMEDA

by Rick Raasch, Dallas

The constellations of Pegasus and Andromeda contain many galaxies, most of which are relatively faint. The challenge the observer not only to find them, but to detect detail in them. I've recently had the opportunity to observe from the dark skies of the Davis Mountains in west Texas, and was able to put my observational skills to work on these objects. I've sorted through my notes, and am here presenting what I feel are the best of my finds. Happy hunting!



NGC 7662 Planetary in Andromeda.
Image by Benoit Schillings.



NGC7479 A Magnificent Barred Spiral

PEGASUS

M15 This is a nice, bright globular cluster that is easily seen in the viewfinder or binoculars. It handles magnification well, showing a tight mass of stars 8' in diameter with a much brighter central region. Individual stars are resolved around the edges and across its face but not quite to the center.

NGC7177 A small, moderately bright galaxy, 3'x1' in size, oriented NE-SW. It has a definite central bulge about 1' in diameter, a stellar nucleus, and is broadly concentrated to the center.

NGC7331 This is a large and bright galaxy, about 7'X2' oriented NW-SE. It has a bright core, a sharply brighter stellar nucleus, and at times, dust lanes can be seen along the SW edge. Very pretty.

NGC7332 A small, but very nice edge-on spiral. It is about 4'X7', oriented NE-SW, sharply brighter to the center, has a stellar nucleus, and a definite central bulge. A much fainter companion (NGC 7339) lies 10' to the east, and is 4'X1', oriented E-W, and is only very slightly brighter to the center.

NGC7479 Large, 6'X3', extended NNW-SSE, with a slightly brighter center. There is a 13th magnitude star seemingly imbedded in its northern tip. The tips of the galaxy show hints of curving slightly, indicating that it is a barred spiral.

Stephan's Quintet These five, tightly gathered galaxies are faint and early impossible to see in moderate instruments, so

Defining Terms Used in Marketing Telescopes

by Jack Kramer, Libertyville Illinois

With the advent of CCD's and the new computer-controlled telescope drives, this may be your first brush with the arcane world of really high-tech. For our members who may be considering some of the advanced products now on the market, we are providing an interpretation of a few terms that you've no doubt seen widely used in advertisements.

ALL NEW – The power supply, connectors, and software are not compatible with previous versions. Even the screw threads are different.

ADVANCED DESIGN – Salespeople don't understand it.

BREAKTHROUGH – It nearly worked on the first try.

DESIGN SIMPLICITY – It was developed on a shoestring budget.

EXCLUSIVE – We're the only ones who have the directions telling how to use it.

FIELD TESTED – The manufacturer has no way to test it.

FOOLPROOF OPERATION – It's unrepairable, short of sending it back to the factory (which can't fix it either).

FUTURISTIC – It only runs with the help of a next-generation computer, which isn't available yet.

HIGH ACCURACY – The screw threads match the threads of the holes they're supposed to mate with.

IT'S HERE AT LAST – We've released a 26-week project in 48 weeks.

MAINTENANCE FREE – See Foolproof Operation.

MEETS OR EXCEEDS OPTICAL STANDARDS – We haven't the foggiest idea about the total wavefront accuracy.

NEW - It comes in a different color than the first version.

PERFORMANCE PROVEN – It worked through beta test.

QUALITY STANDARDS – It works most of the time.

REVOLUTIONARY – Everything that's supposed to go round and round actually goes round and round.

SATISFACTION GUARANTEED – We'll send you another manual if this one fails to work.

STOCK ITEM – We shipped it once before and we can do it again, probably.

UNMATCHED – No one else wants to copy our design.

UNPRECEDENTED PERFORMANCE – May mean two different things:

1. Actually worked the first time right out of the box.
2. Nothing before ever ran so erratically.

YEARS OF DEVELOPMENT – We finally got one to work.

The Age of the Universe

A Center For Astrophysics Release

CAMBRIDGE, MA – A new cosmic distance scale derived from measurements of expanding supernova atmospheres suggests that the Universe may be approximately 14 billion years old, considerably younger than the 20-billion-year age preferred by many theorists but ancient enough to have allowed evolution of the oldest observed stars.

Based on observations of the expanding photospheres of five Type II supernovae made at the Cerro Tololo Inter-American Observatory (CTIO) in Chile, and 13 more from earlier work, an international collaborative effort between two groups of astronomers located at Harvard and in Chile has established a new value for the Hubble Constant, or expansion rate of the universe, at 73 (+/-6) kilometers per second per Megaparsec, a rate that translates into a maximum age of 14 billion years.

Robert Kirshner of the Harvard-Smithsonian Center of Astrophysics (CFA), leader of the group at Harvard, describes the distance measurements as "completely independent of, but complementary to, other attempts to determine the Hubble Constant, such as using the calibration of Cepheids in nearby galaxies." (The Cepheids are variable stars with a well-defined period-luminosity relationship that allows measurement of their absolute magnitudes to yield accurate distances to nearby galaxies.)

These methods require a step-by-step, ladder-like, progression to increasing depths of the universe, first by establishing a distance to an object, then using that measurement as a rung to reach more distant objects, often with different calibration methods at each step. Consequently, the climb to new rungs can add considerable uncertainty to the final figure.

The measure of the Hubble Constant is made more difficult by the fact that the universe does not expand smoothly in our galaxy's local neighborhood, where gravitational forces of nearby clusters may affect the rate. Thus, it is necessary to measure distances to galaxies far beyond our own, and astronomers have sought for many years a "standard candle" by which distances to far objects could be compared with those nearer by.

The "expanding photosphere method" employed by the US-Chilean group is a direct, one-step process, based on a single and simple geometric measurement of bright objects in galaxies far beyond the local group.

Models of the temperature and density of the atmosphere of an exploding star calculated by Ronald Eastman of the Lawrence Livermore National Laboratory provide observers with the precise dimensions of the emerging blast of light. Using the color of a supernova and its brightness as measured at Earth, Eastman's models give the angular size of the exploding star. When combined with measurements of the velocity in the expanding gas, this yields a solution for the supernova's distance.

Brian Schmidt of the CFA, who made several of the observations, notes that the technique works equally well with both nearby and distant supernovae. For example, Supernova 87A in the Large

Magellanic Cloud was one target of this study, but others at distances of more than 500 million light years were also measured.

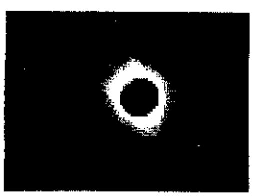
"Since supernovae are a million times brighter than Cepheids," Schmidt explains, "we can see them much farther away." All the supernovae in this survey were Type II, that is, a type with a hydrogen-rich atmosphere which explodes when the core of a massive star collapses. Such supernovae are thought to form neutron stars and pulsars. However, the size and type of the original progenitor stars is not crucial to this measurement technique, according to Schmidt, since the observed atmospheric temperature, brightness, and velocity provide an accurate size for the expanding shell.

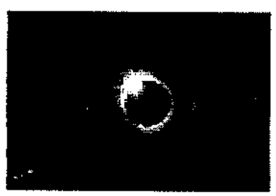
As Kirshner describes it, the expanding photosphere method is not so much a "standard candle" as a "custom yardstick." The chief limitation on the method is the need to make observations within the first few weeks after a supernova's explosion, that is, before the atmosphere cools, thins and turns transparent.

A survey of Type Ia supernovae (thought to originate in the sudden thermonuclear explosions of white dwarf stars) by the CTIO group will provide another path to the Hubble Constant. And a planned Hubble Space Telescope survey of Cepheids in galaxies out to distances of the Virgo Cluster could offer additional calibration.

The international team involved in establishing the new distance scale is a collaborative effort between two group of astronomers. The first group, based at Harvard, includes Kirshner, Schmidt, and Eastman. The second group of astronomers is located in Chile, and is a collaboration between the astronomers Mario Hamuy, Mark Phillips, and Nicholas Suntzeff of CTIO and Jose Maza of the University of Chile. The Cerro Tololo Inter-American Observatory is part of the US National Optical Astronomy Observatories, which is funded through a contract to he Association of Universities for Research in Astronomy by the National Science Foundation. Other support for this research was provided by the Fondo Nacional de Ciencias y Tecnologia (FONDECYT) in Chile; and the National Science Foundation and National Aeronautics and Space Administration in the United States.

A paper describing the new estimated age of the Universe, "The Distances to Five Type II Supernovae Using the Expanding Photosphere Method, and the Value of H0" by Schmidt et al, appeared in the September 1, 1994 issue of *The Astrophysical Journal*.





These images of the November 3 solar eclipse were made with a Sony TR81 camcorder with a doubler working at 16X by Dale Ireland. The observing site was at an altitude of 13,100 feet, 9 miles south of Sevaruyo, Bolivia.

October Inauguration for Twin Telescopes in Hawaii and Chile

Ceremonies in October in both the northern and southern hemispheres will herald construction of the $176 million, 8.1-meter Gemini twin telescopes. Ground-breaking will take place October 6 for the northern telescope on Mauna Kea, Hawaii, followed by an October 22 inauguration for construction of the southern telescope in Cerro Pachon, Chile.

The light-gathering power of the huge mirrors, coupled with the superb imaging-ability of the optical systems, will render these new generation telescopes ten times more sensitive than existing 4-meter telescopes. Astronomers will use the Gemini telescopes' power to study some great astronomical questions, such as the origin of planets, stars, the solar system, chemical elements, quasars, active galactic nuclei, and galaxies. Gemini will also be used to explore the frontiers of cosmology.

The international Gemini partnership consists of the United States, the United Kingdom, Canada, Chile, Argentina, and Brazil. The U.S. National Science Foundation administers the project for the partnership and provides half the support. The project is managed by the Association of Universities for Research in Astronomy under cooperative agreement with NSF.

Together, the two telescopes will provide coverage of the entire sky, in both visible and infrared wavelengths. Building two telescopes from a common design will also save considerably on engineering and fabrication costs. Infrared images from the northern site, in particular, should be comparable to or better than optical images from the Hubble Space Telescope.

The Gemini twins will occupy astronomically superb sites. Mauna Kea is viewed as the best all-around observing site in the Northern Hemisphere. At 4200 meters, it towers above much of the atmospheric water vapor that hampers most observations from Earth into space. Ground-breaking on Mauna Kea will begin with a traditional blessing by a Hawaiian religious leader. In Chile, Cerro Pachon, 2700 meters high, sits within the dry mountains of the Atacama desert and offers an atmosphere for astronomical observation as good as any site in the Southern Hemisphere.

Gemini will be particularly suited for investigating the origins of stars and galaxies. The dust shrouds of young stars can best be parted at infrared wavelengths, revealing the stars at the earliest epochs of their formation. The telescopes will also enable probes of how the farthest known galaxies were formed and evolved.

Corning Glass of New York is producing primary mirror blanks for both telescopes. Each mirror consists of 42 hexagonal blocks of ultra-low-expansion glass, fused into one large, thin disk. The disks will be shipped by boat for polishing at REOSC Optique in France. Canada's Coast Steel Fabrication, Ltd. will build the telescope enclosure. National astronomy laboratories and universities from the partner countries are designing and building Gemini's scientific instruments.

"First light," or inaugural observations, are expected in Hawaii in 1998, with full operation in 2000. The Chilean telescope will see first light in the year 2000, with full operation two years hence.

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