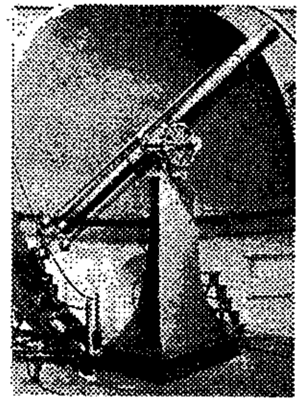
the focal point

Monthly Notices of the Atlanta Astronomy Club, Inc.

Vol. VI No. 2 October, 1993



Why is this telescope famous?
See page 7

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MEETING NOTICE ON PAGE 16

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: **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.

First Class

9310

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

BULLETIN

LUNAR CRATER NAMED FOR AAC MEMBER!

Word has just reached us from the Association of Lunar and Planetary Observers that the crater Amundsen A is to be renamed for former club member Peter Hédervári, of Budapest. Peter was a member of The Atlanta Astronomy Club from the early 1960's until his death in 1985. His name was proposed for the crater by Dr. John Westfall, director of the ALPO.

Hédervári is 74 kilometers in diameter, 3910 meters deep, and has a 570-meter high central peak. It is located at selenographical coordinates 82.5° South and 85.5° East in a region which has hitherto been reserved for explorers and geographers of the Earth's north polar regions.

Peter was a well-known geologist, and applied his knowledge of the Earth to the study of the Moon and planets. His analysis of the volcanic forces at work on the Greek island of Thera was instrumental in leading historians to the conclusion that a gigantic eruption there was responsible for the destruction of the Minoan civilization in the circa 500 b.c. period. Many of his observations of the Moon and planets were made with a telescope constructed from an objective lens presented to him by the club.

In addition to his theoretical work, Peter was a leading advocate of astronomy in Hungary. He wrote many popular books on the subject and was well-known to the amateur and professional astronomers of Eastern Europe. Copies of many of his books and papers are available in the club library.

We were greatly saddened to lose Peter, but we are very proud that he has received the recognition which he so well deserved.

	SUN				MOON				
Date	Rise	Azi	Set	Azi	Rise	Azi	Set	Azi	Age
10/15/93	7:42	99.8	19:03	259.9	7:50	104.2	19:05	253.1	0.8
10/16/93	7:43	100.2	19:02	259.5	9:02	109.8	19:52	248.3	1.9
10/17/93	7:44	100.7	19:01	259.0	10:12	113.9	20:43	245.0	3.1
10/18/93	7:45	101.1	19:00	258.6	11:19	116.1	21:39	243.6	4.1
10/19/93	7:46	101.5	18:59	258.2	12:18	116.4	22:39	244.0	5.2
10/20/93	7:46	102.0	18:57	257.7	13:11	114.9	23:40	246.1	6.2
10/21/93	7:47	102.4	18:56	257.3	13:57	112.1	-----	-----	7.2
10/22/93	7:48	102.8	18:55	256.9	14:36	108.1	0:40	249.6	8.1
10/23/93	7:49	103.3	18:54	256.4	15:11	103.4	1:38	253.9	9.1
10/24/93	7:50	103.7	18:53	256.0	15:42	98.4	2:35	258.9	10.0
10/25/93	7:51	104.1	18:52	255.6	16:12	93.0	3:30	264.2	10.9
10/26/93	7:52	104.5	18:51	255.2	16:41	87.7	4:24	269.6	11.8
10/27/93	7:52	104.9	18:50	254.8	17:10	82.4	5:17	275.0	12.7
10/28/93	7:53	105.3	18:49	254.4	17:40	77.5	6:11	280.3	13.6
10/29/93	7:54	105.7	18:48	254.0	18:13	72.9	7:05	285.1	14.4
10/30/93	7:55	106.1	18:47	253.6	18:49	69.2	8:00	289.3	15.3
10/31/93	6:56	106.5	17:46	253.2	18:29	66.2	7:56	292.7	16.3
11/1/93	6:57	106.9	17:45	252.8	19:14	64.3	8:51	295.0	17.2
11/2/93	6:58	107.3	17:44	252.4	20:04	63.8	9:44	296.1	18.1
11/3/93	6:59	107.7	17:43	252.0	20:58	64.8	10:35	295.8	19.1
11/4/93	6:59	108.1	17:42	251.7	21:56	67.1	11:22	294.0	20.1
11/5/93	7:00	108.5	17:41	251.3	22:57	70.8	12:05	290.8	21.0
11/6/93	7:01	108.8	17:40	250.9	24:00	75.7	12:46	286.6	22.1
11/7/93	7:02	109.2	17:40	250.6	0:00	75.8	13:24	281.2	23.1
11/8/93	7:03	109.5	17:39	250.2	1:04	81.6	14:00	275.2	24.2
11/9/93	7:04	109.9	17:38	249.9	2:10	88.0	14:37	268.8	25.3
11/10/93	7:05	110.2	17:37	249.5	3:17	94.6	15:14	262.2	26.4
11/11/93	7:06	110.6	17:37	249.2	4:26	101.1	15:54	256.1	27.6
11/12/93	7:07	110.9	17:36	248.9	5:36	107.0	16:38	250.7	28.7
11/13/93	7:08	111.2	17:35	248.5	6:47	111.8	17:27	246.6	0.3
11/14/93	7:09	111.6	17:35	248.2	7:56	115.0	18:22	244.1	1.5
11/15/93	7:10	111.9	17:34	247.9	9:00	116.4	19:21	243.7	2.5

OFFICERS AND OTHER DIGNITARIES

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Facilities	Leonard Abbey	634-1222
Light Pollution:	Tom Buchanan	587-0774
Membership:	Terry McHann	441-9097

OBSERVATORY REPORT

by Alex Langoussis

October Observing Session

Our next observing session at Villa Rica will be on Saturday, October 16. Fall brings astronomers two things: clear, crisp skies, and more civil observing hours! No more waiting until 10 pm to get started! The Sun will set about 7 p.m., and the thin crescent Moon and Mercury will set by 8. Comet Mueller (1993a) should be brighter than 10th magnitude, and not far from the pole.

Make a note of your favorite Fall objects, and we'll make a point of getting a look at them through the 20" scope. So join us for a pleasant fall evening under the stars!

PRICE INCREASE FOR *ASTRONOMY* MAGAZINE

Effective Setpember 1, 1993, the cost of subscriptions to *Astronomy* magazine which are ordered through the club treasurer is $18 for one year, and $24 for two years. This represents a 33% discount over the usual rates. The old rate was $16.

To subscribe, contact the treasurer at the address on the back cover.

YOUR EXPIRATION DATE

Remember... the date of your last membership renewal appears at the upper right corner of your mailing label. Add one year to this date to get your expiration date. This date will be highlighted in color for those members who are past due.

COMING ATTRACTIONS

In the near future, we look forward to hearing Dr. Doug Gies, of Georgia State University's Department of Physics and Astronomy. We hope to hear him discuss pulsating variables, a current field of interest.

Doug Chesser will demonstrate our club Electronic Bulletin Board (BBS) system, and will distribute free software for accessing it.

We also look forward to hearing Dr. Ron Tilford, noted Atlanta ophthalmologist, who will describe the effects of the eye's anatomy on what and how we see through telescopes.

Later in the year, Dr. Hal McAlister, director of the Center for High Resolution Astronomy (CHARA) at Georgia State University will speak.

We also hope to have Dr. Tom Van Flandern,a cosmologist who is noted for his new, and highly original, insights into the origin of the universe. We will have to catch Tom on his way through town, so this meeting may not be held on the usual third Friday. Watch the *Focal Point* for details.

TAKING PICTURES WITH YOUR TELESCOPE

Alan Dyer, *Astronomy* Magazine

Telescopes and cameras just naturally go together. Many people buy their first telescope with the idea of attaching their camera to take pictures of what they see through the eyepiece.

If you want to take pictures with your telescope, the first thing you need to do is connect your camera to your telescope. There are several types of camera adapters on the market, making the choice a bit confusing.

Which is the one you want? Will it fit on your scope? What kind of pictures can you take with it?

Before placing your order for a camera adapter, the first thing you need to consider is what type of telescope you have. If you own one of the popular Schmidt-Cassegrain telescopes, or SCT's, your task of selecting astrophoto accessories is a snap. All the SCT's on today's market are offered with a selection of adapters and brackets specifically designed for those models and the manufacturers' brochures clearly illustrate each of the accessories.

Here's step by step instructions on how to connect your camera to a telescope to begin your astrophotography adventure.

If you have a reflector or refractor telescope, the manufacturer might have camera adapters and mounting brackets specifically made for your model. Increasingly, many of the mounts and telescopes available today are sold as the nucleus of complete astrophoto systems. In this case, you are probably best to stick with the accessories made specifically for your scope as they'll be sure to fit.

Many refractor and reflector owners have to rely on using general-purpose or "universal" adapters that are designed to fit a wide range of telescopes. These are available from your local telescope store or from any of the mail order telescope dealers. But fully outfitting some reflectors or refractors for astrophotography can sometimes require a little ingenuity.

There are also several variations of the basic camera-to-telescope adapters depending on what type of celestial object you are after. Long exposure photographs of deep-sky objects can require a different adapter than the basic scope-to-camera coupling needed for shots of the Moon. Close-ups shots of lunar craters or a planet's disk require a different adapter yet again.

There are basically four types of astrophotography with a telescope, each with its own adapters:

- Prime focus (good for snapshots of the Sun and Moon)
- Eyepiece projection (used for close-up shots of the Sun, Moon, and planets)
- Piggyback (used for guided wide-angle shots of starfields taken with a camera lens)
- Guided prime focus (used for long-exposure photos of deep-sky objects taken through the telescope)

We'll discuss the adapters for each of these techniques by type of telescope, breaking them down into those used on Schmidt-Cassegrains and those used on other types of telescopes such as most refractors and reflectors. (See the December 1992 issue of ASTRONOMY for the step-by-step illustrations.) These telescopes have focuser tubes that accept standard-sized eyepieces and accessories. The typical universal camera adapters usually work equally well on both types of non-Schmidt-Cassegrain telescopes.

PRIME-FOCUS PHOTOGRAPHY

The simplest way to take pictures through your telescope is to use the prime focus technique. You'll need a 35-mm single-lens reflex (SLR) camera to do the job but chances are that's what you already own. An SLR has interchangeable lenses allowing you to remove the standard lens and replace it with optional wide-angle, telephoto, or zoom lenses.

For prime-focus photography remove the lens entirely and use the camera body alone. You also don't need an eyepiece on the telescope. Instead, the scope's main lens or mirror projects its image directly onto the film. Attaching your telescope in this manner creates an ultra-long telephoto. For example, if yours is an f/10 scope with a focal length of 2,000 mm, then you've got a 2000 mm f/10 telephoto. Quite a lens!

You'll use this technique most often for shots of the whole disk of the Moon and Sun (although in the case of solar photography you'll also need a safe solar filter over the front aperture of the telescope).

To do prime-focus photography you need a basic coupler. In the case of Schmidt-Cassegrain telescopes it is called a T adapter. It sells for about $25. To use it remove the "visual back" that holds your star diagonal and eyepiece and screw on the T adapter onto the threads that are part of the scope's backplate.

For other telescopes you need a prime focus or "universal" camera adapter. This $30 device slips into your focuser tube in place of the eyepiece. When ordering one, be sure to get the model that will fit your focuser. Most telescopes have focusers with 1¼ -inch tubes. Some scopes have the smaller 0.965-inch focusers. In that case you'll need an adapter that has a 0.965-inch barrel.

Some telescopes have 2-inch or even 2.7-inch focusers. You can buy 2-inch diameter adapters for these. Two-inch adapters are more expensive but have the advantage of not cutting off, or "vignetting," the corners of the frame. The smaller adapters produce vignetted images because even a 1¼ -inch adapter has an inside tube diameter of about 30-mm, less than the 35-mm width of the film frame. However, for shots of the whole disk of the Sun and Moon this slight vignetting isn't a problem since the corners of the frame are dark anyway.

In addition to the basic camera adapter, no matter what type or size it is, you'll also need what's called a T ring. But not just any T ring. You need the one made for your brand of camera. Most telescope dealers and camera stores stock T rings – the ones for 35-mm cameras cost $15 to $20.

T rings are a necessity because each of the many brands of cameras on the market has a different type of lens mount. To get around this all telescope-to-camera adapters are made with a universal T thread at the camera end. The T ring screws onto this thread. The T ring then bayonets into your camera body just like a lens. The advantage to this T system is that if you decide to switch to a different brand of camera you don't need to scrap all your adapters. You just need a new, inexpensive T ring.

A variation on the prime focus technique is to insert a Barlow lens into the light path. This will work for reflectors and refractors – simply insert the prime focus adapter and camera into the Barlow as if it

BBS REPORT

by Doug Chesser

Internet Bound

The information world has hit, and hit hard. If you don't have a modem, get one!

The Atlanta Astronomy Club's BBS has gone Internet! Beginning on September 9th, the AAC BBS has subscribed to CSRNet, an Internet Gateway Network. It is now possible for AAC BBS callers to send and receive Internet mail as well as participate in selected newsgroup conferences. We currently carry the private Internet Email Conference (USENet) as well as sci.space, sci.space.shuttle, and a few others. By the time this article is published the BBS will have sci.astro, sci.astro.hubble, and sci.optics. If you are a caller to the BBS your internet address will be:

firstname.lastname@cld9.sccsi.com

The bulletin section on the BBS contains instructions on how to send and receive internet mail, including how to send and receive mail from services such as CompuServe, Delphi, MCI, and AT&T Easylink.

Ok, so what's the catch. Well, you can't do TELNET, FINGER, or FTP.

What will it cost? The service charges the BBS for access, not the user. It will cost the BBS about $25 per month to keep its internet access. This service is free to individual callers, As are access to all of our BBS' other echo networks.

If you have not called the BBS yet, hang on. In a program later this year, I will be explaining what the BBS is, how you use it, and where to buy the equipment you will need. I will also distribute free software for accessing the BBS.

LOST AND FOUND

Like most public places, our observatory in Villa Rica slowly accumulates a motley collection of lost items. Nothing valuable has turned up this year, but there always seems to be an odd mitten or two on the ground after each session. Check by the warmup building and see if you recognize any of these oprhans.

AAC ACTIVITIES

OCTOBER MEETING

The October meeting will be held at 8:00 p.m. on Friday, October 15 at Bradley Observatory. Our speaker will be our host, **Dr. Alberto Sadun**. His subject will be **Image Processing with Microcomputers**. If the title seems familiar, it is because his book, of the same name, appeared in August.

Photographic film is no longer the medium of choice for producing astronomical images. The new electronic technology fortunately provides us with capabilities and controls which we would not have dreamed possible a few years ago. Amateurs, even with homemade telescopes, can now reach stars as faint as 24th magnitude with exposures of only a few seconds. The resulting images can be electronically optimized so as to make obvious details and aspects of faint objects in ways which were not previously possible.

The new analytical tool of the modern astrophotographer is the computer, and the lowly PC is rapidly becoming the computer of choice for this work. This means that virtually nothing is beyond the capability of the amateur. Who said that the world is getting worse instead of better?

In the last year Alberto has been busy installing a state-of-the-art image processing computer system at Bradley Observatory. He will illustrate his talk with actual examples of the processes he describes by projecting the computer screen onto the screen in the auditorium.

Autographed copies of the book will be available at the meeting.

CLASSIFIED ADS

THE MELLISH REFLECTING TELESCOPES embody the highest optical perfection that experience and skiull can produce. Mechanically they leave nothing to be desired. Made to order, in sizes from 6-inch to 16-inch. Prices are moderate; for example, a 66-inch with portable equatorial mounting, tow slow-motions, two circles, finder, and three eye-pieces sells for $170 net. Photograph on application. John E. Mellish, Leetonia, Ohio.

THE ALVAN CLARK & SONS CORPORATION
Astronomical Telescopes
50 Henry Street Cambridgeport, Mass.

ASTRONOMICAL TELESCOPES — Manufactured by W. & D. Mogey. Send for Catalogue. Works and Observatory, Interhaven Ave., Plainfield, N. J.

(From *The Monthly Evening Sky Map*, November, 1917)

were an eyepiece, then slide the Barlow into the focuser. This will give you a modest increase in magnification. For example, a 2X Barlow will double your telescope's effective focal length, useful for getting a larger lunar or solar image.

You may be wondering what to do if you don't have an SLR camera (perhaps all you own is a point-and-shoot pocket camera). The bad news is that your telescopic photography options are limited. One method available to you is a technique called the "afocal method." This involves aiming a camera (with its lens still attached and focused for infinity) into the eyepiece. This technique is useful for shots of the Moon and Sun, but that's about it. Astrophotographers who use the afocal method usually place the camera on a separate tripod arranged so the camera looks into the telescope eyepiece. However, these setups are difficult to keep focused as the telescope moves. Afocal setups also produce badly vignetted frames and often yield poor image quality.

An area where afocal photography is often required is video astrophotography of the Moon and planets. If you cannot remove the lens from your camcorder, simply aim the video camera lens into the eyepiece of a scope (use a low-power eyepiece). For sharp results it's best to rigidly mount the camcorder in front of the eyepiece. This usually requires a homemade bracket since commercial camcorder-to-scope adapters are rare.

EYEPIECE PROJECTION PHOTOGRAPHY

Prime focus photography with most telescopes will produce an image of the Sun or Moon 10 to 20-mm across. This is enough to show details such as sunspots and craters. But for closeups of the spots and craters you need to turn to eyepiece projection – an eyepiece projects a highly magnified image into the lensless camera body and onto the film.

Besides being useful for lunar and solar closeups, this technique is the only way to get the planet disks large enough on the frame to show any detail.

If you use a Schmidt-Cassegrain, you need what the manufacturers call a tele-extender. This eyepiece projection tube screws onto the visual back of the telescope, slipping over an eyepiece inserted into the back.

If you are using a reflector or refractor, the prime focus camera adapters usually come with an extra extension tube. Use this tube only when you want to do eyepiece projection. (If you try to use the extension tube when doing prime focus photography, chances are you won't be able to get the telescope to focus.) The extension tube screws onto the prime focus coupler. You then slide an eyepiece into the tube.

Like prime-focus adapters, tele-extenders and extension tubes have universal threads on their camera ends. To couple your camera to these tubes, you again need a T ring.

There are a couple of things to look for with eyepiece projection adapters. The tube that contains the eyepiece should have a screw on the side of it. This either locks the eyepiece in place or acts as a stop to prevent the eyepiece from sliding down into your camera body. Also, be sure your eyepieces will fit inside the projection tube. Many of today's eyepieces (in particular ones with rubber grip rings) may be too wide to fit inside. Check with your dealer or manufacturer to make sure your eyepieces are compatible with the adapter you intend to buy.

Another potential problem is that if the eyepiece is too close to the camera, you'll get a vignetted image – the circle of light projected by the eyepiece won't be large enough to fill the frame. To avoid this you may need to add another extension tube. (Some projection adapters have sliding tubes to allow you to vary the projection distance. This also boosts the power – the farther the eyepiece is from the film the more magnification you'll get.) If you have too short a projection distance, you can avoid vignetting (as well as boost magnification) by inserting a higher power eyepiece.

PIGGYBACK PHOTOGRAPHY

Piggybacking your camera to the side of your clock-driven telescope uses the scope as a tracking platform. The camera tracks the moving stars during the exposure, typically 1 to 30 minutes long. For a Schmidt-Cassegrain you can get a bracket that bolts to the top of the tube. You then attach the camera to it as you would to any tripod. This is a solid arrangement but with wide-angle lenses the end of the tube can appear in the photo. To prevent this some brackets have adjustments to point the camera away from the tube.

Telescopes on German equatorial mounts sometimes have accessory rings that clamp around the tube for holding a camera. Other scopes have ¼-20 bolts on the main tube rings themselves. Use these bolts to attach a heavy-duty ball-and-socket tripod head. Any tripod head might do, but with a ball-and-socket head you can easily flip the camera 90° (or to any angle you like) to frame the starfield. Without this ability, your piggybacked camera may end up turned vertically when your scope is aimed to the south, usually not the best orientation for framing constellations.

GUIDED PRIME FOCUS PHOTOGRAPHY

Taking long-exposure photos of deep-sky objects (nebulae, star clusters, and galaxies) through your telescope is the most demanding type of astrophotography. You might think all you need is a prime-focus adapter. Just hook up your camera to your telescope, turn on the clock drive, and walk away for a half an hour or so.

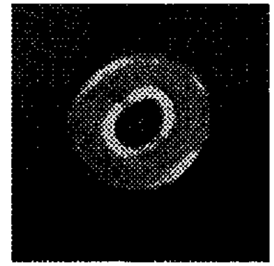
If you do that you'll be in for a rude awakening. The photo will record your deep-sky target, but just barely, and the stars will look like wiggly worms. Don't worry, there's nothing wrong with your telescope drive. Yes, the drive does compensate for the apparent motion of the sky and will keep objects in the field, but no drive runs so accurately that you can walk away from the scope during a long exposure.

There have been dramatic improvements in the tracking accuracy of drives in the last few years (innovations such as periodic-error-correction circuits, for example), but no drive will keep star images precisely on the same spot on the film for long exposures. Slight errors in the gears will cause the stars to wander back and forth in an east-west direction. Less than perfect polar alignment of the mount will cause the stars to drift in a north-south direction. All kinds of other subtle effects can give your deep-sky photos a case of the jitters.

To keep the stars looking like points you need a way of monitoring a star near your target object. While the exposure is underway, you tweak the position of the telescope (preferably using electronic fine-speed adjustments on both axes of the telescope) to keep the star centered in a guiding eyepiece equipped with illuminated crosshairs.

The preferred method for guiding a Schmidt-Cassegrain is to use an "off-axis" guider. This device screws onto the back-plate of the telescope. The camera and T ring then attach to the other end of the guider body. Partway down the guider body sits a small prism that juts into the light path. It picks off a star from the edge of the field and directs its image to the guiding eyepiece.

An option with Schmidt-Cassegrains is to insert a telecompressor into the light path. This accessory lens effectively shortens the focal length and speeds up the f/ratio of the scope (a speed increase from f/10 to f/6 is common), giving smaller but brighter images. The benefit is significantly reduced exposure times, as much as four times shorter.



NGC 7662 Planetary Nebula in Andromeda. Drawn by Barnard with the 40-inch Refractor

diameter, made up of primarily bright and some relatively faint stars, and has a coarse appearance.

M76 The Little Dumbell planetary nebula resembles M27 as seen though a small telescope. It is bi-lobed, with the southern lobe the brighter of the two, and the northern being somewhat rectangular. Some dark lanes or patches are seen with averted vision. This object holds up to magnification well.

NGC 869, NGC 884 The Double Cluster. This is one of the finest sights in the sky. These two open clusters are both large and bright, and fall in the same low power field of view. NGC 869 is the brighter and more concentrated of the two, and is dominated by two bright orange stars near its center. NGC 884 is slightly larger, and has many more orange-red stars. Both clusters contain over 100 stars each.

α Persei Group When you look at Alpha Per, it is easy to see granulation or condensation of the Milky Way in its region. Try looking at this area with binoculars, and you will be stunned by the wealth of stars in this area. This is actually a large open cluster having the designation Melotte 20, and contains over 100 stars. Give this area a peek.

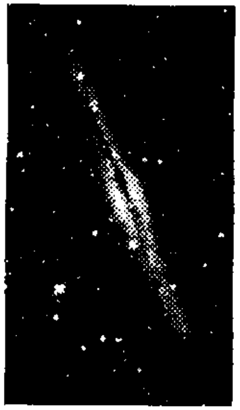
η Per This double star is an easy split, and shows a pretty yellow-gold primary and a fainter blue companion.

M76 the Little Dumbbell Nebula

ε Per A difficult split, but a fine yellow-white and blue double star.

Algol (β Per) This famous variable star dips almost 1.5 magnitudes every 2.86 days. Its variability is due to a faint star eclipsing a brighter star. The eclipses last about 10 hours, so a significant brightening or dimming can easily be observed in one night. Its minima are listed in Sky and Telescope magazine every month, so if you haven't observed a variable star yet, give this one a try.

with over 150 relatively bright stars arranged in many curving chains. Well detached from the background stars and very pretty.



NGC 891 Edge-On Spiral
In Andromeda

NGC 891 In photographs, one of the finest objects to be seen. A classic example of an edge-on spiral galaxy. Visually, it is large and faint, almost like the ghost of the galaxy shown in textbooks. It is 15' X 3', oriented N-S, with faint dust lanes along its eastern side and through the center. Time is needed to extract detail in this beautiful object.

NGC 7662 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.

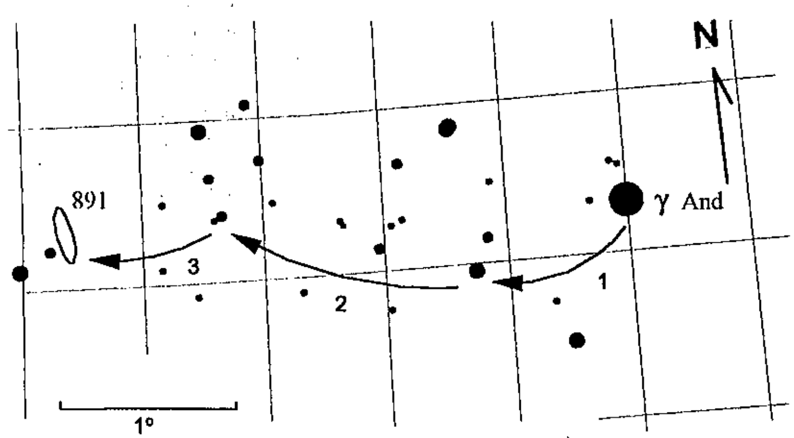
NGC 7686 A small, sparse open cluster surrounding a wide orange and blue double star. Not well detached from the background, I counted only about 15 relatively faint stars in the cluster.

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 most beautiful double stars in the sky. It is easily split, and shows a golden-orange primary and a fine blue companion. A must see.

PERSEUS

M34 This is a fine open cluster, easily seen in binoculars as somewhat box shaped, with many bright stars resolved. Through a telescope, it is almost 40' in



Star Hop to NGC 891

The telecompressor screws onto the telescope, then the guider attaches to the telecompressor. Because some telecompressors require refocusing the telescope, these accessories often come with an extension tube that raises the height of the guiding eyepiece allowing it to reach the new focus point.

A few manufacturers offer off-axis guiders for Newtonian reflectors. These can be used on some refractors as well -- check with the manufacturer for compatibility. They are designed strictly for use with 2-inch focusers. They feature a very narrow body because an off-axis guider that puts too much distance between the camera and the top of the focuser would never focus -- you wouldn't be able to rack the focuser in far enough to compensate for the thickness of the guider.

As an alternative to off-axis guiders, many owners of reflectors and refractors prefer to use a second telescope piggybacked on the main scope. This guidescope need only be a 2.4- or 3-inch refractor but it must have enough focal length (500 to 1000 mm) to provide enough power (100x to 200x) to allow you to spot small movements of the guide star. (Low-power finderscopes won't do the job.) The guidescope must also be very securely attached to the main scope - it should never shift inadvertently. On the other hand its support rings should have adjustment screws so you can move the guidescope around to search for a suitable guide star.

Some telescopes have bolts or holes in their rings or tube to facilitate attachment of rings for guidescopes. But in some cases, you'll need to drill holes in your tube if you want to stack another scope onto your existing tube.

If you use a guidescope, the only type of adapter you'll need for attaching your camera to the main scope is a simple prime focus coupler. You insert an illuminated crosshair eyepiece into the guidescope and you're set. As an alternative, you can buy a nifty device that projects an illuminated bull's-eye pattern into the field of any eyepiece, allowing you to use your favorite eyepiece for guiding. These "projection reticle" accessories are designed for use with separate guidescopes.

Whatever route you take -- off-axis guider or separate guidescope -- getting well-guided deep-sky photos is a challenge. But when it all comes together, the results are immensely satisfying.

THIS MONTH'S COVER

When it left the shop of Josef Fraunhofer in 1839, the 15" Harvard refractor was undoubtedly the finest telescope in the world.

The appearance of a bright comet in the mid 1830's had aroused public interest, and the good citizens of Boston soon raised funds for the purchase of a large telescope by popular subcription.

Fraunhofer's shop produced two identical lenses that year, one for Harvard, the other for the Pulkovo Observatory at St. Petersburg, Russia. The Harvard instrument was placed into service in 1844.

In 1850 Henry Draper made the first celestial photographs with the telescope; and it has now been in continuous use for almost 150 years.

Telescopes are very cost-effective.

CHINESE ARTIFACT PROVIDES CLUE TO EARTH'S ROTATION

by Frank O'Donnell, JPL, Pasadena

Ancient oracle bones, once believed to foretell day-to-day events in China, have been used by researchers at NASA's Jet Propulsion Laboratory (JPL), Pasadena, Calif., and their colleagues to help determine how much the Earth's rotation is slowing down.

Based on inscriptions on the oracle bones — actually, tortoise shell — the researchers have fixed the exact date and path of a solar eclipse seen in China in the year 1302 B.C. That, in turn, led them to conclude that the length of each day was 47/1,000ths of a second shorter in 1302 B.C. than it is now.

Their findings are reported in a talk delivered today by JPL astronomer Dr. Kevin D. Pang at the 174th meeting of the American Astronomical Society in Ann Arbor, Mich.

Working with Pang were East Asian language professor Hunghsiang Chou of the University of California at Los Angeles, physicist Dr. Kevin Yau of Durham University in England, astronomer John A. Bangert of the U.S. Naval Observatory, Washington, D.C., and mathematician Dharam V. Ahluwalia of JPL.

The oracle bones studied by the researchers are pieces of tortoise shell used by seers during China's Shang Dynasty in the 14th Century B.C.

The bones' existence was unknown to historians until 1899, when a Chinese scholar became ill and sent his servant to an apothecary for medicines. One of the ingedients — sold by the apothecary as "dragon's bone" — proved to be bone chips with words inscribed on them in ancient Chinese.

Over the following years, the bones' source was traced to the city of Anyang, about 300 miles southwest of Beijing. Anyang was the capital of the Shang Dynasty in ancient China.

Some 25,000 oracle bones were excavated in Anyang during the 1920's and 1930s and were taken to the Chinese Academy of Science in Taiwan when Chinese Nationalists moved there in 1949. About 135,000 more pieces are in private collections or have been excavated since the founding of the People's Republic of China. The oracle bone studied by Pang and his colleagues is part of the collection now in Taiwan.

The bone's inscription says, "Diviner Ko asks if the following day would be sunny or not." It was dated the 51st day of the cycle then in progress in the calendar system used continuously in China from time immemorial.

The bone is useful to astronomical researchers because it records not only the diviner's question but also the eventual outcome of the next day's weather. On the reverse side the inscription continues, " ... 52nd day, fog until next dawn. Three flames ate the Sun, and big stars were seen."

Pang and his colleagues interpreted that statement as a description of a total eclipse of the Sun. The "three flames" would be coronal streamers licking out from the Sun's surface, visible only during total eclipses. In addition, the masking of the Sun by the Moon would allow Earth observers to see stars during daytime.

The researchers faced a problem, however, because historical records were not complete enough to tell precisely from what year -- according to the modern calendar -- the oracle bones dated.

CONSTELLATIONS OF THE MONTH PEGASUS, ANDROMEDA AND PERSEUS

by Rick Raasch, Dallas

The constellations we'll be examining this month are richly intertwined in mythology, but are vastly divergent in the objects they present to amateur astronomers. While Perseus lies along the Milky Way, and offers many sparkling open clusters and diffuse nebulae, Andromeda and Pegasus lie away from our galaxy's plane and allow us view the inhabitants of intergalactic space. Some of the finest objects of their respective classes reside in these constellations, and it is well worth braving cold weather to observe them.

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' X 1' 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.

NGC 7331 This is a large and bright galaxy, about 7' X 2' 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.

NGC 7332 A small, but very nice edge-on spiral. It is about 4' X 7', 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' X 1', oriented E-W, and is only very slightly brighter to the center.

NGC **7479** Large, 6' X 3', 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 nearly impossible to see in moderate instruments, so 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, M32, M110 The Great Galaxy in Andromeda and its companions. M31 is the closest large spiral galaxy to our own Milky Way galaxy, and therefore presents us with a wealth of details. Numerous dust lanes are evident, and large telescopes can even identify individual members of its system of globular clusters. I find the best view of this galaxy trio to be through large binoculars. At this magnification, the complete extent of the main galaxy can be seen, and the fuzz, star-like M32 and the elliptical M110 can be glimpsed quite easily in the same field of view.

NGC 404 Easily found right next to Beta Andromedae, this galaxy is only well seen when that star is out of the field of view. It is 4' X 3', extended NNE-SSW, broadly concentrated to the center, and has a stellar nucleus.

NGC 752 A large and splashy open cluster which is best seen in the viewfinder or binoculars. It is about ¾ degree in size,

INTERNET...

residual circle will show roughly the imprecision of settings using the circles.)

Some telescope mountings come with an auxiliary telescope fixed parallel to the polar axis designed for aligning with the North Celestial Pole by proper offset from Polaris. I have used a similar device attached to a camera platform in the Southern Hemisphere by memorizing the position of the South Celestial Pole relative to Sigma Octantis and fainter neighboring stars.

Finally, some computer-driven mounts enable a two-star alignment with any orientation of the axes, even altazimuth. Of course, the setting circles are then not useful as such. However, for astrophotography a real polar alignment is necessary; otherwise the camera will rotate relative to the stars during exposures.

Fortunately, the two-star methods work well with no additional equipment. Happy observing!

Truman P. Kohman
Department of Physics
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Pittsburgh, Pennsylvania

taught to shy away from using that 9 mm Orthoscopic for deep sky objects. Give it a try under good seeing on, say, M82, and see if the image doesn't raise your eyebrows.

If you carefully read Walter Scott Houston's notes in *Sky & Telescope* each month, or if you study the excellent deep sky notes in the Webb Society Handbooks, you're bound to find that the most detail is always extracted from comparative observations at a variety of powers — right up to the very highest useful power for that object. After a point, you reach powers that obviously do more harm than good, but you ought to be changing powers on up to that point in order to explore all the possibilities for a given object. Since you'll be making multiple observations of the same object, notekeeping will be a big help with sorting out the various details. (Keeping notes is another habit of the more successful observer, and is a good subject for another article some day.)

I bought a handy accessory for my 8" Celestron some years ago which has helped my observing significantly. It is a rotary ocular holder, or "turret" which takes the place of a star diagonal. I load it with 4 eyepieces — usually a 28mm widefield design for 71X, a 20 mm Erfle for 100X, a 12.4 mm Erfle for 161X, and a 9 mm Orthoscopic which gives 222X. The LPR filter which I sometimes employ fits between the main tube and the turret, rather than in a single ocular. This way, I can filter all the eyepieces at once, without having to change filters in the dark. Even swapping eyepieces for changing powers is a hassle - especially on a cold night. Before I got the turret, I would often skip the power-changing process because it was such a bother, but now I never fail to record my observations on all four powers. Somebody needs to invent a multiple ocular holder for Newtonians, so that the majority of observers can benefit this way.

The old advice is still priceless — stick with low powers most of the time. This is a must, especially for the beginner, but for those of us looking for more detail and more substantial satisfaction from observing, a cautious venture into a more closeup universe can be just the thing.

Using computers to calculate dates and paths of total solar eclipses visible in Shang China, the research team came up with two eclipses that might be the one referred to by the oracle bone. One of the eclipses was on June 5, 1302 B.C., the other on March 4, 1250 B.C.The researchers then turned to records of eclipses of the Moon in Shang Dynasty China to decide which of the two dates was right.

The seers who reported the lunar eclipses were known to work for King Wu Ding, who also was the patron of the seer who recorded the solar eclipse on the oracle bone. The lunar eclipses were known to span the years 1322 to 1278 B.C. That would cover the period of the solar eclipse of 1302 B.C., but not the solar eclipse of 1250 B.C.

The final step in their quest was to use a computer model of the Earth's rotation to see how fast the Earth must have been spinning for such an eclipse to be seen from Anyang, China, on the given day. If the Earth's rotation were faster or slower, the eclipse path would be moved to the east or west of Shang, China, and the total eclipse would not have been seen there.

According to Pang, the value they came up with — a day 47/1000ths of a second shorter in the 14th Century B.C. — is consistent with other studies of ancient eclipses from historical records.

Last year, Pang and several colleagues studied three eclipses reported in Chinese historical writings in 532 A.D., 899 B.C. and 1876 B.C. Their current study of the oracle bones, however, is the first time Pang's team has worked with an eclipse record from an archaeological artifact as opposed to ones in collected writings.

The research is not only useful in determining how fast the Earth's rotation has been gradually slowing down, Pang said, but also helps historians by establishing an exact date in the reign of King Wu Ding. Dates in Chinese history before the 9th Century B.C. tend to be uncertain.

The research was supported by the Dudley Observatory of Schenectady, N.Y., and the U.S. Naval Observatory, Washington, D.C.

WALTER F. BARBER

The death of Walter Barber, on November 29, has deprived the club of one of its most valued members.

Walter and his wife, Cleo, first visited us in 1953, when they brought their young son, Walter Jr., to our meetings. Walter Jr. had been bitten by the astronomy bug in a big way, and he was one of our most avid enthusiasts until his death in 1970.

Shortly thereafter, the club began to plan for an observatory at a dark location, and the Barbers very kindly insisted on donating land to us for that purpose. The observatory, was dedicated to the memory of Walter Jr. Since that time, it has introduced thousands of people to the wonders of the universe.

But Walter's contribution did not end with the donation of land. He always made sure that the grass was cut, that the locks were secure, and that the observatory was a pleasant place to visit. He was always available to intercede on our behalf with the county and utility authorities. He assured that our equipment was safe from any kind of harm. He was always there.

Our members, and most other astronomers in North Georgia , have benefited immensely from Walter Barber's kindness and enthusiasm.

In Defense of Power

Dean Williams, Little Rock

When I first got into observational astronomy, I was fortunate to have plenty of good advice from advanced amateurs and many excellent publications. One thing I learned, and which was drilled into me from the moment I first looked through a telescope, was to stick to low powers. This is a pretty good rule of thumb – especially for a beginner, and I'm certain that heeding this advice prevented a lot of frustration in my early days.

The only problem with following the low-power rule is that it leads to a brain-washing of sorts. Like many observers, I associated high powers with dark, shaky, terribly fuzzy images which are impossible to track. A quick glimpse at a deep sky object at 222X from time to time would convince me that sure enough, my short focal length oculars were good for nothing but a little planetary or double star work.

Slowly I have found my attitude in this area changing, and today I can stand proudly in defense of the use of high power – even for deep sky observing. A number of factors contribute to my appreciation for power, and I'll present them here for others' consideration.

> *The study of telescopic images is a black art...*

The key to successful use of higher powers lies in your own observing skill. An observer accustomed to only quick glimpses of objects will never find good detail at high power (and not much at low power either). However, amateurs with more polished habits ought to be acquainted with some important disciplines of observing which help to bring out extra detail at any power, but more so at high powers. Skilled use of dark adaptation, averted vision, tube movement, use of filters, knowledge of seeing conditions, proper polar alignment, and above all, patient, lengthy observation of every object all lead to success. It is quite true that a 200X image will never be as sharp and bright as the same object at 80X, but with a skilled eye, you'll be able to find exciting detail hiding in the more difficult 200X image which simply is not to be had at 80X.

Higher power yields better contrast and a darker background sky, so you'll be able to see those dark lanes and spiral arms which were washed out in the smaller less contrasty low-power image. The larger image will also allow such detail as bright knots of nebulosity, which may look like faint stars at low power, to be more easily identified.

The study of telescopic images is a black art, with emphasis on all kinds of things we tend not to worry about. Optimum exit pupil sizes, actual and apparent fields of view, image surface brightnesses and many other esoterics all influence what you'll get from a given eyepiece under different conditions. Since almost none of us can (or wants to) work out these specifics for an observation, I'll offer a neat solution. Instead of advocating the use of higher powers all of the time, what I really recommend is the use of a range of powers for every observation. Yes – I believe that you'll find lots of juicy extra detail at high powers, but even more useful is the contrasting blend of information you can obtain by comparing a set of observations for an object made at a variety of powers. Low power images offer the best impression of the overall field, and larger-scale structures, while higher magnifications can bring out finer details on a smaller scale. You probably use a variety of powers already, but perhaps like me, you've been

OVERHEARD ON THE INTERNET

Stephen Hardy inquired about locating objects with an equatorially mounted telescope by using their celestial coordinates. I assume that the telescope has circles marked for right ascension and declination and a drive motor for the proper hemisphere.

The essential requirement is a good polar-axis orientation. There are several methods of accomplishing this. I find most satisfactory one of several "two-star" methods, which I described in an article in *Sky and Telescope*, 1976 February, pages 135-139 (with 1975 star coordinates). Anyone can update it him/herself using a current *Astronomical Almanac* or a catalog giving 2000.0 coordinates.

Method A is the general two-star method, using any high-declination and low-declination pair. It can be used in either the Northern or Southern Hemisphere.

Method B, the Polaris two-star method, is specifically for the Northern Hemisphere. But an analogous method using Sigma Octantis could be used in the Southern Hemisphere.

Method C is a simplified Polaris method.

Method D is a simplified Southern Hemisphere method.

In each method, the mounting is aligned roughly; the telescope is pointed at the low-declination star, and the right ascension circle is set; the telescope is set for both coordinates of the high-declination star, and the mounting is adjusted to point the telescope at that star; and the process is repeated cyclically until little change is necessary. With experience, two cycles suffice.

It helps if the right-ascension circle is turned by the motor along with the telescope. Then it is simple to set the circles by the right ascension and declination of the object, and it should appear in a low power eyepiece. This is quite gratifying! If the right-ascension circle is stationary, a mental correction for the elapsed time is satisfactory for short times, and from time to time the circle can be reset using any low declination star.

It is assumed that the declination and polar axes, and the optical and declination axes, are precisely perpendicular. This is often not the case with inexpensibe mounts (and sometimes with expensive ones). Then an object far from both alignment stars may be out of the field. One should then reset the right ascension axis and note the declination offset using a bright star in the neighborhood of the sought object.

It is also assumed that the declination circle reads exactly 90° when the optical axis is parallel to the polar axis. This can be checked, and if necessary adjusted, as follows. Set the telescope so that the declination circle reads 90°. By moving the mount bring Polaris (or other high-declination star) into the center of the field of view. Rotate the upper part of the mount with the telescope around the polar axis. Ideally, the star should remain in the center of the field. If it does not, but moves in an arc of a circle, it is likely that the declination circle or its indicator is out of adjustment. Offset the telescope a little from 90° and repeat the test. Continue this way until the star remains stationary, or describes a circle of smallest radius (indicating that the optical and declination axes, and/or the declination and polar axes, are not exactly perpendicular). Reset the declination circle or the indicator to read 90°. If this is not possible, note the offset from 90° and apply this correction mentally (noting the direction) to all declination readings. (The size of the