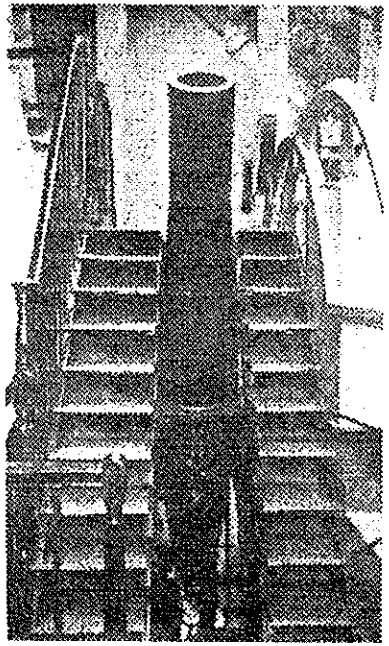
the focal point

Monthly Notices of the Atlanta Astronomy Club, Inc.

Vol. VI No. 6 February, 1994



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the focal point

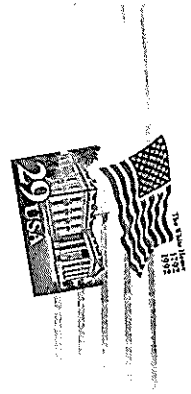
Monthly Notices of the Atlanta Astronomy Club, Inc.

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 455-3686. The BBS, which is free and open to the public, provides contact with both amateur and professional astronomers around the world.



First Class

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

2310

BASHING SMALL REFRACTORS

by Gene Lonak & Jack Kramer, Chicago

Refractors have their place in amateur astronomy, and we'd like provide some information that will be of special interest to those of you who are thinking of buying one as your a telescope. Some of these suggestions apply to instruments of all sorts. In the article "Are Refractors Obsolete" (appearing in *NightTimes*, the newsletter of the Chicago Astronomical Society), Jack only mentioned in passing the refracting telescopes normally sold in

> *As instruments go, not all of them are inferior, though most have some limitations.*

department stores. Typically, they're about 60-mm in diameter and come equipped with very high-power eyepieces. As instruments go, not all of them are inferior, though most have some limitations. In the hands of a knowledgeable observer, they're capable of good results, so we can't dismiss them as totally worthless. A person who knows how to use them is able to transcend their limitations by observing objects for which they're suited. It's unfortunate that these telescopes usually wind up in the hands of novices who become frustrated with their limitations. They expect to be able to use the high powers advertised...and they can't. They want to find faint objects in the sky...and they can't. A typical example of "niche marketing," they're aimed at the newcomer, rather than the experienced amateur astronomer. When was the last time you saw a Jason or Tasco telescope advertised in the astronomical press? Experience suggests that these refractors probably aren't the best telescopes for newcomers to our hobby.

But they can be improved upon.

The title of this article doesn't mean that it's purely a criticism of "department store" refractors. It comes from a term used in model railroading. To "kitbash" means that you take something as it comes out of the box and make improvements on it to suit your taste and/or needs. So let's try the same thing with these refractors.

For an unknown reason, a few of these telescopes use nonstandard eyepiece sizes. This means you cannot upgrade your eyepiece collection with better .965" oculars. If you'd like a wider field, in the typical 60-mm refractor a 32-mm ocular gives a field of 77' and a 40-mm gives 80'. To take advantage of the newer eyepiece designs, you'll need a focusing mount that accepts 1.25" oculars. That calls for change number one: remove the existing focusing mount and replace it with a 1.25" focusing mount. They're available from many equipment suppliers. If you have a telescope that already comes equipped for the standard .965" eyepieces, then you're in good shape; from this point, you can purchase some better .965" oculars or get an adapter for 1.25" oculars. If you opt for upgraded .965" eyepieces, stay away from those supplied by Jason and Tasco, many of which tend to be of the antiquated Huygenian design.

Rickety tripods are a constant annoyance, as are mountings that won't keep the telescope where you pointed it. Most of the tripods are made of wood, a material which does a good job of dampening vibrations. The only problem is that the wood generally used here is very light weight, so the tripods aren't really stable. Gene replaced the center struts with steel pipe filled with sand. (If they're made longer than the originals, that'll raise the telescope and make observing easier for the taller person.) Rubber doorstops on the bottom of each leg will absorb some

WHAT'S UP

	SUN				MOON				
Date	Rise	Azi	Set	Azi	Rise	Azi	Set	Azi	Age
2/15/94	7:22	104.7	18:22	255.4	9:44	76.1	23:16	286.3	5.1
2/16/94	7:21	104.2	18:22	255.9	10:18	71.8	-----	-----	6.0
2/17/94	7:20	103.8	18:23	256.3	10:55	68.5	0:11	290.2	6.9
2/18/94	7:19	103.4	18:24	256.7	11:36	65.9	1:05	293.2	7.8
2/19/94	7:18	103.0	18:25	257.1	12:22	64.5	1:58	295.1	8.7
2/20/94	7:17	102.5	18:26	257.6	13:13	64.4	2:51	295.8	9.7
2/21/94	7:16	102.1	18:27	258.0	14:09	65.7	3:41	295.0	10.7
2/22/94	7:14	101.6	18:28	258.5	15:10	68.6	4:28	292.8	11.7
2/23/94	7:13	101.2	18:29	258.9	16:14	72.9	5:12	289.1	12.7
2/24/94	7:12	100.8	18:30	259.3	17:20	78.3	5:54	284.4	13.8
2/25/94	7:11	100.3	18:30	259.8	18:28	84.6	6:33	278.5	14.9
2/26/94	7:10	99.9	18:31	260.3	19:37	91.2	7:11	272.0	16.1
2/27/94	7:09	99.4	18:32	260.7	20:46	97.9	7:49	265.5	17.2
2/28/94	7:07	98.9	18:33	261.2	21:55	104.0	8:28	259.1	18.3
3/1/94	7:06	98.5	18:34	261.6	23:03	109.3	9:09	253.4	19.5
3/2/94	7:05	98.0	18:35	262.1	-----	-----	9:55	248.9	20.6
3/3/94	7:04	97.6	18:36	262.5	0:10	113.1	10:44	245.8	21.6
3/4/94	7:02	97.1	18:36	263.0	1:14	115.3	11:38	244.3	22.7
3/5/94	7:01	96.6	18:37	263.5	2:12	115.8	12:35	244.5	23.7
3/6/94	7:00	96.2	18:38	263.9	3:04	114.6	13:34	246.3	24.7
3/7/94	6:59	95.7	18:39	264.4	3:51	112.0	14:35	249.5	25.7
3/8/94	6:57	95.3	18:40	264.9	4:32	108.3	15:34	253.7	26.6
3/9/94	6:56	94.8	18:40	265.4	5:08	103.7	16:32	258.5	27.6
3/10/94	6:55	94.3	18:41	265.8	5:42	98.7	17:29	263.8	28.5
3/11/94	6:53	93.8	18:42	266.3	6:13	93.3	18:24	269.3	29.4
3/12/94	6:52	93.4	18:43	266.8	6:44	88.1	19:19	274.7	0.8
3/13/94	6:51	92.9	18:44	267.2	7:14	82.8	20:14	279.8	1.7
3/14/94	6:49	92.4	18:44	267.7	7:45	78.0	21:08	284.6	2.6
3/15/94	6:48	91.9	18:45	268.2	8:18	73.5	22:02	288.6	3.5

OFFICERS AND OTHER DIGNITARIES

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

☑ Afternoon talks and presentations on Friday and Saturday that focus on the amateur astronomer. Remember those speakers mentioned earlier? This is when you'll find them. Your NIGHTS are for observing.

☑ Observing field swap-tables with a variety of doodads available throughout the event. Got something no longer needed, or that you might even have doubles of? You're bound to find a grateful buyer. Just bring a card table, put your stuff out and ask your price. Then, when you've got enough cash, go out and buy something from someone else.

☑ Door prizes donated by some of America's top astronomical equipment suppliers and manufacturers. Sky Publishing, Software Bisque, Technical Innovations, Jim's Mobile -- all have donated topnotch merchandise to the PSSG. And YOU could take something home.

☑ Astrophotography contest for those who believe in showing the rest of the world what we already know about. There comes a time when you're just not content to look anymore, you want to show it all, hang it on the wall, brag about it! So here's your chance to show your stuff.

☑ Electric power on the observing field. Dew-zappers and drive correctors unite!

☑ Your choice of lodging – from cottage-style to camping – with all meals home-cooked on site.

Remember – April 7 - 10 under the dark skies of the Future Farmers of America (FFA) campground near Covington, Georgia. Only an hour's drive east of Atlanta, comfortable, cottage-style and dormitory-style cabins in the beautiful foliage of Georgia's spring woods with the darkest skies in northern Georgia.

Call Ken Poshedly at (404) 979-9842 for more information.

OBSERVATORY REPORT

by Alex Langoussis

Our next observing session will be February 12. Tim Puckett and Jerry Armstrong will be demonstrating CCD imaging with the 20" telesocpe. Also that evening we will have as our special guests, high school astronomy students from DeKalb County. Thus, the evening will provide opportunities to learn something new and to teach others as well.

March means Messier marathon., Our observing session will be Saturday, March 12th. While you may not wish to stay out all night to see over 100 objects, this is an excellent opportunity to view those Messier objects which you may have missed previously.

This year's Eskimo Nebula Award goes to Clay McHann and Dave Riddle, who were out observing through the 20" scope on the night it reached 4°!

vibration. Strategic cross-bracing can markedly improve your existing tripod. The ultimate solution is to permanently affix the tripod legs in the open position, perhaps with a large accessory shelf. This makes the system very steady; however, it's hardly conducive to portability. You might also try the use of a centered weight hanging from the underside of the tripod; this is what Ladd Mazur did to stabilize the tripod of his Celestron reflector.

Short of buying a whole new mounting, there are a few things that'll improve your existing one. You should verify that the telescope is properly balanced around both axes; if so, the scope shouldn't move on its own. This balancing should be done with the scope just as you use it – with an eyepiece and diagonal in place. Many scopes can be adjusted fore-and-aft so as to balance better around the declination axis. Small counterweights attached to the tube can help, but Gene prefers the method where a secondary weight is mounted parallel to the tube extending upward from the weight side of the equatorial head. Make certain the axles are clean and free of tiny metal particles where they rest on bearing surfaces. A coat of WD-40 oil and Vaseline helps smooth out the motion. Usually, there's a tension adjustment that will help stabilize the movements of the mounting, but rough operation may be caused by set screws that have scored the axles. Here you'll have to burnish the ends of the set screws and smooth out the surfaces of the axles.

Another minor problem with most mountings on these scopes is that you can't reach the zenith. The telescope tube will run into the tripod legs every time. You have to wait until an object is off the meridian before the scope is in a convenient position in relation to the tripod. Short of elevating the entire head off the tripod, we can't find a solution, except to scrap the tripod and use a pier.

If your mounting has flex lines for the slow-motion controls, the RA control cable may extend off the east side of the tripod, but when you're on the west side, you can't reach it. Gene cut the cable and put the knob next to the head, so now it's at arm's reach at all times.

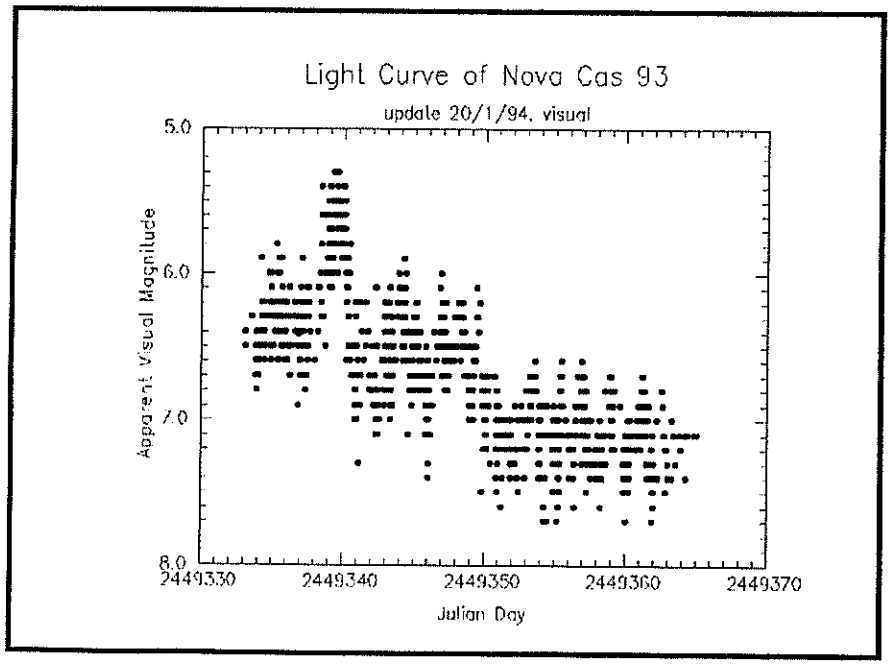
A good finder is an asset in locating objects. If your scope came equipped with a 5 X 24 finder, you might consider upgrading to a 6 X 30, or better yet, an 8 X 50 (provided your mounting is hefty enough to support this added weight). Or how about the unmagnified Telrad finder? The larger finder scope can be used for variable star comparisons where a wider field of view is needed. Gene's 8 X 52 finder has an exit pupil of 6.5 mm and true field of about 3.8°. Jason makes a 10 X 60 finder with crosshairs, but with that magnification, the field is narrower.

When it comes to the optics themselves, Gene thoroughly tested the objective on his Jason telescope. He found that it resolves to the Dawes limit and reaches the theoretical limiting magnitude. It provides a textbook diffraction pattern both in and out of focus. (Of course, the f/15.3 focal ratio helps.) Gene has seen stars down to 10.6 magnitude, and he's confident that better sky conditions would allow even fainter objects to be glimpsed with the 60-mm. The scope was purchased from Service Merchandise with a 30-day money-back guarantee; you can be sure it was well checked out during that first thirty days! For Gene's purposes, he's fairly well pleased with its performance thus far.

The department store refractor isn't the ideal first instrument, but as long as the buyer realizes the limits of its aperture, it can be a useful instrument for the novice. Naturally, there's junk on the market. A prospective owner would be smart to bring along a more experienced amateur for insight into the purchase. But before you run off to Service Merchandise to buy a refractor, you may want to consider one distributed by the likes of Celestron, Meade, or Orion. Taking a look at a Meade 60-mm refractor and a similar instrument made by Jason, it appears that they are virtually identical. We suspect that they're

made by the same manufacturer. (Although we've used Meade as an example here, it looks like the same thing applies to the low-end refractors by Celestron, Parks, Orion and other "name" suppliers.) Of course, the Meade doesn't come with eyepieces that'll give 400X. And the Meade may cost a bit more. The main advantage to purchasing the Meade is that generally it's distributed by a reputable supplier who can provide knowledgeable information about his products. We also hope that outfits like Meade, Celestron and Orion will demand tighter quality control from the manufacturer.

What this boils down to is the fact that a top-of-the-line department store refractor can be a decent scope, provided you don't expect more than it can deliver. The lower priced refractors usually have inferior mountings, and some of the cheapies even use plastic lenses. You get what you pay for! If your budget limits you to around $300, your choice in telescopes is also limited. If you don't want to build your own telescope from scratch, then you'll have to look for a good used telescope or do some smart shopping for a new one "off the shelf." You'll probably have to put up with some limitations or else spend extra money and invest some sweat equity in improving the telescope and mounting. A 60-mm refractor does a fine job on planets, variables, and double stars. For the fainter objects, you need more aperture to get a good view. One alternative is the 8" Coulter Odyssey. Here again, there are limitations that you'll need to address...but that's another story.



AAC ACTIVITIES

FEBRUARY MEETING

The January meeting will be held at 8:00 p.m. on **Friday, February 18**, at Bradley Observatory. Our speaker will be **Jenny White**, a junior at Agnes Scott. She will share with us her exciting summer of research at the **Maria Mitchell Observatory** in Nantuckett, Massachusetts, and her October stay at the **National Underground Research Observatory** in Flagstaff, Arizona.

The subject of her study at Maria Mitchell was the open cluster, NGC 2324; located in the constellation Monoceros.

Ms. White is a Stone Moutain native and she is working towards a degree in astrophysics at Agnes Scott. She presented her findings at the January meeting of the American Astronomical Society in Washington, DC.

PEACH STATE STAR GAZE MOVES AHEAD

What's the big deal about a "star party" when I can have just as much fun with my own telescope in my own yard?

Oh, but CAN you? A well-organized star-gazing event, like the upcoming Peach State Star Gaze, benefits you and others as well. Amateur astronomy, like most hobbies, is pretty much a social thing, with periodic get-togethers for those who are likeminded. You'll have a chance to learn new tricks AND share what you know with others who are just getting into the hobby.

The PSSG will feature:

☑ Repeat appearances by Jim Rouse and Doug Gegen, as well as nationally-known astrophotographers, like Michael Covington, and other individuals who attended the Fall 1992 gathering of 100 amateur and professional astronomers from across the southeastern United States at this same site. Jim's work has graced the pages of *Astronomy* and *Sky & Telescope* magazines for years, plus he's also been published in Terence Dickinson's book, *The Backyard Astronomer*. Doug is a wealth of information on the historical aspect of astronomy, including the 23-inch Alvan Clark refractor now at Roper Mountain Observatory in Greenville, South Carolina. And Michael Covington, author of *Astrophotography for the Amateur*, will talk on and answer your questions about astrophotography film selection.

☑ Open observing – the primary reason for the Peach State Star Gaze – on a flat, open field located only a short walk from the lodging and meeting facilities. Yeah, some of us might have wide, open backyards, but most of us don't. And how many of us live in "dark sky" areas? THIS is your chance to find that clusive object and shout Wahoo! and just know that you won't be getting any crazy stares -- because that's what WE do.

☑ Daytime high temperatures average in the mid-70's F, and night time lows around 50 degrees F. Not too cold, and no too hot. The timing is right with steady skies and the humid weather and boiling skies of summer are yet to come.

THE AIRY TRANSIT CIRCLE
by Lenny Abbey, Atlanta

A great telescope is not always one that incorporates optics capable of seeing greater distances, fainter magnitudes, or smaller details than ever before. There is important work to be done which requires improvements in areas other than aperture.

The "ancients" handed down to us a collection of instruments which were handheld, but capable nevertheless of surprising accuracy. During the Renaissance, these astrolabes and amillary spheres were replaced with more elaborate devices, reflecting the capabilities of our increased capacity to manufacture precision instruments. Mural quadrants and equatorially mounted circles replaced their ancestors. The golden era of positional astronomy was ushered in by the coming of the Industrial Revolution in England.

The culmination of this science was presided over by George Biddell Airy, the Astronomer Royal. When Airy assumed his position in 1836, he found the Royal Observatory at Greenwich filled with antiquated instrumentation, some of it dating back to Halley's day. He set about designing and supervising the constructing of new equipment which would bring an accuracy to the observatory's work which had not been imagined possible.

His greatest achievement was the 8" transit circle which he designed in the years 1840 - 1848. The design incorporated three new principles, which were all aimed at reducing error. First, as many parts as possible were to be included in single castings. Second, screws were to be avoided at all costs. And third, the necessity for adjustments to the completed parts was to be avoided as much as possible. The 8" lens was produced by Simms, the most respected lens maker of the day, for £300. This was an unheard of

George Biddell Airy
The Astronomer Royal

aperture for a transit circle, and it made possible the measurement of faint stars and asteroids. The mount was supplied (to Airy's design) by Ransomes and May.

The giant declination circle is graduated on a silver strip that can be read by six equidistant microscopes. Using all six, and taking their mean, the observer can read to 0.01"! In practice, however, instrumental and personal errors reduce this figure somewhat.

Such was the accuracy of this instrument, and the volume of excellent measurements which it produced, that Greenwich was chosen as the basis of our longitude system.

The circle, along with its accompanying chronograph, was in service for over a century. When the Royal Observatory relocated to Herstmonceaux in the 1960's the circle's work was assigned to more modern equipment there. But Airy's transit circle remained in place, because the old observatory had become an astronomical museum. Visitors can see it today, sitting proudly astride the prime meridian which it defines.

OVERHEARD ON THE
INTERNET

DOMINIQUE BEAUCHAMP COMMENTS ON NOVA CASSIOPEIA 93

It seems more and more obvious that Nova Cassiopeiae, which was discovered in mid-December, presents a strange behavior. If one looks at the light curve, he or she will see, superposed on the normal decreasing slope, an oscillation with a period of about 1.5 d. and an amplitude of about 0.3 mag.

Data reported by many observers dispersed worldwide show a systematic oscillation greater than the normal "human" dispersion with which the AAVSO is accustomed to deal. In the present case, we observe a dispersion up to 1 magnitude. (I recently used only V magnitudes obtained with photometers or CCDs and I saw this oscillation too...)

The first question that comes to mind is: is there an error? But to date, the curve seems to follow the predicted oscillations. Let us see what could be wrong if we reject the hypothesis that observers are wrong "periodically".

1) The magnitude is evaluated by comparing the nova with comparison stars. Maybe one of those stars is a periodic variable. But this has not been reported yet, and the problem of oscillations was reported by December 29 (see *The Astronomer Electronic Circular* No 803, by Guy Hurst).

2) The nova is an eclipsing binary. But it would have shown variations before the cataclysm and the Osservatorio Astronomico di Padova, from old Schmidt plates, reported no variation of the progenitor. But the precision of their measures is at the same level as the variations we expect to find, 0.2-0.3 magnitude.

3) Each observer uses his/her own comparison star set. HST, AAVSO, SAO, etc. Each one has a slightly different calibration. If a given observer does his/her observations almost at the same hour each day, he or she will introduce a bias into the global database. But this bias should show a period of about one day, not fractional days.

Andy Scott, from United Kingdom (sorry I don't remember his position), (ads@astro.keele.ac.uk), said that such oscillations have been observed in novae like v2214 Ophiuchi, but not so early after the outburst.

In order to investigate the light curve of that nova, it will be necessary to remove the "normal" component (increase and decrease) from the data. Then, we will have to apply Fourier transforms to see what periods are present. It will be interesting to see what happens if we filter data by observer and by comparison star set.

I am posting this message because I would like to discuss this strange behavior. Have you observed the nova? Have you remarked these fluctuations? Any ideas? hypotheses?

Dominique Beauchamp

beaucham@phy.ulaval.ca

PHOTOGRAPHING THE MOON

by Mark J. Coco, *Astronomy* Magazine

If you're starting out in astrophotography, the Moon is the best target. Compared with most other celestial objects, the Moon has a decided advantage – it's bright! This makes it easy to find, easy to focus on, and allows exposures to be short. It also means you can photograph the Moon from a city – no need to worry about light pollution on an object as bright as the Moon.

If you'd like to take pictures through your telescope, shooting the Moon is a good place to start.

For lunar photography, as with most astronomical photography, the best camera to use is a 35-mm single-lens reflex, or SLR. There are hundreds available on the market today, each loaded with features. But for taking shots through your telescope, the most important feature is a removable lens. The second requirement is that the camera must allow you to change shutter speeds with a manual control.

Ideally, the camera also should have mirror lockup and a self-timer. These reduce camera shake by locking the mirror up out of the way before the shutter is released and by allowing you to keep your hands away from the camera at the moment the shutter opens and closes. Another nice feature is a mechanical shutter, one that operates without the need for battery power. It's a feature you'll appreciate on chilly nights.

Three good mechanical cameras still on the market are the Pentax K1000, Nikon FM2N, and high-end Canon F1. Older cameras I can recommend that are no longer in production are the Nikon F and F2, Minolta SRT 101, and Olympus OM-1. They often can be found in the used equipment section at your local camera store.

THREE STAGES

There are basically three ways to photograph the Moon. The first doesn't even require a telescope. Simply mount a telephoto lens (135 mm or longer) on your 35 mm camera, attach the camera to a tripod, and shoot. This method is good for shots of the crescent Moon setting in a twilight sky, the Full Moon rising, or other pictorial compositions.

The advantage of this technique is that it couldn't be simpler – literally point and shoot. The limitation is that even with relatively long telephoto lenses (500 mm or so), the image of the Moon will be small. To determine the size in millimeters of the lunar image on your frame, divide the focal length of your lens or telescope by 110. A 500 mm telephoto will produce a Moon about 4.5 mm across, still a small disk compared with the 24-mm height of the frame.

To reveal individual craters on the Moon, you need to use a focal length longer than 500 mm. This is where your telescope comes in. Even a modest 60-mm refractor usually has a focal length of 700 mm or more.

To shoot through a telescope we turn the second technique, "prime-focus" photography. Here the camera (with its lens removed) replaces the eyepiece. Your telescope's lens or mirror is the only optics in the system. To do this you need a prime focus camera adapter along with a T-ring to mate your particular camera to the adapter's universal threads. As an option, you can also use a Barlow lens to multiply

A SIRIUS MATTER

by Lenny Abbey, Atlanta

Sirius is without doubt, the most popular of all double stars; even though most amateurs have never seen it resolved. The problem is that even though the companion is not too close to its primary for small scopes, the overwhelming difference in brightness (9 magnitudes) makes it a challenge for all observers. But it is worth trying. Resolving Sirius is one of the most rewarding observations an amateur can make.

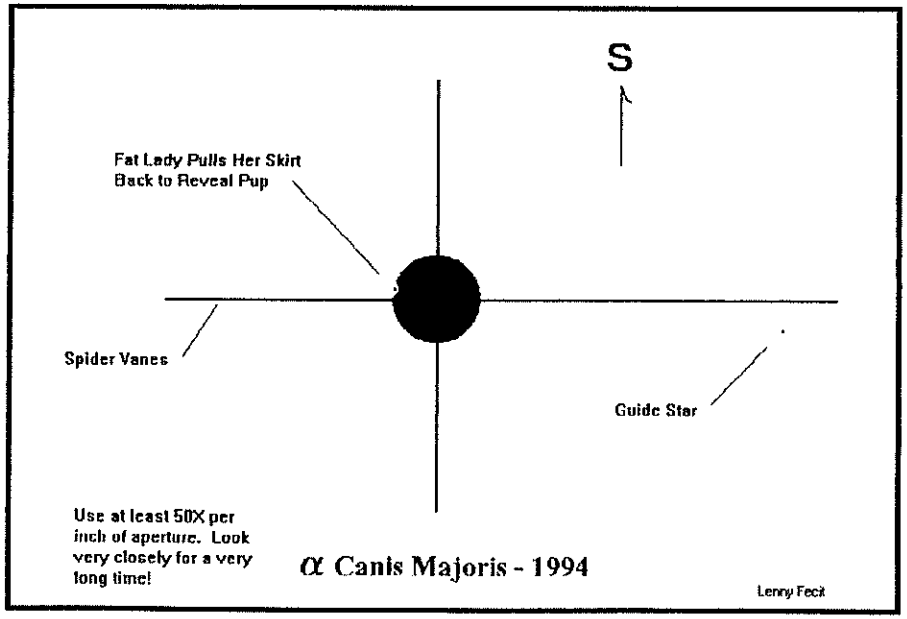
The pair, which is at its closest separation in 1993 - 1994, is widening noticeably on a year-to-year basis. However, it should be visible now in a 12" to 24" instrument.

The trick is to be prepared. You will need an excellent telescope, a steady night, good vision, a road map (provided below), and lots of patience.

Do your homework, which includes:

- Clean your optics. Eyepieces and Barlows especially. They should be free of all traces of grease and oily film. Use compressed air, alcohol, and Q-Tips to clean them.
- Choose a very steady night, so that you can use your highest powers. Start with 50X per inch of aperture, and work downwards if that is required.
- Know where to look. The chart will show you what to expect.

Under extreme magnification, Sirius will look like a can of glowing worms, writhing and squirming. But every now and then, when moments of good seeing allow, the image will shrink , and the tiny pinpoint of light which is the "pup" will be revealed.



CONSTELLATIONS OF THE MONTH
CANIS MAJOR and PUPPIS

by Rick Raasch, Dallas

Containing the brightest star visible on earth, the constellation of Canis Major is one of the few constellations in the heavens which resembles what it is supposed to be: a large dog. Puppis, on the other hand, boasts no bright stars, and is difficult at best for even seasoned observers to identify. Stellar beacons notwithstanding, both of these constellations are rich in open clusters, as they lie along the winter Milky Way. Several interesting planetary nebulae and double stars are also found in this region.

CANIS MAJOR

M41 Large and splashy, this fine open cluster is easily seen as a hazy patch to the naked eye, and is fully half a degree in diameter in the telescope. About 60-70 stars can be seen at low power, in many curving chains. The cluster is dominated by a bright orange star near its center. A great open cluster.

NGC 2354 Relatively large, this open cluster is about 15-20' in diameter, round, and composed of relatively bright stars and a sprinkling of fainter stars. The center seems empty, with very few stars.

NGC 2359 The Duck Head Nebula. This is a large and faint diffuse nebula which is best seen at low powers. It is about 10' in extent, and is composed of an arching segment intersected at almost right angles by a straighter component, resembling a duck's head and bill. I found it best seen with an Orion Ultrablock filter, while the Lumicon UHC filter did not do as well. This is a good object for you light bucket owners.

NGC 2362 A small but very pretty open cluster surrounding the star Tau CMa. It is about 6' in diameter, compact, and well concentrated. I counted about 40 stars with most of them being moderate in brightness. This is one of my personal favorites.

NGC 2360 This is a large open cluster, 12-15' in diameter, with about 75 stars well concentrated to the center. It is visible in the viewfinder and impressive through the telescope.

ADS 5951 One of my favorite double stars, this is a fine pair composed of yellow-orange and blue stars. It reminds me of a fainter version of the more famous Albireo. It's easily split, so check it out!

PUPPIS

M46 This is a bright open cluster almost a half of a degree in diameter, containing about 100 moderately concentrated stars. As a special treat, the planetary nebula NGC 2438 lies seemingly imbedded in its northeastern edge. The planetary is about 40" in diameter, grayish, and is distinctly ring-shaped. This is a great deep sky double!

M-47 About the same size as M-46, this is another fine telescopic sight. This open cluster contains about 50 relatively bright stars moderately concentrated to the center.

M93 Another fine open cluster. It is about 20' in diameter with a distinct triangular or wedge shape. Composed of about 50 stars, it is fairly well concentrated, with a moderate range in magnitudes of the stars.

NGC 2440 This planetary nebula appears as an out of focus star, about 20" in diameter, with a bright center fading to the edges. No central star was seen in this blue-green nebula.

the focal length of your scope by a factor of 2 or 3, giving you a larger lunar disk.

The last lunar photo technique is also used for shots of the planets – eyepiece projection. With it you can use your telescope to close in on selective areas of the Moon. To achieve this degree of magnification you need a camera adapter that allows you to place an eyepiece in the telescope-to-camera coupler. The eyepiece projects a highly magnified image of the Moon onto the film frame. This technique multiplies the effective focal length of your telescope by a factor of 10 to 20 - to 20,000 mm or more.

For this last type of high-power lunar photography, you must have a telescope equipped with an equatorial mount and electric clock drive. For prime focus shots of the whole disk of the Moon, if you have an equatorial mount and clock drive, by all means use them – you won't have to keep centering the Moon for each exposure and you'll get the sharpest possible shots.

However, you can still get decent shots of the Moon using an altazimuth-mounted telescope (one that cannot track the stars), such as a small refractor or a Dobsonian-mounted telescope. Lunar exposures are short enough, especially if you use fast film (ISO 400 or so) and focal lengths under 1000 mm, that the movement of the Moon during the exposure shouldn't impart objectionable blurring.

WHEN TO LAUNCH

Because the Moon moves around Earth, it is not always in the same place in our sky. The phase of the Moon for any given date can be found in your local newspaper or in *Astronomy* each month. As a general rule, the waxing crescent, First Quarter, and waxing gibbous phases are visible in the evening sky. The Full Moon is directly opposite the Sun and, therefore, visible all night. To catch the waning gibbous, Last Quarter, or waning crescent you have to go out late at night or very early in the morning.

While the Full Moon tends to attract the most attention, it is not the best phase to photograph. The side we see is illuminated by direct sunlight, eliminating shadows. The Full Moon looks flat, with no contrast.

The best time to photograph the Moon is during the crescent, Quarter, and early gibbous phases. During these times, long shadows from mountain ranges, crater ridges, and other lunar features create striking contrasts along the terminator, the day/night line on the Moon.

Table 1. MAXIMUM EXPOSURES

If you are using a tripod-mounted telephoto or a telescope without a clock drive these are the maximum exposures you should use at each focal length. Go longer and the apparent motion of the sky will trail the Moon's image. (Determine the maximum exposure by dividing 250 by the focal length of your telescope.)

Focal Length	Max. Exposure
500 mm	1/2 second
1000 mm	1/4 second
1500 mm	1/8 second
2000 mm	1/8 second
3000 mm	1/15 second

Depending on the f/ratio of your telescope, keeping exposures below these limits may require you to use fast films.

For the sharpest shots always try to photograph the Moon when it is as far above the horizon as possible. The higher in the sky, the less atmosphere there is to look through, which means an image affected least by turbulence. For thin crescent phases there is not much you can do because the Moon is always low in the sky when the Sun is below the horizon.

FUELING YOUR CAMERA

If you are using a clock drive, you're best off using a slow, fine-grained film. With a clock drive the longer exposures demanded by slow films are no problem. If you are not using a clock drive then your choice of film depends on the lunar phase. When full, the Moon is extremely bright and even slower films offer short exposures. During crescent phases the Moon is dimmer and faster films are better since they allow shorter exposures.

For color print work try the Ektar series of films, either ISO 25 or 100. If you prefer color slides, use Kodachrome 25 or 64 or Fuji Velvia. Ektachrome 100X or 100IIC are also worth trying, as are comparable speed films from Fuji. For black and white photography, try Ilford's FP4 Plus, Kodak's T-Max 100, or Technical Pan 2415.

If you need a faster film (such as eyepiece projection shots), try Kodachrome 200, Ektachrome 400X, Fujichrome 400, or any of the ISO 400 color print films or black and white films.

Table 2. MOON SHOT EXPOSURES

Try the following exposures when photographing different lunar phases with ISO 200 film at various f/ratios. These are based on the easy-to-remember sequence that as the Moon waxes in phase, it doubles in brightness at each successive phase. For example, a wide crescent Moon is twice as bright as a thin crescent Moon and requires half the exposure time.

f/ratio	Thin Crescent	Wide Crescent	Quarter	Gibbous	Full
5.6	1/60	1/125	1/250	1/500	1/1000
8	1/30	1/60	1/125	1/250	1/500
11	1/15	1/30	1/60	1/125	1/250
16	1/8	1/15	1/30	1/60	1/125
22	1/4	1/8	1/15	1/30	1/60
32	1/2	1/4	1/8	1/15	1/30
44	1	1/2	1/4	1/8	1/15
64	2	1	1/2	1/4	1/8
88	4	2	1	1/2	1/4
100	6	3	1.5	1	1/2

For films other than ISO 200:

- For ISO 100 films, double the exposure times (for example, 1/4 second becomes 1/2).
- For ISO 50 films, multiply exposures by 4 (1/4 second becomes 1 second).
- For ISO 400 films, exposures are one-half those recommended.

mark the spot. Then I wind up the film away from the paper and carefully untape the outside end of the film from the paper, leaving the tape on the film. I roll the film onto a 120 stainless steel reel and put the rolled up paper on its spool in the hypering tank with the reel. Then I hyper the film. After hypering, I take the inside end of the film and align it with the hole in the end of the paper. I wind the paper and the film back onto the spool. When I get to the outside end of the film, I press the tape back onto the paper again. Then I finish rewinding and seal the roll in an airtight container with a desiccant to keep it dry. I recommend you waste a roll of film and practice this a few times in the light and then a few more times in the dark until you get the hang of it.

Q: How long have you and Daphne been taking serious astro photos?

A: Three years. But I was a color photo lab technician and a professional photographer long before I started astronomy. The two sciences come together quite naturally.

Q: Since you own a commercial photo lab, would you be willing to perform commercial darkroom services for other astrophotographers?

A: Yes.

Q: If invited, would you present a talk at the next Texas Star Party?

A: Gladly. I could put together a very pretty slide show of astrophotos. But more than that, I would be happy to share some of the secrets of color processing and explain my darkroom techniques in detail with graphic illustrations. Color processing is not hard once you learn to recognize and identify colors correctly. I can teach that. I would drive to Texas with the new 16-inch f/5 Newtonian with the truncated cone mirror that I have ordered.

HOW TO BUILD AN ANTI-DEW HEATER

by David Lee

I made my anti-dew heating coil using #26 magnet wire as a resistance heating element. I wound 150 turns of the wire around a drum on the lathe. I sized the coil so it would just fit inside the front cell opening of my C8. After I wrapped the coil with silicone tape, it was a push fit inside the opening.

This length of wire gives sufficient resistance to limit current at 12 volts to about 1 amp. The heater therefore produces about 12 watts of power.

If you want to power the heater from house current, use a transformer rectifier power supply to get 12 volts DC. I have not tried it with 12 volts AC, but I suspect that the AC would set up a 60 cycle "hum" due to the inductance within the coil and any surrounding metal.

If you have a larger area to heat, use a shorter total length of wire in the coil. This will increase the current flow, and produce more heat. If you are interested in building a heater, give me a call at 214-323-6226 during the day.

20 rolls or so of the old film. The new Konica SRV-400 is worthless for astrophotography. I used some by mistake one time, and I wasted the whole night. I couldn't believe how bad it was. Even when hypered, it will not record faint nebulosity, and the blues and reds are not as vivid. I don't know of another film that can touch the old SR 400. Konica SRV-3200 is O.K. if you can stand the large grain, but it needs to be hypered unless you have a very fast camera. At f/8, I would expose hypered SRV-3200 for at least 30 minutes.

Q: Have you tried Fujichrome 100D developed as a negative?

A: It is very slow. It has coarse grain and no tonal scale.

Q: Do you use a color lab to make color slides from color negatives or do you do it yourself? If you make your own, how do you do it?

A: I make my own positive transparencies from color negatives with an enlarger. I own a custom lab, and I also work there as a color lab technician. For single negatives, I use a filter pack of 30Y and 30M. For stacked negatives I use 50C and 30M (these are rough guesses).

Q: How do you make the composite print film transparencies from stacked negatives, as reported in the *Sky & Telescope* article?

A: I register the 120 sized negatives on a light box, using a 22x lupe, lots of tape, and sweat. I always leave a blank frame between each image to give me a handle on the film to work with. I tape one negative securely to the light box and tape the other negative lightly to the box at opposite corners using masking tape or black photographic tape. Then I untape one corner of the top negative, and register that corner carefully with the lupe and tape it back down. Then I untape the opposite corner, register it under the loupe and tape it back down. I repeat this process several times, going back and forth from one corner to the other until the negative is perfectly registered. Then I tape the two negatives to each other using a thin mylar tape and put the sandwich in a glass carrier. Then I enlarge the negative sandwich to make a pair of 4x5" print film transparencies. You could stop at this point. To take this process "to the limit", as described in the article, I sandwich these 2 transparencies in a similar fashion and make a pair of internegatives. Then I sandwich these internegatives to make the final color enlargement.

Q: Since you use relatively slow film and optical systems, what are some typical exposure times?

A: 90 to 120 minutes is typical.

Q: How do you take such long exposures and maintain critical guiding without getting exhausted?

A: Daphne Mount and I take turns guiding sometimes. I can also stop the C-14 photos with a dark slide to take a quick break. I modified the Giant Easy Guider by cutting a slot behind the prism. I insert a dark slide in this slot to interrupt the exposure. Since the slide is behind the prism, I can stop and restart the exposure in perfect alignment.

Q: What polar alignment and focusing techniques do you use?

A: I use the star drift method E-W and N-S. I focus visually on a laser screen or I use the knife-edge method.

Q: Do you hypersensitize your own film? If so, what kind of tank do you use?

A: hyper my own film using a tank we made from a stainless steel filter tank. I use a commercial container of forming gas. It has lasted over 3 years!

Q: How do you hyper 120 size film?

A: First I unroll the 120 film carefully and cleanly in the dark. When I come to the inside end of the film, I punch the paper where the film ends with a hole punch to

AVOIDING OVEREXPOSURE

When determining exposures, don't use your camera's internal light meter if your telescope has less than 2,000 mm of focal length. Most camera light meters will be fooled by the large area of blackness surrounding the Moon, resulting in an overexposed Moon. If your telescope's focal length is 2,000 mm or more, the Moon almost fills a 35 mm frame and your camera's internal light meter will provide more accurate metering.

For recommended exposures, see the Table 2. However, whether you determine your exposure from a light meter or from a table, keep in mind that lots of variables other than phase can affect the brightness of the Moon. These include the Moon's latitude and the transparency of Earth's atmosphere. To ensure you get good photos at each shooting session, bracket your exposures – make some longer and some shorter than the recommended time. So, if 1/30 of a second is the recommended exposure, take shots at 1/8, 1/15, 1/30, 1/60, and 1/125 second.

BOOSTING THE POWER

To record just a few craters or other lunar features up close you need the added magnification of eyepiece projection photography, a technique that places additional demands on your equipment and skills.

For example, in addition to the mount and clock drive mentioned earlier, it's best to have a drive corrector that allows you to vary the speed of your scope's drive motor. A slightly slower drive speed, sometimes called the "lunar rate," tracks the Moon with finer precision than a drive operating at the normal sidereal rate.

You should also consider counter-weights to balance your telescope. Eyepiece projection adapters can extend quite a distance from the telescope, throwing the scope off balance, producing inaccurate tracking.

And with eyepiece projection, you need to be more concerned about polar alignment. Simply aiming the polar axis roughly at the pole, as can be done for prime focus shots, is not good enough for eyepiece projection.

Calculating the exposure for eyepiece projection shots requires a little math. The eyepiece increases the effective f/ratio of the scope - you need to calculate this value before determining your exposure.

Use this formula to determine the effective f/ratio of your telescope during eyepiece projection.

New f/ratio = Normal f/ratio x [(D - F) / F]

The telescope's normal f/ratio is its f/ratio at the prime focus. This is simply the scope's focal length divided by the aperture. D is the distance between the eyepiece and the film plane at the back of the camera. F is the focal length of the eyepiece.

For example, say you have a 5-inch (127-mm) f/9 refractor with a focal length of 1,140 mm used with a 25-mm eyepiece. First, you will need to determine the distance from the eyepiece to the film plane – this will vary depending the length of the camera adapter.

For this example we'll use a commercially made adapter that separates the eyepiece and film by 165 mm. Subtract from this the focal length of the eyepiece, in this case 25 mm. This yields 140 mm. Now divide this number (140) by the focal length of the eyepiece (25) to get 5.6. Finally, multiply this by the f/ratio of the telescope, which is f/9. This yields an f/ratio of 50 for this telescope/eyepiece combination. Use this f/ratio when looking up recommended exposures.

HELPFUL HINTS

With both prime focus and eyepiece projection techniques, the trickiest part is focusing. A telescope, unlike a telephoto lens, does not have a preset infinity focus –

you must look through the camera and turn the telescope's focus knob until the image is sharp. If your camera has a central split-screen focuser, this circle may black out due to the long focal length of your telescope. If this happens, focus off center on the ground glass portion of your focusing screen.

To help you see the exact point of best focus, use a focusing magnifier. These devices clip onto a camera's viewfinder and make it much easier to tell when the image is in focus.

To reduce vibration use a cable release when tripping the shutter. Better yet, use the self-timer on your camera. Center the Moon and focus as usual. Once you are ready, cock the shutter, set the timer and release it, then stand back. The few second wait before the shutter fires will allow vibration to die down.

If the exposures called for are longer than 1/2-second, then cover the front of the telescope with a dark card, lock the shutter open on B, wait a few seconds for the vibration to die down, then make the exposure by flipping the card away and then back. Then close the shutter. This "hat trick" method is by far the best way to get Moon shots free of vibration-induced blurring.

When using long focal lengths, nights of steady air, or "good seeing" as it's called, will give best results. Turbulence in the upper atmosphere can degrade fine detail and take the edge off what would otherwise be a sharp photo. Slight wind can also cause enough vibration to smear your photos. Always wait for the wind to die down before tripping the shutter.

When starting out always keep accurate records for each roll of film. Record the date, telescope, exposures, eyepiece, f/ratio, film, and some comments on the seeing conditions. Those notes are your best teaching tool.

A final tip: start with tripod and prime-focus shots of the Moon. These simple methods will get you good results in your first rolls of film that will inspire you to try more advanced techniques like eyepiece projection. Before long, you'll be a master at staging Moon shots.

Mark Coco is a technical writer and amateur astronomer living in southern California. This article is reprinted, with permission, from the August, 1992 issue of *ASTRONOMY* magazine.

OVERHEARD ON THE
INTERNET

WHITHER GASSES?

What happens to exhaust gasses above the atmosphere? Do they remain in the vicinity of Earth, are they completely dispersed in space or are we slowly building up a plasma ring around the sun analogous to the one generated by (I think) Io around Jupiter?

Dave Bradley
bradley@prl.philips.nl

AN INTERVIEW WITH TONY HALLAS

by Glen Deen, Plano, Texas

Tony Hallas and Daphne Mount have set a new standard for excellence in deep sky astrophotography. I had been aware of their work before their article appeared in the August 1989 issue of *Sky & Telescope* with those gorgeous shots of the Rosette nebula, the Pleiades, IC2177 and M31. The work they are doing with an Astro-Physics 5" f/8 refractor is equal (if not superior in some ways) to Jim Riffle's work with his $23,000 Astromak 12" f/5 Maksutov.

For other examples of their work, look at the cover of the May, 1989 issue of *Astronomy* for a beautiful color shot of the M8/M20 region, the Astro-Physics ad in the July, 1989 issue of *Sky & Telescope* for a black and white shot of M31 that is every bit as good my Palomar 48" Schmidt Camera poster, and the 1988 Celestron catalog #93895 for excellent C-14 shots of M16, M82, NGC 2392 (Eskimo Nebula), and M27. Also, see pages 5, 32 and 33 of the Autumn 1989 issue of *Deep Sky* for gorgeous black and white 300 mm and C-14 shots of M101 and C-14 shots of M81, M83, NGC 4038/4039, M51, and NGC 4725. They have also had photographs of M13, NGC 4565, M42, Omega Centauri, and many other objects published in various publications.

The S&T article left lots of questions unanswered for me, so I asked Tony to answer them. His answers may be of general interest to other astrophotographers.

Q: Could you describe your astrophotography setup?

A: I have a Celestron C-14 Schmidt-Cassegrain, a 10" f/6 Newtonian, and an Astro-Physics 5" f/8 Starfire refractor. I generally use a Schaefer 12" mount for all of these instruments, but sometimes I use an Astro-Physics 800 mount for the refractor.

Q: How do you do your guiding?

A: I use a modified Lumicon Giant Easy Guider on the C-14 and the Newtonian. I use the Astro-Physics guide scope (which is totally excellent) for the refractor.

Q: What do you like about the Astro-Physics guide scope?

A: It has great optics, a very tight focuser, and a reinforced tube where the set screws contact.

Q: What mounts being marketed today would you recommend for serious astrophotographers?

A: I like my Schaefer mount, which was made by Schaefer himself. I understand there is a 6-month wait for the mounts presently being sold under the "Schaefer" name. My first choice today would be the Astro-Physics 800 mount for small to medium size compact telescopes. Get a short pier if you are using a Newtonian rather than a refractor. My second choice would be a Losmandy mount with a lapped gear. These mounts may not have 12" RA gears, but gear size means nothing. Accuracy and stability mean everything. Losmandy mounts are accurate and stable. But for tracking accuracy, the Astro-Physics mount is the best. Mine measures 4 to 6 arc seconds of periodic error!

Q: What are your favorite films for astrophotography?

A: I use hypered Kodak Tech Pan developed in D-19 at 68° - 70° degrees for 8 minutes for black and white. I prefer the old Konica SR 400 (hypered) for color. I'm still using my limited private stockpile of