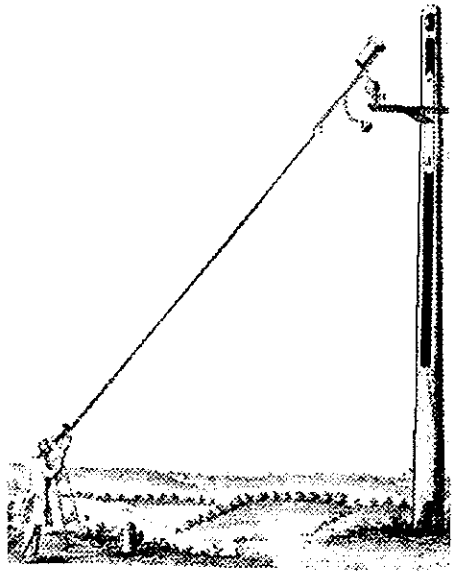
the focal point

Monthly Notices of the Atlanta Astronomy Club, Inc.

Vol. VI No. 7 March, 1994



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the focal point

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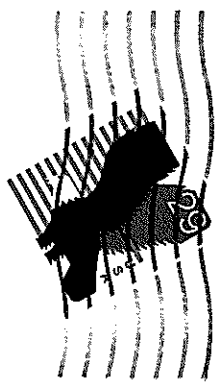
FROM:
Leonard B. Abbey, Editor
1002 Citadel Drive
Atlanta, Georgia 30324



First Class

W. Tom Buchanan **9410.**
105 Carriage Station Circle
Roswell, GA 30075

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.

Seeking the Best 35-mm Camera

by Alan Dyer, *Astronomy* Magazine

Rumors had it they were extinct. Wiped out by the emerging species of automatic, all-electronic cameras, old-fashioned manual cameras seemed destined to disappear from the face of the Earth. But despite the success of the fancy new cameras, a few old models have managed to survive. And it's a good thing for backyard astronomers. These classic cameras are the best on the market for doing astrophotography.

Astronomy magazine goes in search of an increasingly rare creature – a non-electronic manual camera ideal for astrophotography. And guess what? We found several!

The best choice for astrophotography is a 35-mm single-lens reflex, or SLR, camera. SLR's allow you to look through the same lens that takes the picture. Most SLR's also have removable lenses. This is an essential feature if you want to attach your camera to a telescope. Twist the lens off, snap on a camera adapter in its place, slide the adapter tube onto your telescope, and you're ready to take pictures through your telescope. The reflex-viewing feature allows you to frame and focus the image exactly the way it will appear on film.

Although the SLR type of camera is mandatory, not all 35-mm SLR's are equally suitable. The newest cameras offer autoexposure, autofocus, built-in motor drives and flashes, and impressive digital readouts. These may be great aids to your daytime photography, but none of these features is of any value for taking pictures of the night sky.

What's worse, not only are the automatic features unnecessary, some are downright detrimental for our purposes. Many of today's cameras are dependent on battery power to operate every function, even the shutter. In astrophotography, that's asking for trouble. At night, the cold temperatures will sap batteries of their power. With electronically-operated shutters, long 15- to 60-minute exposures common in astrophotography will also drain batteries. Under these conditions, shutters will lock open or close prematurely, ruining your photo and turning your camera into an expensive counterweight.

The Short List

For astrophotography, the best type of 35-mm SLR has a mechanical shutter, one that will operate without batteries. Ideally, it should operate at all shutter speeds sans batteries. But 1/500-second shots of the Moon don't usually pose too much of a problem. Electronic-shutter cameras such as the Canon EOS, Minolta Maxxum, Pentax SF, most Nikons, and many others can do a good job here - the short exposures don't place too many demands on the batteries. It's during long exposures where trouble arises. For these, you set the shutter on B for Bulb, a term left over from the days of flash bulbs. On the B setting, the shutter stays open as long as you hold the shutter button down, usually with a locking cable release. Any camera suitable for astrophotography should at least have a shutter that can operate at the B setting without battery power. This simple requirement rules out just about all the cameras on the market today except for the select few profiled here.

The short list of candidates for astrophoto cameras include the Canon New F-1, Contax S2, Nikon F3, Nikon FM2, Olympus OM-4T, Pentax LX, and Pentax K1000. The Leica R6.2 also has a mechanical shutter, but a sample was unavailable for review. We have listed its specs in the summary table but were unable

WHAT'S UP

	SUN				MOON				
Date	Rise	Azi	Set	Azi	Rise	Azi	Set	Azi	Age
3/15/94	6:48	91.9	18:45	268.2	8:18	73.5	22:02	288.6	3.5
3/16/94	6:47	91.5	18:46	268.7	8:54	69.9	22:56	291.8	4.4
3/17/94	6:45	91.0	18:47	269.2	9:33	67.0	23:49	294.2	5.3
3/18/94	6:44	90.5	18:47	269.6	10:17	65.2	-----	-----	6.2
3/19/94	6:43	90.0	18:48	270.1	11:05	64.6	0:41	295.3	7.1
3/20/94	6:41	89.6	18:49	270.6	11:57	65.3	1:31	295.2	8.0
3/21/94	6:40	89.1	18:50	271.1	12:54	67.4	2:18	293.7	9.0
3/22/94	6:39	88.6	18:51	271.5	13:55	70.8	3:03	290.8	10.0
3/23/94	6:37	88.1	18:51	272.0	14:59	75.5	3:44	286.7	11.1
3/24/94	6:36	87.7	18:52	272.5	16:05	81.4	4:24	281.4	12.2
3/25/94	6:35	87.2	18:53	273.0	17:12	87.8	5:02	275.3	13.3
3/26/94	6:33	86.7	18:54	273.4	18:22	94.5	5:41	268.9	14.5
3/27/94	6:32	86.2	18:54	273.9	19:32	101.0	6:20	262.3	15.6
3/28/94	6:30	85.8	18:55	274.4	20:43	106.8	7:01	256.1	16.8
3/29/94	6:29	85.3	18:56	274.8	21:54	111.4	7:46	251.0	17.9
3/30/94	6:28	84.8	18:57	275.3	23:01	114.5	8:36	247.1	19.1
3/31/94	6:26	84.4	18:57	275.8	-----	-----	9:30	244.8	20.1
4/1/94	6:25	83.9	18:58	276.2	0:04	115.6	10:28	244.5	21.2
4/2/94	6:24	83.4	18:59	276.7	1:00	115.0	11:28	245.8	22.2
4/3/94	7:22	83.0	20:00	277.2	2:49	112.8	13:29	248.6	23.2
4/4/94	7:21	82.5	20:00	277.6	3:32	109.3	14:29	252.5	24.2
4/5/94	7:20	82.0	20:01	278.1	4:10	105.0	15:27	257.2	25.1
4/6/94	7:18	81.6	20:02	278.5	4:44	100.2	16:24	262.3	26.0
4/7/94	7:17	81.1	20:02	279.0	5:16	94.9	17:19	267.6	27.0
4/8/94	7:16	80.7	20:03	279.5	5:46	89.7	18:14	273.0	27.9
4/9/94	7:14	80.2	20:04	279.9	6:16	84.5	19:08	278.2	28.8
4/10/94	7:13	79.8	20:05	280.4	6:47	79.6	20:02	283.0	0.1
4/11/94	7:12	79.3	20:05	280.8	7:20	75.0	20:57	287.2	1.0
4/12/94	7:11	78.9	20:06	281.2	7:55	71.2	21:51	290.7	1.9
4/13/94	7:09	78.5	20:07	281.7	8:33	68.0	22:44	293.4	2.8
4/14/94	7:08	78.0	20:08	282.1	9:15	65.8	23:36	294.9	3.7
4/15/94	7:07	77.6	20:09	282.5	10:01	64.8	-----	-----	4.6

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

AAC ACTIVITIES

March Meeting

A special treat is in store for us in March! Our speaker will be **Michelle Thaller**, of Georgia State University. Michelle came to GSU from Harvard, and is a graduate student in astronomy. She has a special gift for explaining the way the universe works; in fact, she is the best speaker we have heard in years! Michelle is a member of the Astronomical Society of the Atlantic, where her presentations always draw large crowds.

Her topic will be **The Life Cycle of a Star**. The meeting will be at Bradley Observatory, at 8:00 p.m. on **March 18**.

You do not want to miss this meeting!

OBSERVATORY REPORT

by Alex Langoussis

We again have three club telescopes in operation at Villa Rica. The 8" Maksutov has now rejoined the 10" and 20" scopes. Come on out and take a look!

Our next public observing night will be on Saturday, March 12. Tim Puckett and Jerry Armstrong will be demonstrating CCD imaging on the 20" telescope. (We were rained out last month.) March is also Messier Marathon month. This is an excellent time to come out and view those Messier objects that you may not have yet seen, or simply see your old favorites. Let's hope the weather cooperates this month!

In April, I encourage all of you to come out to the Peach State Star Gaze. It is a chance for you to view the universe under dark skies with fellow astronomers, while also enjoying interesting talks, good food, and comfortable accommodations. However, for those members unable to make it to the Star Gaze, the Barber Observatory will still be available to you.

For more information, call Alex Langoussis, 429-8384.

COMING ATTRACTIONS

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

to assess its performance with a hands-on test. The seven models we did examine represent a wide range of prices, from the bargain-priced Pentax K1000 ($245) to the high-end Canon F-1 ($2,100). Among this small group there is a camera to suit every budget.

These recommended cameras have one thing in common: a mechanical "B" setting. Some have other shutter speeds that will also operate without batteries. In the case of the Contax S2, Nikon FM2, and Pentax K1000 all the camera functions are mechanical; the batteries simply operate the light meter. With the Canon F-1, the batteries must be removed before the mechanical shutter speeds will function. With the Nikon F3, when the batteries fail the main shutter button becomes inoperative. Triggering the shutter mechanically requires flicking a light-touch lever near the base of the camera. Firing the shutter in this fashion with the shutter dial set to "T" (for Time) locks the shutter open until you turn the dial to another setting. This is not as convenient as using a locking cable release but it does work.

Finders and Focusing Screens

Although a non-battery-dependent shutter is the main requirement, it is not the only characteristic to look for in an astrophoto camera. Changeable focusing screens are another asset. When shooting through a telescope the standard microprism or split-image style of focusing screen standard in most cameras can go very dark making it difficult to focus. A better choice is a ground glass screen with a plain matte finish. Most manufacturers offer this type of screen. An alternative is the series of ultra-bright Intenscreens made by Beattie and available for several models of cameras. (Intenscreens are not available for Canon cameras. However, Canon's own laser-matte Type K screens are similar.)

The fine matte screens are best for deep-sky photography. For high-magnification lunar and planetary shots a focusing screen with a clear central spot is useful - it provides a very bright image to focus on. Clear spot screens are available for several cameras in the group.

Another useful feature is an interchangeable finder. Only the Canon F-1, Nikon F3, and Pentax LX offer this feature. Their optional magnifier finders provide the brightest images possible, making framing an object easy and focusing very precise. The right-angle viewing these finders provide makes it comfortable to look through these cameras when they are attached to a Schmidt-Cassegrain or refractor telescope. The finders and bright viewfinder images of these three cameras make them the top choices, although the most expensive.

Some cameras without interchangeable finders (such as the Olympus OM-4T and Nikon FM2) have right-angle viewing attachments that clip onto the normal viewfinder. (We checked the Olympus Varimagni Finder and the Nikon DR-3 finders.) These work fine but produce dimmer images than cameras with interchangeable finders do. Dimmer images make it more difficult to see faint objects through the camera. The Nikon FM2 also has a straight-through clip-on magnifier, the DG-2. It helps in critical focusing but only shows the center of the frame.

Quiet Shutters

Another worthwhile feature is a mirror lockup. When shooting the Moon shutter speeds usually fall in the 1/500- to 1/2-second range. The slap from the mirror as it swings up just prior to the shutter opening can introduce image-blurring vibration. Locking the mirror up beforehand greatly reduces the level of vibration and makes for a sharper photo. Not all cameras have this feature. Some top-end models such as the Canon F-1 lack a mirror lockup. The economical Pentax K1000 has an "unofficial" mirror lockup not mentioned in the manual – cock the shutter and then lightly tap the shutter release button. Voila! The mirror locks up! You can then fire the shutter. The mirror comes down when the shutter closes.

A quiet, vibration-free shutter is also a plus. The Nikon F3 and Olympus OM-4T had the gentlest shutter mechanisms. The Pentax K1000 was also very quiet and vibration free, a surprising trait for such a low-cost camera.

Some cameras have frame advance levers that can be cocked by a single stroke or with several short strokes. This "ratchet winding" can be useful for advancing the film without jarring the telescope. All the cameras on our list have built-in light meters. These are useful for photos of sunsets, the planets in the twilight sky, and daytime subjects. But for shots through a telescope there is little need for a light meter, let alone any type of automatic exposure control. Instead, exposures for telescopic shots are almost always determined from tables or from experience. Nevertheless, if your choice is going to perform double duty as a general purpose camera, you may want to select a model with auto exposure capability. The Canon F-1, Nikon F3, Olympus OM-4T, and Pentax LX have "aperture-priority" auto settings - you set the lens aperture and the camera will select the shutter speed for you.

Weight is another consideration. Lightweight cameras are easier to balance on a telescope and are a better match for small telescopes on lightweight mounts. Of the cameras on our list, the Olympus OM-4T and Pentax K1000 are the lightest of the bunch.

Buying Used

If you are on a budget, an excellent alternative is to purchase a used camera body and perhaps lenses to match. There is a thriving market for secondhand cameras. Buyers are snapping up both current and discontinued mechanical shutter models as fast as other people are trading them in when they switch to new electronic cameras.

You'll find used cameras in your local camera store and through mail-order camera dealers. Prices are much lower than those on new models, and by shopping around you can get even 20-year-old cameras and lenses in surprisingly good condition. Some of the best discontinued models to look for suitable for astrophotography are the original Canon F-1 (it had a mirror lockup), the Nikon F and F2, and Olympus OM-1. But watch out - with some brands the manufacturer's new lenses and accessories won't fit the old camera bodies. For example, autofocus lenses for Canon's EOS series of cameras will not fit on their current or older model F-1 cameras. The F-1 requires the FD series of manual-focus Canon lenses. With Nikon, all their lenses, old and new, will fit and focus on every 35-mm camera Nikon has ever made. However, some of their old lenses won't connect to the light meters in the new Nikon bodies, and vice versa. Focusing screens and finders for the new Nikons won't fit on the old Nikon F and F2 bodies. With Olympus, lenses and focusing screens for the OM-4T are all compatible with the original OM-1. New Pentax lenses will fit all their older K-mount cameras.

Not Extinct But Endangered?

While it's easy to bemoan the current crop of automatic cameras and their unsuitability for astrophotography, the fact is, a very good selection of new cameras is available with all the requisite features. The question is, how much longer will these manual, mechanical cameras survive in the world of electronic marvels? Some, like the venerable Pentax K1000, seem to go on forever. Others could be discontinued at any time, putting them on the endangered species list.

Nevertheless, most manufacturers and dealers have realized there is a market for the no-frills reliability of a mechanical camera. Whether new or used, these workhorses will be around for some time.

THE PEACH STATE STAR GAZE

by Ken Poshedly

Okay folks. Peach State Star Gaze answer time.

Question: Why spend all my time out there when I live so close by?

Answer: The event was designed to be a comprehensive activity that provides total and instant access to the observing field, the featured talks, and a ready source of answers, that is, other amateur astronomers.

As a participant, you have all the comforts of home -- whatever your expectations, from camping on the field to fully furnished sleeping quarters and with all meals home-cooked and provided on site.

You do have the option of leaving the campground for excursions into town or wherever, but with so many other amateur astronomers just dying to ask questions or give answers, why leave?

To review the available lodging options:

The Future Farmers of America facility consists of cottage-style cabins with semiprivate arrangements and dormitory-style cabins which vary from 18 to 28 beds per cabin. All include heat and large attic fans.

✓ Option 1 – Heated/air conditioned semiprivate motel-style rooms - including bed linens/pillows, towels and private bathroom. Each room consists of two sleeping areas separated by a full height privacy walls; each sleeping area includes either a full double bed or twin beds.

✓ Option 2 – Dormitory-style rooms with bunkbeds - including bed sheets, pillows, blankets, wash cloths, towels and shared bathroom (ladies only or men only).

✓ Option 3 – Same as option 2, but NO bed sheets, pillows, blankets, wash cloths or towels.

✓ Option 4 – Camping on the observing field only. Bathroom facilities available in the dorm-style buildings directly across the road from the observing field. No bed linens/pillows or towels provided.

Register at the March meeting and NO late fees! That's right! NO late fees.

Remember that infamous learn-to-type phrase, "Now is the time for all good men to come to the aid of their party?" Well, to put a new spin on it, Now is the time for all of our good members to come to the aid of their club and have a hell of a good time to boot!

Don't forget to get your registration in at the March meeting. We'll have extra forms in case you need one, though.

To register or for more information, contact Ken Poshedly at (404) 979-9842.

Peach State Star Gaze

Registration and Lodging

Registration includes programs, lodging and all meals. Children ages 2 and 4, subtract $8 from the listed youth fee below. If you have any questions, contact Ken Poshedly at address/phone number at bottom of this sheet.

Arrival/Lodging Option	Adult	Youth (5-12)
Arrive Thursday -- Lodging Option 1	$114	$102
Arrive Post-Thursday -- Lodging Option 1	102	90
Arrive Thursday -- Lodging Option 2	108	96
Arrive Post-Thursday -- Lodging Option	96	84
Arrive Thursday -- Lodging Option 3	93	81
Arrive Post-Thursday -- Lodging Option 3	81	69
Arrive Thursday -- Lodging Option 4	93	81
Arrive Post-Thursday -- Lodging Option 4	81	69

Name_____

Address_____

City, State, ZIP_____

Daytime and Nighttime Phone_____

Names of Those Attending _____

_____

Lodging Choice (first come, first served):

- Option 1 (cottage-style cabin as available) and amount $_____
- Option 2 (dorm-style with bed and bath items) and amount $_____
- Option 3 (dorm-style, NO bed and bath items) and amount $_____
- Option 4 (observing field camping) and amount submitted $_____
- Special lodging requests or questions. (We will try to accommodate as best as possible.)

_____

_____

Camp rules and regulations, confirmation of your registration, route instructions and general information about the general vicinity will be sent to you well ahead of the Peach State Star Gaze date.

Make check or money order (no cash) payable to: The Atlanta Astronomy Club. Send to: Atlanta Astronomy Club, c/o Ken Poshedly, 3440 Everson Bay Court, Snellville, GA 30278-4463. Telephone: (404) 979-9842.

ASTROPHOTO CAMERAS AT A GLANCE (35-mm SLR CAMERAS)

Canon F-1	
Non-battery speeds	1/90 to 1/2000 + B
Slowest shutter speed	8 sec.
Changeable screens?	yes
Fine matte screen	Type K
Clear spot screen	Type I
Changeable finder?	yes
Mirror lockup?	no
Ratchet winding possible?	yes
Exposure control	Auto
Weight (body only w/ finder)	795 g (28 oz)
Sugg. list (body only w/ standard finder)*	$2,100

Contax S2	
Non-battery speeds	1 to 1/4000 + B
Slowest shutter speed	1 sec.
Changeable screens?	yes
Fine matte screen	FU-5
Clear spot screen	NA
Changeable finder?	no
Mirror lockup?	no
Ratchet winding possible?	no
Exposure control	Manual
Weight (body only w/ finder	565 g (20 oz)
Sugg. list (body only w/ standard finder)*	$999

Leica R6.2	
Non-battery speeds	1 to 1/2000 + B
Slowest shutter speed	1 sec.
Changeable screens?	yes
Fine matte screen	#14304
Clear spot screen	#14307
Changeable finder?	no
Mirror lockup?	yes
Ratchet winding possible?	?
Exposure control	Manual
Weight (body only w/ finder	625 g (23 oz)
Sugg. list (body only w/ standard finder)*	$3,675

Nikon FM2	
Non-battery speeds	1 to 1/4000 + B
Slowest shutter speed	1 sec.
Changeable screens?	yes
Fine matte screen	Type B2
Clear spot screen	NA
Changeable finder?	no
Mirror lockup?	no
Ratchet winding possible?	no
Exposure control	Manual
Weight (body only w/ finder	540 g (19 oz)
Sugg. list (body only w/ standard finder)*	$605

Nikon F3

Non-battery speeds	1/60 + B
Slowest shutter speed	8 sec.
Changeable screens?	yes
Fine matte screen	Type D
Clear spot screen	Type C
Changeable finder?	yes
Mirror lockup?	yes
Ratchet winding possible?	yes
Exposure control	Auto
Weight (body only w/ finder	760 g (27 oz)
Sugg. list (body only w/ standard finder)*	$1,400

Pentax K1000

Non-battery speeds	1 to 1/1000 + B
Slowest shutter speed	1 sec.
Changeable screens?	no
Fine matte screen	NA
Clear spot screen	NA
Changeable finder?	no
Mirror lockup?	yes (see text)
Ratchet winding possible?	yes
Exposure control	Manual
Weight (body only w/ finder	525 g (19 oz)
Sugg. list (body only w/ standard finder)*	$245

Olympus OM-4T

Non-battery speeds	1/60 + B
Slowest shutter speed	1 sec.
Changeable screens?	yes
Fine matte screen	#1-8
Clear spot screen	#1-11
Changeable finder?	no
Mirror lockup?	no
Ratchet winding possible?	yes
Exposure control	Auto
Weight (body only w/ finder	510 g (18 oz)
Sugg. list (body only w/ standard finder)*	$1,300

Pentax LX

Non-battery speeds	1/75 to 1/2000 + B
Slowest shutter speed	4 sec.
Changeable screens?	yes
Fine matte screen	SE-25
Clear spot screen	SD-21
Changeable finder?	yes
Mirror lockup?	yes
Ratchet winding possible?	yes
Exposure control	Auto
Weight (body only w/ finder	570 g (20 oz)
Sugg. list (body only w/ standard finder)*	$1,977

*The prices are for the camera body and standard pentaprism finder only. Lenses are extra. The prices are suggested list as of mid-1993; actual retail prices will be lower through most camera stores and mail-order houses.

OVERHEARD ON THE INTERNET

MICHAEL RICHMOND ANSWERS A QUESTION ON STATISTICAL PARALLAX

This is a tricky one – see the discussion on "Secular and Statistical Parallaxes" in Chapter Six of Mihalas and Binney (old edition, anyway).

The basic idea is to use the motion of the Sun through space to create a baseline over which you can measure parallaxes which are much smaller than those visible with just a 1 AU baseline. The Sun moves with a velocity of around 20 km/s relative to some nearby stars (don't ask me how one defines this!), and so moves roughly 4 AU per year. Over a period of several decades, this gives you in theory a baseline of around 100 AU!

The problem, of course, is that you need to know the actual motion of some other star relative to the Sun, which usually means you need to know the distance, which is what you're trying to measure. In essence, however, you can define a large set of stars with similar properties, and assume that the mean motion of that entire set of stars should be, say, zero, relative to the Sun's motion. It's a lot more complicated than this in practice – you have to measure the proper motion and radial velocity for as many stars in the ensemble as possible, and then make several assumptions (such as an isotropic distribution of stellar velocities in the solar neighborhood).

However, in the past, this has been the only way to get distances to a number of fundamental types of stars – such as Cepheids or RR Lyrae stars. Fortunately, there are several newer methods that may get more direct distance measurements in the near future (Hipparcos and some interesting ground-based ideas I've read).

Parallax-minded people might want to read the latest PASP for the article by Gatewood and, um, someone else (sorry, else), in which the report the parallax to Delta Cephei and UV (?) Lacertae.

Michael Richmond
richmond@astro.princeton.edu

ROCKET GAS

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) lo around Jupiter?

Dave Bradley
bradley@prl.philips.nl

YOUR EXPIRATION DATE -- A CHANGE

Remember....the date on which your membership expires appears at the upper right corner of your mailing label. This date will be highlighted in color for those members who are past due.

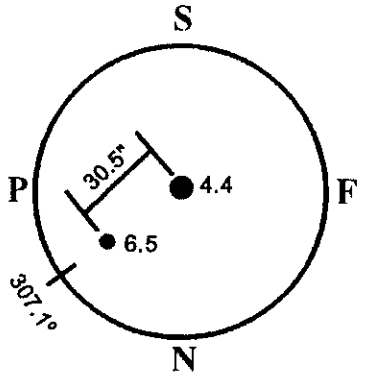
moderate range in stellar magnitudes, and is visible in the viewfinder.

CANCER

M44 The Beehive Cluster. This bright open cluster is easily seen with the naked eye from a dark sky site. It is large, over a degree in diameter, and is best seen in binoculars or viewfinder. It is a somewhat loose cluster of about 50-100 stars, with several star chains and pairs seen.

M67 This large open cluster is one of the oldest clusters known, at an age of about 10-billion years. It is about one-half degree in diameter, and is composed of well over 100 stars, although many of them are moderately faint. It is well detached from the background, and is moderately concentrated to the center.

NGC 2775 The first of many galaxies to come. This object is about 4' X 2', oriented NNW-SSE, has a very bright core, with fainter extensions to the listed



Iota Cancri

dimensions. The center appeared to me to be somewhat granular.

ι Cnc A fine, easily split double star, showing a yellow-orange and blue pair.

Huygens and his Great Refractor

The first astronomical telescopes contained only simple lenses. For the discoveries made by Galileo, such simple instruments, with their low powers, were adequate. But soon the race for magnification was on. The problem was that along with the fine details, the objective's aberrations were also magnified. Chromatic and spherical aberrations were the main villains. Early telescope makers soon discovered that both problems could be controlled by using very large focal ratios. However, the monster telescopes which were developed in the mid-17th Century were extremely unwieldy.

Christian Huygens was the first to discard the long wooden tubes of earlier instruments. His first "aerial" telescope was 2½ inches in aperture, with a focal length of 123 feet! The objective and eyepiece assemblies were connected by a long string. The eyepiece was held in the hand, while the elbows rested on a waist-high bipod.

Huygens' first discovery was astronomical seeing. He found that atmospheric currents hindered the telescope's ability to image small details. Later, his drawings of Mars provided the basis for our accurate determination of that planet's rotation period.

STAR TESTING THE LENSES

Photographing stars is a tough test of any lens. For our check, we selected a 50-mm f/1.4 "normal" lens and a 180-mm or 200-mm f/2.8 telephoto from each manufacturer. (The Olympus 50-mm was an f/1.2 – their f/1.4 lens is now discontinued.) We shot the telephoto lenses wide open at f/2.8 aimed at Lyra. We shot the 50-mm lenses wide open and stopped down to f/2 and to f/2.8, all aimed at the Bootes/Hercules area.

When used wide open at f/1.4 or f/1.2, all the 50-mm lenses showed severe off-axis coma and stars across the frame bloated from spherical aberration. Wide open, the 50-mm Contax lens (made by Zeiss) gave the sharpest images, the 50-mm Olympus Zuiko lens the most aberrated. But when stopped down to f/2, all the lenses improved dramatically. At f/2 there was little difference among the five brands. All lenses were sharp in the center of the frame, and showed a similar low level of coma on the brightest stars near the corners. When stopped down to f/2.8, this residual coma disappeared – all lenses exhibited pinpoint stars corner to corner. All 50-mm lenses exhibited some degree of vignetting (dark corners and a bright frame center). This effect decreased as the lenses were stopped down and was negligible at f/2.8.

With the telephoto lenses, all showed sharp stars across the entire frame even wide open at f/2.8. The Olympus Zuiko 180-mm had noticeable out-of-focus blue glows around bright stars. The ED lenses from Nikon and Pentax lacked this chromatic aberration and produced crisp bright star images with no blue haloes.

We did encounter a problem with the two Nikon lenses. Both were autofocus (AF) models with focus rings that rotate past infinity, a characteristic of some AF lenses which makes them difficult to focus precisely at infinity. As a result, test shots with the Nikon 50-mm and 180-mm lenses came back with slightly blurry stars. The lesson is to always buy manual focus lenses for astro-photography, even if that means purchasing used lenses.

THE CANON FD 50-mm f/1.4 lens ($260) showed moderate coma at f/2 and average vignetting. The Canon FD 200-mm f/2.8 lens ($810) gave sharp star images edge-to-edge and showed only a trace of chromatic aberration.

THE CONTAX 50-mm f/1.4 Zeiss lens ($259) showed moderate coma at f/2 and slightly better (less) than average vignetting. The Contax/Zeiss 180-mm f/2.8 ($1,183) showed sharp stars corner-to-corner and a trace of chromatic aberration.

THE NIKON 50-mm f/1.4 lens ($322) showed moderate coma at f/2 and slightly worse (more) than average vignetting. The Nikon 180-mm f/2.8 ED lens ($970) gave uniform star images edge-to-edge and showed no chromatic aberration. Both lenses were difficult to focus precisely.

THE OLYMPUS Zuiko 50-mm f/1.2 lens ($457) showed moderate coma at f/2 and slightly better (less) than average vignetting. The Zuiko 180-mm f/2.8 lens ($1,320) showed noticeable chromatic aberration and some coma in blue light on stars near the corners of the frame.

THE PENTAX Type A 50-mm f/1.4 lens ($280) showed moderate coma at f/2 and an average level of vignetting. The Pentax 200-mm f/2.8 ED lens ($1,497) gave sharp star images edge-to-edge and showed no chromatic aberration.

Modifying a Department Store Refractor for Improved Usability

by Bob Perry, St. Louis

A recent project for Saint Louis Astronomical Society telescope makers group has been the modification of several typical 60-mm department store refractors for improved usability.

This type of telescope, unfortunately, is sold with

- A marginal finder
- High magnification eyepieces
- A barely adequate alt-azimuth mount

Each of these weak points will be addressed.

To replace the finder with a Telrad™ is tempting but not cost effective. In 1989, a telescope and mount of this type retails for about $100 and a telrad is typically available through mail order dealers for less than $50, delivered. The simplest (and cheapest) solution is to fabricate a notch and pip gunsight. A small hole can be drilled near the top of the dew cap lip and a small bolt can be screwed from the inside upward. That will be the pip.

The notch can be cut from the black bottom of a two liter plastic soda jug. Depending on where the original finder was attached to the telescope, the notch may be fitted to the finder footprint of the telescope tube. Since the plastic is from a throw away item, the first attempt need not be the final version.

If the observing site is a dark site, consider cutting the notch from a white plastic gallon milk jug and painting the pip white.

A wide field, low magnification, long focal length eyepiece is recommended. As the saying goes, "Try it, you'll like it!". Orion Telescope Center is now selling a .965 diameter 40-mm f.l. "Achromatic Huygens" for $32.95 plus $1.89 shipping. With a 60-mm objective of 700-mm f.l., it gives 700/40 = 17.5 X, a field of about 1 3/4 degrees, and an exit pupil of 60/17.5 = 3.5 mm. Note that the "exit pupil" is the image of the objective created by the system, where light from the objective leaves the eyepiece and enters the pupil of the observer's eye. With this eyepiece, the moon's diameter appears as one third of the field and at this magnification the moon shows very good detail. Also, this exit pupil is approaching the 6.5 mm exit pupil of a deep sky, rich field telescope so objects like the double cluster in Perseus and M13 in Hercules look good.

Note that high-magnification eyepieces cannot bring out detail that is not there. A star, being at a fair approximation to an infinite distance, should have an infinitesimal image. Because of the wave nature of light and subsequent wavelength interference effects, the stellar image formed by a circular lens is a circular blur. In fact, this 'Airy Disk', (named after the scientist who first explained the effect), is larger for smaller objectives. Larger objectives give better images until the objective is about ten inches in diameter, then the 'seeing' becomes obvious. Atmospheric cells of different density are typically that size and as they randomly interact, degrade the image. Recall how the sky looks from underwater or anything looks on the other side of a fire.

There are several problems with the alt-azimuth mount:

- The telescope may be balanced for terrestrial use with the focuser racked out and several accessories installed. Then when the telescope is used for celestial viewing, in order to hold a

CONSTELLATIONS OF THE MONTH
GEMINI and CANCER

With spring approaching, deep sky observers can look forward in anticipation (or dread) to the tangles of galaxies in Virgo, Coma Berenices, and Ursa Major. This month, however, we will be taking one last look at a region of the Milky Way which is rich in open clusters and planetary nebulae. Gemini lies right along the Milky Way, and the ecliptic (the region in which the Sun and planets are constrained) passes through it. Cancer lies further away from the Milky Way, and in it can be seen many faint galaxies as well as bright open clusters.

GEMINI

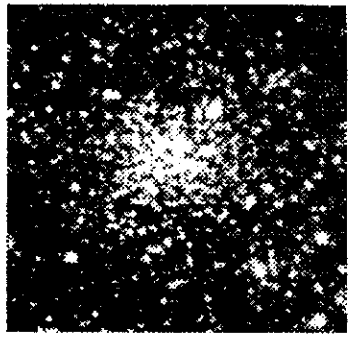
M35 This is a fine open cluster, easily seen in binoculars and blazing with stars through a telescope. Well over 100 stars can be counted in this moderately concentrated cluster. It is well detached from the stellar background and has a moderate range in magnitudes of stars.

NGC 2158 Until I started pursuing my Herschel certificate, I never noticed this small cluster lying on the outskirts of M35.

NGC 2392 The Eskimo Nebula

It is about 3' X 2', with about 10 stars superimposed on a nebulous patch of fainter, unresolved stars.

NGC 2371-2 You've probably heard of the Dumbbell Nebula (M27), and the Little Dumbbell (M76), but how about the Micro-Dumbbell? You probably haven't because that's my name for this object!



NGC 2158 Open Cluster in Gemini

This planetary nebula (some authors say it is two line-of-sight planetaries) appears as two softly glowing gray puffs of light, seemingly touching. It is about 30" X 12" in total extent, with the western lobe appearing brighter. I think this faint object is one of the many fascinating gems found by those willing to delve into the deep sky, past the bright and splashy showpieces.

NGC 2392 The Eskimo Nebula. This is another fine planetary nebula. It has a bright central star which is surrounded by a halo of nebulosity about 40" in diameter. The halo is brightest close to the star, and fades out further way. Mottling and a lacy texture can be seen in this very pretty object.

NGC 2420 This open cluster is about 10' X 6', oriented north-south, with an arrowhead shape pointing to the east. I counted about 25 stars, with more stars hinted at due to its nebulous appearance. This object is fairly well detached, has a

Selected 1994 Occulations

by Mike Kazmierczak

	DATE	TIME	PH	STAR #	MAG	% SN	MN	SN	CA
MAR	4	8:44	R	2,376	4.4	54-	24		90S
MAR	15	00:01	D	203	6.9	6+	24		68S
MAR	31	5:49	R	2,307	4.1	80-	18		84N
MAR	31	6:07	R	2,310	4.6	80-	20		61S
APR	2	8:44	R	2,633	3.8	58-	26		62S
APR	2	9:30	R	2,638	5.4	58-	31		44N
APR	17	1:47	D	940	5.7	30+	40		79N
MAY	6	10:02	R	3,512	5.8	16-	20		58S
MAY	13	23:58	R	894	4.6	10+	37		-2N
MAY	14	00:13	D	895	5.9	10+	33		12S
MAY	14	00:24	D	X07880	4.8	10+	32		36N
MAY	25	2:11	D	2,310	4.6	100-	17		119U
MAY	25	3:02	R	2,310	4.6	82E	25		117U
JUL	5	10:18	R	614	5.7	11-	28		66N
AUG	12	00:31	D	1,884	5.3	26+	27		80N
AUG	31	07:20	R	913	5.2	31-	15		54N
SEP	2	11:10	R	1,197	6	13-	38	-5	43N
SEP	21	6:55	R	105	4.6	98-	63		59S
OCT	17	1:16	D	3,494	4.6	95+	44		64N
OCT	28	8:45	R	1,332	5.7	43-	40		81N
NOV	19	10:43	R	668	3.6	99-	29		52S
NOV	25	7:31	R	1,397	5.5	60-	39		67S
NOV	27	10:12	R	1,623	5.4	38-	44		80N
DEC	4	23:47	D	2,715	6	6+	8		86S
DEC	12	00:30	D	105	4.6	71+	63		75S

PH is phenomenon D for disappearance, R for reappearance, MN is moon altitude, CA is cusp angle. All times are UT. %MN is percent of moon sunlit.

If you have any questions about occultations or want to join one of these exciting expeditions, please contact me on this BBS, or at mike@beow.mese.com or at 760-8502.

certain direction, the altitude pivots may need to be tightened to such an extent that moving to another object is a major effort.

- The telescope motion in azimuth is typically controlled by a jam bolt that must be tightened to hold a certain direction and loosened to move to another object.
- Proper "push" in the two axes may not only be difficult to obtain, it may be difficult to maintain.
- The altitude pivots may loosen as the telescope is moved.
- The azimuth pivot may become damaged by overtightening of the jam bolt, or by galling as the steel jam bolt slides against the aluminum pivot – or by both.

Let us address the last problem first because we want to rework the azimuth fork separately. Remove the altitude pivots bolts and set them aside with the telescope tube. Next, remove the azimuth pivot from the tripod head; a small allen-head set screw is probably what locks it in. Then wipe off the grease and check the jam bolt track; if it is severely dimpled and galled, machining may be required to true it and polish it. Do consider working it by hand. A lot can be accomplished with sandpaper and emery cloth.

Obtain a cheap pair of scissors and dedicate it to cutting the sandpaper and emery cloth. Medium sandpaper should give fast enough action and fine sandpaper may be used instead of emery cloth. Cut your strips from the full width of the sheet and make them wide enough to just fit in the track.

The azimuth pivot should be well supported during the sanding of the track. If a vise or C-clamp is used to hold it out over the edge of a workbench, be sure to use wood or thick cardboard to protect the metal faces. Alternatively, if the center of the pivot has been drilled out, insert a wooden dowel or a screwdriver and then rest that on your belt and rest the pivot fork arms on the edge of your workbench. Sand 180 degrees of the track, invert the pivot, and sand the other 180 degrees. You might break a strip or two until you learn the coordinated motion necessary for applying a consistent, moderate tension and for keeping the strip moving perpendicular to the axis of the pivot.

After a few cleanup passes, check for concentricity. Reinstall the pivot and place a narrow strip of tape on the shoulder of the fork, just above the tripod head. Slowly tighten the jam bolt while spinning the pivot. Stop when it just begins to drag – with no grease, it will gall easily. Mark this high spot on the tape, turn the pivot 180 degrees, and tighten the jam bolt until it just touches the track. Note how much the jam bolt can be tightened between these high and low points. Back the bolt out half this amount, slowly turn the pivot until it drags, mark the tape, then go around to the other side of the bump and mark that. Remove the pivot and sand down the bump. Repeat this procedure but turn the pivot rather then spin it. Eventually the track will be reasonably concentric and it may be polished.

A plastic brake shoe in the track will keep the jam bolt from dimpling and galling it. Cut one from the black bottom of a plastic two liter soda jug so that it just fits in the width of the track and just touches when wrapped around the track. Of course, it should be thinner than the depth of the track.

When installing the azimuth pivot for the last time, put some grease on the lower part, slide it into the tripod head, and then get the plastic brake shoe started. Line up the joint of the strip with the allen-head set screw, put some grease on the upper part of the pivot, slide the pivot in the rest of the way, and adjust the set screw to the depth which holds the pivot in the tripod head. A

drop of Loctite™ on the screw before adjusting it will help keep it in place

Some department store refractors have the pivot extend into an open space at the bottom of the tripod head. The shoulder for each leg has room between the channel and the bolt securing its leg, room for a coil spring to press against the end of the pivot. A bolt or large wood screw inside the spring will keep the spring from settling down on the leg bolt and possibly working loose.

Another strip of black plastic from a soda jug will keep the ends of the springs from damaging the end of the pivot. Cut the strip so that it lays in one channel, with a notch to clear the leg bolt, wraps all the way around the end of the pivot, and lays beside itself in the same channel, with a notch to clear the leg bolt. The spring in the channel where the strip doubles back should also hold the strip against the side of the channel.

Washers or spacers can used to increase each spring's compression. Three springs with the right compression will provide enough drag to make the "push" in azimuth feel right. Now to get the "push" in elevation to feel right.

We noted earlier that the typical telescope tube is out of balance. Adding a counterweight will probably be easier than relocating the altitude axis. A simple counterweight can be fabricated with hand tools, double sided carpet tape, large diameter solder, and black electrical tape. The necessary length of solder may be determined with a little experimenting with some other objects as a temporary counterweight. Be sure to balance the telescope with the most commonly used eyepiece installed and focused to infinity. Next form the solder around the tube, verify the balance, determine the width of double sided tape required, and preshape the ends of the solder. Then remove the solder, apply the double sided tape, rewrap the solder, and apply a finish wrapping of black electrical tape to protect the solder and provide a neat appearance.

With the tube balanced, the altitude pivots need not be very tight to obtain a reasonable amount of friction. We have encountered two different styles of pivots, one where the friction results from the ends of the steel pivot bolts resting in steel seats on the telescope tube and one where the friction comes from the plastic heads of the bolts squeezing the altitude fork tines against flat seats on the telescope tube. The steel-on-steel pivots are not as likely to back off as the other type when the telescope is moved. Locktite or jam nuts might be necessary. The other type requires a little work.

The altitude pivots that squeeze the fork tines against the tube will benefit from the installation of polyethylene washers. These can be cut from a plastic one gallon milk jug, using scissors and an X-Acto™ knife. Four washers are required, one for each sliding surface. Locktite in the threads of the flat seats prior to assembly should keep the pivot bolts at the preferred tightness and so maintain the desired 'push' necessary to move the telescope in altitude.

With these modifications, a typical department store refractor will be easier to use and should provide many hours of enjoyment.

Collimating Newtonian Telescopes

by Richard Wiesen, Milwaukee

1. Using a compass draw a circle on photograph-mounting board the exact size as your primary.

2. Cut out the circle to use as a template over your primary and enlarge the center hole made by the compass point.

3. Remove the primary from its cell and place the template over the primary. Then using a waterproof marker pen, place a dot in the center of the mirror through the center hole in the template. Next use a Dennison gummed hole reinforcer to surround the dot. Replace primary in its holder.

4. Remove the secondary from its holder. Place graph paper over your secondary and use finger pressure to make a crease outline of your elliptical flat and then find the intersection of the major and minor axes. Perforate the graph paper with a compass point at the intersection. Then realign the graph paper template over your secondary and place a dot on the mirror at the intersection hole.

5. Make a collimating eyepiece out of 35-mm Kodak film canister by cutting off the bottom of the canister and making a very small hole in the exact center of the canister cap. The exact center is already marked on the inside of the cap during the manufacturing process. You can use a hot compass point to melt your way through or use a small awl.

6. Reassemble your scope. Put your collimating eyepiece in the focuser. Adjust your secondary until the dot on it is in the center of your eyepiece. (Vertical adjustment.) Then rotate the secondary about its axis until you can see your entire primary mirror. If you can't then you will have to adjust the 3 screws on your secondary until you can see all of it.

7. Now adjust the primary mirror so that the dot on your secondary sits on the dot of your primary.

J.R. PETERSON

We were saddened to learn of the death, on February 26, of John R. Peterson. Pete and his wife, Mimi, were founding members of our club, and were very active in our early years. The Petersons moved to Jackson, Mississippi about 25 years ago, but made occasional return visits to Atlanta. Pete contributed many interesting and informative articles to our first publication, *The Atlanta Astronomers' Report*.