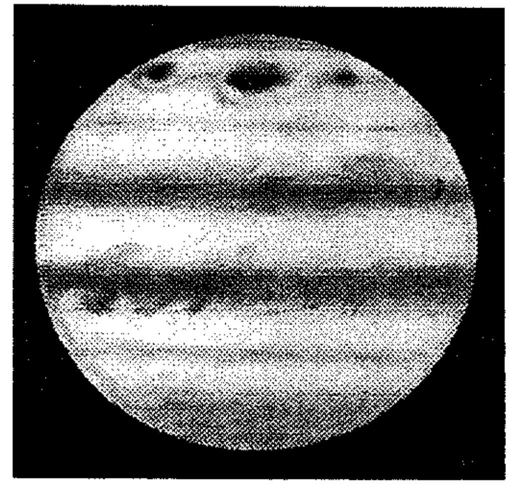
the focal point

Monthly Notices of the Atlanta Astronomy Club, Inc.

Vol. VII No. 4 September, 1994



Rich Jakiel Observes Jupiter's New Festoons

See page 12

IN THIS ISSUE

- *Jack Kramer Discusses Definition and Light Grasp.*
- *Ken Poshedly Tells Hows to Get Maximum Usage Out of a Starter Scope.*
- *David Lee Tells Hows to Build Your Own Electric focuser.*

NEXT MEETING SEPTEMBER 16 – SEE PAGE 18

HOWARD BREWINGTON TALKS ABOUT COMETS

OBSERVING PARTY/PICNIC WITH THE ASA ON SEPTEMBER 10 – DETAILS ON PAGE 16

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Monthly Notices of the Atlanta Astronomy Club, Inc.

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

The Atlanta Astronomy Club Inc., the South's largest and oldest astronomical society, meets at 8:00 p.m. on the third Friday of each month at Agnes Scott College's Bradley Observatory. Occasional meetings are held at other locations (check the hot line for details). Membership is open to all. Annual dues are $20 ($10 for students). Discounted subscriptions to *Astronomy* ($18), and *Sky & Telescope* ($20) magazines are available. Send dues to: **Alex Langoussis, Treasurer, 3595 Canton Road, Suite A9-305, Marietta, Ga. 30066**

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

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

First Class

9510.
W. Tom Buchanan
105 Carriage Station Circle
Roswell, Georgia 30075

Definition and Light Grasp
An Either/Or Situation?

by Jack Kramer, Libertyville, Illinois

There's usually a tradeoff that faces amateur astronomers. When you set out to acquire a telescope, you want images that are as sharp as possible, along with the greatest possible light-gathering power. Refracting telescopes are renowned for their high definition. Reflectors are less costly, which allows larger mirrors with more light gathering. The problem is that large optics that give excellent definition may not be affordable. This generally forces a compromise that was highlighted when one of our members made a side-by-side comparison between two different scopes - a Coulter Odyssey 13.5" and a 5" refractor with an objective by D&G Optical. Both were aimed at the Lagoon Nebula in Sagittarius. The image in the Odyssey was brighter, as you'd expect, but the image in the refractor was notably sharper, even though this was a nebula – a diffuse object which normally isn't a good test for sharpness.

> ...inch-for-inch, a refractor is up to five times as expensive as a fully-equipped reflector....

A discussion over the merits of a refractor versus a reflector really boils down to how you intend to use your telescope *most of the time*. Since a refractor doesn't have the central obstruction of a secondary mirror, the image presented will usually be sharper than in a reflector, assuming the optics are of good quality. But inch-for-inch, a refractor is up to five times as expensive as a fully-equipped reflector. For the same price, you'll get much more light gathering in a reflector.

There's a saying among amateur astronomers: given a tradeoff between image quality and light gathering, go for the light gathering. What good is image quality if you can't *see* the image? As with most generalities, this is true only up to a point. Better optics may be the difference between seeing a fuzzy blob and seeing some detail, and details make an object interesting. It also assumes that your intended targets are faint objects and that you'll be observing from reasonably dark skies. But if you observe objects that are fairly bright, then *definition* becomes more important. And if your site is light polluted, then the light-gathering ability of large optics can be self-defeating, since they tend to gather more light pollution along with light from the objects observed.

The refractor often gives better results in less than optimum atmospheric conditions, because there are fewer air currents within the closed telescope tube and a smaller telescope is looking through a smaller column of air. In certain cases, this makes a compelling

WHAT'S UP

	SUN				MOON				
Date	Rise	Azi	Set	Azi	Rise	Azi	Set	Azi	Age
9/15/94	7:21	85.8	19:44	273.9	17:06	107.0	3:13	250.8	11.2
9/16/94	7:21	86.2	19:43	273.4	17:44	102.5	4:14	255.0	12.2
9/17/94	7:22	86.7	19:41	273.0	18:19	97.3	5:14	259.9	13.2
9/18/94	7:23	87.1	19:40	272.5	18:52	92.1	6:13	265.2	14.1
9/19/94	7:23	87.6	19:39	272.0	19:24	86.7	7:10	270.7	15.1
9/20/94	7:24	88.1	19:37	271.6	19:56	81.8	8:06	276.0	16.0
9/21/94	7:25	88.6	19:36	271.1	20:29	77.0	9:02	280.9	16.9
9/22/94	7:25	89.0	19:34	270.6	21:04	72.9	9:57	285.2	17.8
9/23/94	7:26	89.5	19:33	270.2	21:42	69.7	10:51	289.0	18.7
9/24/94	7:27	90.0	19:32	269.7	22:22	67.3	11:44	291.8	19.6
9/25/94	7:27	90.4	19:30	269.2	23:06	65.9	12:36	293.6	20.5
9/26/94	7:28	90.9	19:29	268.8	23:54	65.7	13:26	294.4	21.4
9/27/94	7:29	91.4	19:27	268.3	-----	-----	14:14	293.9	22.3
9/28/94	7:30	91.8	19:26	267.8	0:46	66.7	14:59	292.2	23.2
9/29/94	7:30	92.3	19:25	267.4	1:41	68.9	15:41	289.3	24.2
9/30/94	7:31	92.8	19:23	266.9	2:39	72.3	16:21	285.3	25.2
10/1/94	7:32	93.2	19:22	266.4	3:40	76.8	16:59	280.5	26.2
10/2/94	7:32	93.7	19:20	266.0	4:43	82.2	17:36	274.8	27.3
10/3/94	7:33	94.2	19:19	265.5	5:48	88.2	18:14	268.6	28.4
10/4/94	7:34	94.6	19:18	265.0	6:55	94.4	18:53	262.6	29.5
10/5/94	7:35	95.1	19:16	264.6	8:04	100.7	19:34	256.7	1.1
10/6/94	7:35	95.6	19:15	264.1	9:13	106.2	20:20	251.7	2.3
10/7/94	7:36	96.0	19:14	263.6	10:23	110.6	21:10	248.0	3.4
10/8/94	7:37	96.5	19:12	263.2	11:30	113.4	22:05	245.9	4.5
10/9/94	7:38	96.9	19:11	262.7	12:34	114.5	23:04	245.6	5.6
10/10/94	7:38	97.4	19:10	262.3	13:31	113.8	-----	-----	6.7
10/11/94	7:39	97.9	19:09	261.8	14:21	111.6	0:05	247.0	7.8
10/12/94	7:40	98.3	19:07	261.4	15:06	108.0	1:08	249.9	8.8
10/13/94	7:41	98.8	19:06	260.9	15:45	103.8	2:09	253.8	9.8
10/14/94	7:41	99.2	19:05	260.5	16:20	98.8	3:09	258.5	10.7
10/15/94	7:42	99.7	19:04	260.0	16:54	93.7	4:07	263.7	11.7

The speaker for the evening was AAC member Tom Crowley, who is also a member of the Society of Amateur Radio Astronomers (SARA). Tom's been a radio astronomer for about four years, about as long as he's been a radio astronomer. His insightful presentation on radio astronomy proved that there's a lot to be done by those who can't afford or don't want to dabble in optical astronomy. Thanks again, Tom. Great job!

The Atlanta Astronomy Club also thanks Fernbank Science Center for its hospitality in accommodating us at various times. Following Tom's talk, the meeting was adjourned for refreshments and an impromptu birthday party for one of our younger members, Rosey Colaluca, newly-turned 10. Afterwards, several dozen persons finished the evening at Jaggers pizza restaurant across from Emory University.

THE SEPTEMBER MEETING

Lately, we've been very fortunate in bringing some top notch amateur astronomers to share their exploits. And September is no exception. Join us at 8:00 p.m. on **September 16** when we present amateur astronomer Howard Brewington. The title of his talk will be: **"South Carolina's Only Comet."** The meeting will be held at **Fernbank Science Center**.

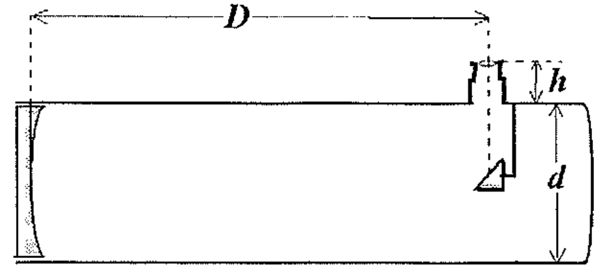
Howard is originally from the "neighborhood", specifically Newberry, SC, before he and wife, Trudy, moved to Cloudcroft, New Mexico, for the sole purpose of hunting comets. During the daytime, Trudy is a science teacher, and Howard has a TV/VCR repair shop.

Howard has been interested in astronomy since age 9. Today, his equipment stable features a 16" Dobsonian-mounted reflector with an 8-inch scope piggy-backed to it for comet hunting, an 8" Schimdt camera, a (Celestron) C-8, and a 15.5" Fecker cassegrain with a 4" inch refractor mounted to it.

To date, Howard's comet discoveries include: Arseth-Brewington 1989a1 P/Metcalf-Brewington 1991a; Zanota-Brewington 1991g1; and P/Brewington 1992p.

Howard now says he wants to find just one more comet then he might call it quits.

If you don't believe it, ask him yourself at the meeting. For more information, call the Club's hot line at the number given on the back cover.



$$D = f.l. - (d/2 + h + 1'')$$

(f.l. is focal length of the primary mirror)

argument for a refractor. (That's why we recommended a refractor for the Lake County Museum.) But now we're talking about a lot more money for a larger-sized refractor, more than most of us can afford. Can you get light gathering ability *and* sharp images for an affordable price?

Long-focus Newtonian reflectors can provide images that are virtually identical to those in refractors of comparable size. A high focal ratio Newtonian isn't as sensitive to slight optical imperfections and allows the use of a very small secondary mirror (diagonal). By minimizing the size of the central obstruction, the image quality is improved.

In addition, using a low-profile focuser allows the secondary to be placed slightly farther from the primary mirror because the light cone doesn't have to extend as far out of the tube. As a result, the size of the secondary can be reduced even further. The following diagram shows a general formula for the placement of components in a reflector, and it helps to illustrate how the secondary can be positioned optimally.

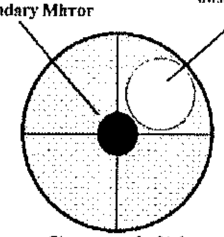
Diagonal Minor Axes for a 1.75" Field

f Ratio	Mirror Diameter in Inches					
	3	4.25	6	8	10	12.5
f/4	-	1.83	2.14	2.60	2.60	3.10
f/5	-	1.83	1.83	2.14	2.14	2.60
f/6	1.52	1.83	1.83	2.14	2.14	2.14
f/7	1.52	1.52	1.83	1.83	2.14	2.14
f/8	1.52	1.52	1.83	1.83	1.83	2.14
f/9	1.30	1.52	1.83	1.83	1.83	2.14

Many planetary observers have adopted the six-inch, long-focus (f/8 and up) reflector as a mainstay of their observing arsenals. Such an instrument often outperforms four-inch refractors that cost many times more. Of course, as you increase the diameter of the primary mirror, long focal length brings the liability of a large, ungainly telescope tube.

Off-axis diaphragms permit reflectors (including Schmidt-Cassegrains) to mimic the performance of a refractor by restricting the incoming light to a smaller opening that bypasses the secondary mirror. The procedure is simply to make a mask that fits over the opening of the telescope tube. The mask has a circular hole (diaphragm) cut out so that light entering the tube won't encounter the secondary mirror. As an example, a ten-inch mirror with a 2.14" secondary would require a cutout slightly less than 4" in diameter. In effect, that telescope is now gathering the light equivalent to a 4" unobstructed scope (i.e.: a refractor).

Use of a diaphragm dims the image somewhat and since it changes the effective focal ratio, you must re-focus the eyepiece slightly. A diaphragm works well for examining surface details on the brighter planets and for close double stars, which become easier to split cleanly. But there is one drawback - by restricting the aperture, the telescope is less able to pick up colors, which require as much light gathering as possible. Often, the ability to see subtle colors on a planet is an important factor in distinguishing details.



Diaphragm fits over end of telescope tube

Highly accurate mirrors compensate for the effects of the central obstruction and shorter focal ratios. Light is a precious commodity in astronomy, so you want to make the best use of what's available. An accurate mirror concentrates more light into the Airy disk – the image itself – rather than dispersing it around the field, so you get a sharper image and make better use of the existing light-grasp. You can actually end up seeing objects at fainter magnitudes, since the available light isn't being wasted. You also get higher contrast, which enables you to see more detail. The best mirrors are often made by skilled amateurs who take the time to do the job right. You might upgrade your scope with a better mirror, but refiguring a thin mirror is extremely difficult and the results seldom equal the quality of a good full-thickness mirror. If you buy a commercial product, look for a supplier who's likely to stand behind the performance claims and, better yet, is willing to provide surface accuracy data specifically on the *mirror you purchase*. Although perfection is elusive, an article in *Sky & Telescope* a while back stated that beyond a certain point, an increase in the surface accuracy of a mirror is almost imperceptible to the eye. Going from a system

AAC ACTIVITIES

by Ken Poshedly

Last Month . . .

The August 19 meeting of the Atlanta Astronomy Club was called to order at 8:05 p.m. by president Steve Gilbreath. A count of those attending showed over 90 persons present. The meeting was held at the Fernbank Science Center.

Before the featured program, the following announcements were made:

- Observing Chairman Eric Shelton reviewed the recent observing activities of the impacts of Comet Shoemaker-Levy 9 at Jupiter. For many folks, it was a memorable occasion, especially for one elderly woman in her 90s and who was confined to a wheelchair; Eric said it was her first-ever look through a telescope.
- Eric also announced that the inter-club picnic by the AAC and the Astronomical Society of the Atlantic would be held Saturday, September 10 at the AAC Villa Rica observing site; all are asked to please bring aa covered dish to share and the refreshments will provided by the club(s). Additional cooking grills and tables would also be welcome. PLEASE phone Eric at 664-2837 to let him know you can go, or can help with arrangements.
- Recording secretary and newsletter editor Leonard Abbey also noted that there have been many new faces at the past few meetings and encouraged all to enjoy the meeting and, hopefully, join the AAC.
- Treasurer Alex Langoussis gave the official membership tally at 158 members (as of the meeting night).
- AAC Light Pollution committee chair Tom Buchanan reported that a City of Atlanta outdoor sign ordinance came very close to including a ban on skyward-directed billboard lighting. Unfortunately, the final version of the ordinance was stripped of this clause. A city council member has made a motion to amend the ordinance by reinstating the clause and prohibit light fixtures from bring directed skyward. For more information, call 587-0774.

Filling in for program chairman Jerry Armstrong to introduce the featured speaker was Ken Poshedly. Ken did his best to let the nonmembers know some of the club benefits (hefty discounts on subscriptions to Astronomy and Sky & Telescope magazines, voting privileges, unlimited access to the AAC observatory at Villa Rica, plus a real comradery with other amateur astronomers from all over northern Georgia and beyond).

intriguing, as it is arrowhead or chevron shaped, pointing to the west. Binoculars show a faint unresolved patch of light in an interesting field.

DELPHINUS

NGC 6905 This planetary nebula is about 40" in diameter, and is gray-blue, reminiscent of the Ow Nebula (M-97).

NGC 7006 This small, unresolved globular cluster is unremarkable until you realize that it is some 185,000 light years distant, comparable to the distance of the Magellanic Clouds, and may actually not even belong to the Milky Way's system of globulars.

NGC 6934 This globular is closer to home, and shows a 4' diameter disk which hints at resolution and granulation with averted vision.

γ This very pretty double star is easy to split, and presents a gold primary and a pretty blue secondary.

PICNIC - OBSERVING PARTY ON SEPTEMBER 10

Time's running out, so . . .

NOW is the time to clear your schedule for Saturday afternoon and evening, September 10, for the Atlanta Astronomy Club/Astronomical Society of the Atlantic club picnic!

The site is Villa Rica and all the ants will be on their best behavior, so bring a covered dish to share that's REAL good! We'll provide the refreshments, though we DO need help with tables and cooking grills, if you have any or both of the above.

To get to the observing site, take I-20 to exit 5, head north about 2 miles and turn left onto Route 120; go 0.1 mile and turn right onto Harlan Lane Rd., then go about 2 miles and turn left onto Tapley Rd. (the sign is hidden on the left, so be observant). The picnic site/observing site is a mile down the road on the right.

To help us plan on how many refreshments to muster up, please phone Eric Shelton at 664-2837 with your RSVP as soon as possible.

accurate to 1/4 wave to one accurate to 1/10 wave may not be worth the effort or cost. But here "system" refers to the *true* total wavefront accuracy, not what some claim in their ads. Total wavefront accuracy means the combined accuracy of the primary and secondary mirrors at the point of focus. Since a mirror doubles its error at the wavefront, a primary mirror with a surface accuracy of 1/8 wave is really accurate to only about 1//4 wave or less in actual use at the wavefront. Knowledgeable opinion seems to be that once you've decided what you can afford, look for the best quality mirror in your price range, even if it means having to settle for a smaller telescope than you'd really like. Don't be blinded by the siren call of the light bucket! If you're simply interested in counting fuzzy blobs, then get the largest you can afford. However, higher quality optics will generally let you see more detail than with a larger primary mirror of significantly lesser quality, and you'll have a scope that's easier to handle and that you'll use more often.

If cost is no object, then go for the biggest and the best, but practically speaking, everything is some sort of compromise. Knowing *where* to compromise is the trick.

THE WELCOME MAT

Our club continues to grow. We are now not only the Southeast's largest astronomy club, but its most rapidly growing club!

Gary Jordan
Brett and Vicky Barnes
Jeff Wiseman
Steven and Sandra Taft
Zach, Peggy and Shannon Davidson
David Parker
James and Betty Monroe
Lewis Warner
Larry Hample
Michael Shaw
Stephen Jones
Charles Young
Carey Fisher
Ginny Mauldon-Kinney

Starter Scopes -- Don't Write Them Off

by Ken Poshedly

With more and more folks discovering the fun of astronomy, some have purchased what many call "introductory telescopes" from department stores and the like. While inherently a good design, these small refractors and reflectors often suffer from poor workmanship, unsteady mounts and poor optics.

Several good folks brought their Tasco and Jason 60-mm refractor scopes out to the Atlanta Astronomy Club's August 6 public observing session at Villa Rica. The owners were full of enthusiasm, but the scopes had unsteady mounts, and one scope was supplied with only a single eyepiece that provided far too much magnification for the scope.

That doesn't mean these scopes can't be used successfully after some upgrading. Lots of owners have learned how to make over a scope like this to make it perform far better than it did out-of-the-box.

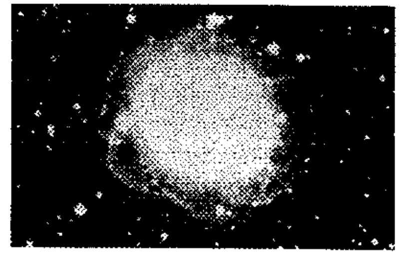
One satisfied Tasco scope owner, David Benn of the University of Tasmania at Launceston (internet: D.Benn@appcomp.utas.edu.au), tells all on the Usenet sci.astro newsgroup how he upgraded his scope:

"I bought my 4.5" Tasco 11-T (Newtonian) about 10 years ago. About six years ago, I started a radical modification program. Modifications include (in order):

- Replacing the Huygens eyepieces with Orthoscopics and Kellners. This made a HUGE difference in terms of contrast and general quality (about $300 for five eyepieces).
- Replaced the next-to-useless finderscope with a $70 finder which gives about a 5-degree field of view. I was amazed when I could see Omega Centauri through this new finder.
- Replaced the tripod with a solid pier and flat legs with height adjustment screws. This was built by a local small engineering firm for around $50, mostly out of scrap metal which was painted black by my wife (who likes to paint things. I even gained about an extra 4 hours of right ascension in right ascension clearance where the tube used to foul on the tripod previously. Also, knocking the telescope over is now next-to-impossible (yes, it has happened to me).
- Bought a clock drive. I could have built one I guess, but I saw it in the shop and handed over my $300.

Okay, so I paid about $700 on top of the original $400. But at $1,100 I now have a very nice scope. All I know is

concentrated in the center, and faintly resolved across its face. It is visible in binoculars as a small, unresolved fuzzy spot.



The Faint Outer Reaches of M57.

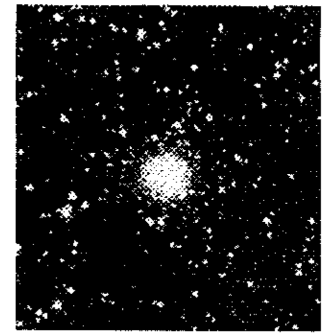
M57 One of the jewels in the sky. The Ring Nebula is bright and easily found. The ring shape is easily seen in almost any size instrument. It is slightly elongated ENE-WSW, and has a star just off its eastern edge. This object handles magnification very well, and is one of my personal favorite deep sky objects. At 15th magnitude, its central star is only well seen in large amateur instruments.

ADS 11834 When you're through viewing the Ring Nebula, look in your viewfinder to see the relatively bright star just north of it. This is a fine, easily split double star showing a very pretty yellow-orange primary with a nice blue companion.

δ This double star is wide and easy to split, and shows a pretty orange and blue-white pair.

ADS 11834 If you look at the Ring Nebula, give this pretty double star a glance. It is just north of the Ring, and is easily seen in the finder. It is easily split and presents a wonderful orange and blue contrast.

ε The famous "double-bouble" is easily split into two components, but needs a steady night to further split these two into four. A very nice sight.



NGC 7006. Tiny Globular in Delphinus

VULPECULA

M27 The Dumbell Nebula. This huge planetary nebula is easily seen in binoculars as a gray puff of light in a very pretty field. In a telescope, the hourglass shape is obvious, and extensions are seen which actually make it more football shaped. A wealth of detail awards careful scrutiny. Justifiably one of the most observed deep sky objects.

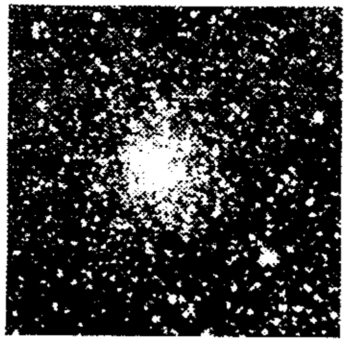
Cr 399 The "Coathanger". This star cluster is easily seen with the naked eye with its distinctive star pattern. A cruise though it with binoculars reveals many bright stars and star fields.

SAGITTA

M71 This globular cluster is about 6' in diameter, and show many stars resolved across its face. The shape is

CONSTELLATIONS OF THE MONTH
THE CYGNUS REGION
by Rick Raasch, Dallas

This month. we'll be surveying a very rich area of the sky composed of Cygnus, Lyra, Vulpecula. Sagitta. and Delphinus. Here. in a relatively compact region. are a wealth of objects to keep observers busy on an autumn night. Scanning this region with binoculars is a pure joy, with field after field of star clusters and groupings everywhere you look. The listing of objects presented here are just a few of the splendors waiting for you to observe.



M71. Asymmetrical Globular in Sagitta.

CYGNUS

M39 Through binoculars, this open cluster is very impressive. It is large and bright and stands out well from the background. I see it as having an overall triangular shape. Through a telescope, it loses some of its impact, because of its size and the fact that it is not very concentrated to the center.

M29 This small open cluster is seen through binoculars as a diamond shaped grouping of about 6 - 8 stars in a nice field. In a telescope, the count increases to about 15 sparsely concentrated stars.

NGC 7000 The North America Nebula. I usually see this best with the naked eye as a milky patch just to the east of the bright star Deneb. The "Gulf of Mexico" region stands out particularly well. Try holding an O-III or UHC filter in front of your eyes to increase the contrast. Then, as an added treat, use these filters while looking through binoculars.

NGC 6969/6992-5 The Veil Nebula. This is a large supernova remnant best seen at low power, divided into two major segments. NGC 6960 is the more difficult to see, as the bright star 52 Cygni overwhelms it. NGC 6992-5 lies to the east, and shows a wealth of filamentary detail, especially when using a filter.

Alberio This is a classic double star. Easily split, it shows a beautiful contrast of yellow-orange and blue stars. Even if you're not a double star fan, try this one. You'll like it.

LYRA

M56 This is a relatively bright globular cluster, about 5' in diameter,

that Jupiter looked beautiful at 150X. And when the seeing is poor, my 4.5" often outperforms an 8" Newtonian."

But Benn credits his choice of better oculars as the biggest improvement: "Without a doubt, the eyepieces were the key to a far better scope. The primary optics are the best part of the Tasco instrument. Pretty much everything else seems to be there primarily to keep the cost down."

David Graham, another online fan of these scopes agrees with his message on the Fidonet astronomy echo. He says that it's not just getting better eyepieces, but eyepieces with the standard size, 1 1/4-inch barrel: "Once you get 1.25's on your Tasco you'll really like it! I've got the Sears equivalent (t'was a Christmas present back in '72) and I use it with a 40-mm Kelner and 20mm Erfle and it works great. The field should be horribly vignette, but I don't notice it."

Craig MacDougal of Florida, chooses to post his scope dimensions in metric and chimes in his two cents worth on Fidonet's astronomy: "I have tried some VERY temporary methods of using my 32-mm barrel (1 1/4-inch diameter) eyepieces. The difference in contrast in my 18mm Orthoscopic compared to the (Tasco-supplied) "stock" 20-mm Huygens is striking.

Mark Kaye another fan says that if you can't afford a new 1 1/4-inch focuser, 32-mm sized plumbing pipe can be used."

Okay, so you've already invested a hundred or so bucks in your Tasco or Jason scope. You know it can do better, but how much will it cost?

Unsteady mount? Steve White of Orion Telescope Center in California suggests fabricvating a way to keep the tripod legs of your Tasco or Jason scope open more. This should add at least a small amount of steadiness.

Eyepieces? Locally, Mike Marcus's shop, "The Astronomical Enterprise," Atlanta's astronomy-only store, has a number of possibilities.

First, remember that the highest *usable* magnification is no more than 50X the aperture of your scope in inches; many experienced users say the figure is really only 45X the aperture – especially with Atlanta's growing problem of light pollution, haze and fair-to-poor transparency. The *lowest* usable magnification is 4X the aperture in inches.

Then choose a good range of low to high-power eyepieces that will approach but not exceed these limits. A 60-mm scope is really a 2 1/2 inch scope: 2 1/2 X 45 = about 112 power; 2 1/2 X 4 = 10 power.

To figure out exactly which eyepieces to choose, divide the approximate desired magnification into the focal length of the telescope. Let's say your scope is a 2 1/2-inch (60-mm) refractor that has a focal length of 850 millimeters (it should say something like "f/850" or "fl = 850-mm" or something similar on the tube, in the instruction booklet or on the box).

You already know your highest useable magnification is just over 100X, so decide on the range of magnifications;

possibly 100X, 75X, 50X and 25X. Divide each into 850 and you get eyepieces of 8.5-mm, 11.3-mm, 17-mm, and 34-mm respectively.

At Mike's shop, you can get a set of Celestron Plössl eyepieces in the existing 0.965-inch barrel size the scope came with. They're available in 7.5-mm, 10-mm, 17-mm and 26-mm focal lengths for only $50 each. For the scope used in this example, these figure out to 113X (really at the upper limit for the scope), 85X, 50X and 33X.

For even a lower power to view open clusters and so forth, Mike offers Celestron Kellner-type eyepieces (again, in the existing barrel size) for less than $43 each; a 30-mm will give you 28X and a 40-mm will give 21X. Kellner-type eyepieces give sharp, bright views at low powers – just what we need here.

Check with Mike at (404) 843-3838 for more information on what he stocks. His hours are 10 a.m. to 6 p.m. (Eastern Time) Monday through Saturday.

Finally, what also impressed Tasco owner Benn is the Tasco replacement policy: ". . . Tasco scopes are guaranteed for life, it's not bad. My declination mechanism broke one night without warning. Tasco supplied a new one *free*. And that was when the telescope was around seven years old."

Ask a Meade or Celestron scope owner about THEIR last faulty part crisis.

Look for more ideas here in the future about fixing up your starter scope.

THE EDITOR SAYS . . .

In November we will mail out the current Atlanta Astronomy Club membership list with the *Focal Point*. If you have any corrections to be made, either addresses or telephone numbrers, please contact the Treasurer, Alex Langoussis. His phone number is shown in the list of officers on page 19.

In your oCTOBER *Focal Point* . . .

We're kind of short on space this month, but look for an expanded review of Tom Crowley's great talk on radio astronomy from the August AAC meeting. Look for it.

Peach State Star Gaze news . . .

If you liked last April's Peach State Star Gaze, you're *sure* to love the next one! A site for the 1995 event has been selected and checked for dark skies by several AAC experts. The location, accomodations and cost should suit eveybody. More news as it develops.

How to Build an Electric Focuser

by David W. Lee

The plans and instructions for this focuser are based on an article on page 317 of the September 1989 *Sky and Telescope*. I first built the power supply and control unit as described in the article. However, I modified it by adding a variable resistance in series with the motor. This allows you to vary the speed of the motor allowing fine control and high speed focusing. I used a Radio Shack wire wound potentiometer #271-265 - $2.99 .

I later decided to power the focuser motor from my Celestron drive corrector ha nd control.To do this, I opened up the box and tapped into the 12 volt incoming power leads from the drive corrector. I ran the 12 volts into (2) 10 ohm power resistors (Radio Shack 271-132 - 2/$.99) in series. Then I ran it through the potentiometer described above. This reduces the voltage across the focuser motor to around 3 volts, the potentiometer letting you vary this to control the speed. I then ran this DC output into a double throw double pole momentary contact toggle switch as described in the "single battery pack" version of the controller described in the *S&T* article. All of these resistors, switches, and potentiometer fit inside the hand control or are mounted through holes drilled in its housing. I used a regular audio jacks and plugs to make the wire to the motor from the hand control removable.

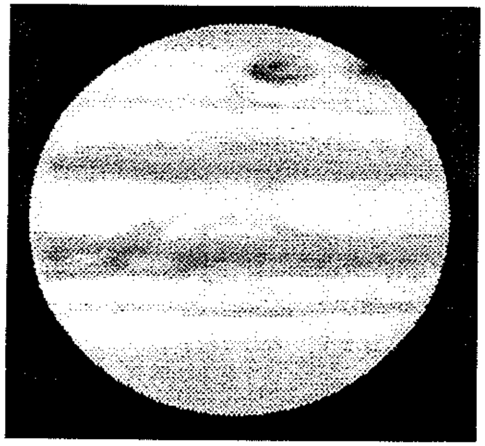
As far as the motor goes, you just have to scrounge toy cars, tractors, robots, etc to find one with a gear train that turns at the right speed. Look for toys that run on 2 batteries. Or, you can buy the one from Edmund Scientific described in the *S&T* article. I drove my focuser knob by using the front tire from a toy car slipped over the focuser knob as a pulley and used a rubber band that comes wrapped around broccoli from the grocery store as a belt. The motor gear train output was the axle for the car. It had a plastic sleeve on it about 1/4" in diameter that I roughed up with a file to serve as the drive pulley for the belt.

You fabricate a mounting bracket to hold it to your scope. In the case of my Super C8 plus, a late model, I removed the three allen screws holding the focuser shaft bearing retainer to the rear cell and made a sheet metal plate with a big hole for the focuser shaft bearing and three small holes for the allen head bolts. Bend the rest of the sheet metal plate to whatever shape it takes to let you mount the motor so the output shaft is about 2" from the centerline of focuser knob and parallel to it. Mount the motor to the sheet metal, the sheet metal to the telescope behind the focuser bearing retainer and reinstall the bearing retainer. Slip the tire on the focuser knob, install the belt, hook up the wires and you should be in operation!

If you have any questions give me a call on 214-248-0303.

goals of the OPSWG: study of the geology and morphology, mapping of the surface composition, and neutral atmosphere.

Rich Jakiel Observes Jupiter.



Jupiter on July 23, 1994 by Rich Jakiel.

The AAC's premier visual observer, Rich Jakiel, has been very busy these days. Expanding his repertoire from galaxy and cluster drawings to include the planets, he naturally turned his attention to Jupiter in the last few weeks. On the cover is the view through his 13.1" f/4.5 reflector at 257X on July 24. Impact site H is nearing the limb. The complex of impact sites G, S and D is on the central meridian.

The above drawing was made on July 23, 1994, with the same instrumentation.

Rich notes that the larger impact sites are intensely black. They should be clearly visible in good instruments as small as 4".

PLUTO FAST FLYBY
A NASA FACT SHEET
Solar System Exploration Division

MISSION SUMMARY

Pluto, the smallest planet in our solar system, has remained enigmatic since its discovery by astronomer Clyde Tombaugh in 1930. Pluto is the only planet not yet viewed close-up by spacecraft, and given its great distance and tiny size, study of the planet continues to challenge and extend the skills of planetary astronomers. Most of what we know about Pluto we have learned since the late 1970s. Such basic characteristics as the planet's radius and mass were virtually unknown before the discovery of Pluto's moon Charon in 1978. Since then, observations and inferences about Pluto-Charon, now considered a "double-planet" system, have progressed steadily to a point where many of the key questions about the system must await the close-up observation of a space flight mission.

For example, there is a strong variation in brightness, or albedo, as Pluto rotates, but we do not know if what we are seeing is a system of varied terrains, or areas of different composition, or both. We need a much closer look to understand these features and the chemical, geological and perhaps orbital history they represent. We know there is a dynamic, largely nitrogen and methane atmosphere around Pluto that waxes and wanes with the planet's elliptical orbit around the sun, but we need to understand how the atmosphere arises, persists, is again deposited on the surface, and how some of it escapes into space. Telescopic studies indicate that Pluto and Charon are very different bodies, Pluto being more rocky, Charon more icy. How and when the two bodies in a double-planet system could have evolved so differently is a question that awaits data from close-up observation.

More fundamentally, beyond our basic interest in Pluto and Charon, is the likelihood that these bodies hold important keys to our understanding of the giant planets and comets and their role in the formation of the solar system. From the Voyager missions to the outer planets and their moons, we have a basic inventory of the characteristics of the icy and rocky bodies of the outer solar system. We have learned much about such planet-like bodies as the moons Triton and Titan, and are beginning to understand Pluto as a third member of this triad of small outer "planets." Data about Pluto and Charon, gathered using ground-based and Earth-orbiting observatories like the Hubble Space Telescope, continually improve our understanding of these bodies and have helped define the important questions about Pluto-Charon. To address these questions, NASA is now studying a robotic reconnaissance mission to Pluto-Charon called PLUTO FAST FLYBY.

Pluto Fast Flyby will be unique in its approach. In order to minimize cost, while containing the risks associated with lower cost, Pluto Fast Flyby is being conceived as a pair of very small spacecraft, using, where possible, lightweight advanced-technology hardware components. The baseline Pluto Fast Flyby mission, based on a 1996 new start authorization, calls for launch of the two ~110-150 kg spacecraft in 1999-2000 toward encounters with Pluto and Charon around 2006-8. Pluto began receding from the Sun in 1989, and its thin atmosphere is condensing out into surface frost as it cools. Therefore, minimizing flight time and launching at an early opportunity is important for the mission's atmospheric and surface science objectives (see below). There is a direct relationship between spacecraft weight and flight time, so spacecraft design tradeoff analyses are particularly critical for this mission.

PLUTO FAST FLYBY SCIENCE OBJECTIVES

- Characterize Pluto's and Charon's global geology and geomorphology.
- Map the surface composition of both sides of each body.
- Characterize Pluto's neutral atmosphere, measuring its composition, thermal structure, and aerosol content.

CANDIDATE EXPERIMENTS

- Visible Imaging System: a charge-coupled device (CCD) imaging camera to map surface features and geomorphology of Pluto and Charon, and to search for small satellites.
- Infrared Mapping Spectrometer (perhaps sharing foreoptics with the CCD camera) to study the surface composition of Pluto and Charon.
- Ultraviolet Spectrometer to measure atmospheric composition.
- Radio Science Uplink Occultation Experiment to profile temperature and pressure of the atmosphere from the surface through the ionosphere.

MISSION CHARACTERISTICS

Trajectory: Two spacecraft, on direct trajectories (i.e., no gravity-assists)

Launch Vehicles: Titan IV/Centaur or Proton; both would entail kick stages

Launch Dates: 1999-2000, assuming a 1996 new start

Cruise: 6.5-8.5 years, depending on mass

Cruise Science: None planned, but asteroid flyby, other imaging, H/He detection, and radio science are possible

arrival at pluto-charon: 2006-2008, depending on mass and assuming a 1996 new start

Flybys: PFF-1 @ 10,000 km; PFF-2 TBD based on PFF-1 results; both flybys @12-18 km/sec

Data Return: Onboard storage capability of at least 400Mb per spacecraft; science data downlink at 25-40 bps to 34-meter ground stations

BASELINE SPACECRAFT CHARACTERISTICS

Type: Highly miniaturized descendant of the present class of outer solar system platforms: aluminum hexagonal bus, no deployables

Mass: Less than 150 kg; goal is 110-120 kg (7 kg total instrument allocation)

Power: RTG source providing 65 watts at Pluto

Communication: X-Band transponder; 1.47 meter high-gain antenna

Propulsion: Pressure-fed hydrazine monopropellant design delivering 350 m/s delta-V

Attitude Control: Widefield star sensor and three solid-state rate sensors

Pointing Knowledge: Will exceed 1.5 mrad; stability of 10 urad over 1 sec

Slewing Ability: 90 in 3 minutes via cold nitrogen gas thrusters

A BIG MISSION FOR SMALL SPACECRAFT

Recent interplanetary spacecraft like Galileo and the upcoming Cassini have been designed relatively large and heavy in order to bring a maximum exploration payload (including probes) through gravity assists and the intense radiation of Jupiter. A large mission of this type to Pluto had been under consideration since the Voyager 2 encounter with the frigid Neptunian moon Triton in 1989. The encounter revealed to a surprised science community that Triton had polar ice caps, evidence of seasonal changes, active volcanism, and an atmosphere. The implications for Pluto and Charon were recognized immediately, and spurred plans for a Cassini-class mission. But recent emphasis at NASA on smaller, cheaper, and faster missions pointed toward the possibility of a much smaller mission to Pluto-Charon. The key for such a mission is to deliver a scientifically useful payload to the distant system at minimum cost, and to do so before Pluto's atmosphere collapses (in about 2020).

The Pluto Fast Flyby baseline emerged from careful consideration of a complex web of tradeoff analyses regarding trajectory, weight, risk, and durability, within an envelope of low-cost and scientific goals. The overall scientific goals for a mission to Pluto and Charon were articulated and prioritized by NASA's Outer Planet Science Working Group (OPSWG) and endorsed by the Solar System Exploration Subcommittee of the NASA Advisory Council. The goals adopted for Pluto Fast Flyby are the three first-priority