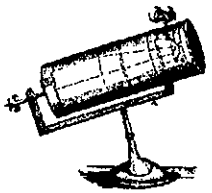
the focal point

Monthly Notices of the Atlanta Astronomy Club, Inc.

Vol. VI No. 1 **September, 1993**



Why is this telescope famous?
See page 6

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MEETING NOTICE ON PAGE 16

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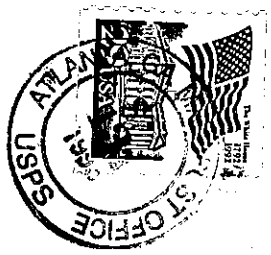
Monthly Notices of the Atlanta Astronomy Club, Inc.

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

First Class



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

9210

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* ($16), 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.

CHOOSING A TELESCOPE FOR ASTROPHOTOGRAPHY

by Alan Dyer, *Astronomy* Magazine

I know what you're thinking: "Why would I want a telescope for astrophotography? I'm not interested in astrophotography. It's too difficult!"

Well, you're partially right. astrophotography can be demanding. The standards set by today's top astrophotographers are very high and may scare off more people than they attract. A few years ago just about everyone wanted to take pictures through their telescopes, but today a common reaction is "I'll never get results as good as that. I'll leave it to all those masochists out there to take the pictures. I'll just enjoy their results."

But there's no need to put yourself into an "all or nothing" bind. Astrophotography doesn't have to be a deadly serious pursuit. Even if you're a dabbler, you can get images that provide you with a lot of personal satisfaction, especially with the help of today's fast films.

Ah, but what about the expense? I've heard people critical of astrophotography say "Sure, all it takes is money. If you spend enough, you'll eventually get good results." It's a myth that's all too common these days. With today's marketplace rich in high-priced telescopes and accessories, it's also a tough myth to dispel. But the truth is having an incredible array of custom-made equipment doesn't guarantee success. Nor do good results only come from high-end systems costing $5,000 or more. Award-winning photos don't require expensive equipment, just the right equipment.

SELECTING THE RIGHT MOUNT

If you're in the market for a new telescope, chances are you'd like to try some photography with it. But even if astrophotography is the last thing on your mind, you likely still want the best telescope in your price range. Astrophotography puts high demand on a telescope's mount and optics. So, some of the features that make for a good astrophoto scope also make for a good telescope for discriminating buyers looking for a basic visual-only telescope.

There is one big difference between a telescope for visual use and one for photography, however - the mounting. For a visual scope, the optical system tends to drive your choice, with the aperture of the telescope often being the most important difference between the various models on your short list.

For an astrophoto scope, optics take a back seat to the mounting. If you're deciding between two telescopes, make your choice based on the quality of the mounting. The more solid the mounting, the better - to a point. Remember that unless you're installing the telescope in a permanent observatory, you're going to have to carry the thing around. A mounting should be sturdy but also compact and easy to setup.

The reason the mounting is so important is that every form of photography done with a telescope, from wide-angle piggyback pictures to high-powered planetary portraits, benefits from having the optics held rock steady during the exposure. Even if you're only taking shots of the Moon at 1/250 second, any vibration or wind will blur the picture. On poor mounts, the very act of focusing the scope can shake the image so much that you can never tell if you're really in focus, needlessly introducing another source of error. Even winding the camera to advance to the next frame can jolt a flimsy mount, creating frustration.

WHAT'S UP

	SUN				MOON				
Date	Rise	Azi	Set	Azi	Rise	Azi	Set	Azi	Age
9/15/93	7:21	85.9	19:44	273.8	6:43	87.3	19:13	269.1	0.0
9/16/93	7:21	86.3	19:42	273.3	7:54	94.4	19:52	262.3	1.2
9/17/93	7:22	86.8	19:41	272.9	9:05	101.4	20:33	255.8	2.4
9/18/93	7:23	87.3	19:40	272.4	10:17	107.4	21:16	250.3	3.5
9/19/93	7:23	87.7	19:38	271.9	11:26	112.2	22:04	246.2	4.6
9/20/93	7:24	88.2	19:37	271.5	12:33	115.4	22:56	243.9	5.7
9/21/93	7:25	88.7	19:35	271.0	13:34	116.7	23:52	243.3	6.7
9/22/93	7:25	89.1	19:34	270.5	14:29	116.2	-----	-----	7.7
9/23/93	7:26	89.6	19:33	270.1	15:17	114.2	0:50	244.4	8.7
9/24/93	7:27	90.1	19:31	269.6	15:59	111.0	1:49	247.0	9.7
9/25/93	7:28	90.5	19:30	269.1	16:36	106.8	2:47	250.8	10.6
9/26/93	7:28	91.0	19:28	268.7	17:09	101.9	3:44	255.3	11.5
9/27/93	7:29	91.5	19:27	268.2	17:40	96.8	4:40	260.4	12.4
9/28/93	7:30	91.9	19:26	267.7	18:09	91.4	5:34	265.8	13.3
9/29/93	7:30	92.4	19:24	267.2	18:38	86.1	6:28	271.3	14.2
9/30/93	7:31	92.9	19:23	266.8	19:07	80.8	7:22	276.7	15.1
10/1/93	7:32	93.4	19:22	266.3	19:38	76.0	8:16	281.8	16.0
10/2/93	7:33	93.8	19:20	265.8	20:12	71.6	9:11	286.5	16.9
10/3/93	7:33	94.3	19:19	265.4	20:49	68.1	10:06	290.5	17.8
10/4/93	7:34	94.8	19:17	264.9	21:30	65.4	11:01	293.6	18.7
10/5/93	7:35	95.2	19:16	264.5	22:16	63.9	11:55	295.6	19.6
10/6/93	7:36	95.7	19:15	264.0	23:07	63.8	12:48	296.3	20.5
10/7/93	7:36	96.1	19:13	263.5	-----	-----	13:38	295.6	21.5
10/8/93	7:37	96.6	19:12	263.1	0:03	65.2	14:25	293.4	22.5
10/9/93	7:38	97.1	19:11	262.6	1:03	68.1	15:08	289.7	23.5
10/10/93	7:39	97.5	19:10	262.2	2:06	72.3	15:49	285.0	24.6
10/11/93	7:39	98.0	19:08	261.7	3:12	77.7	16:27	279.1	25.7
10/12/93	7:40	98.4	19:07	261.3	4:19	84.0	17:05	272.5	26.8
10/13/93	7:41	98.9	19:06	260.8	5:28	90.8	17:43	265.9	28.0
10/14/93	7:42	99.3	19:05	260.4	6:39	97.7	18:22	259.1	29.1
10/15/93	7:42	99.8	19:03	259.9	7:50	104.2	19:05	253.1	0.8

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
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Bulletin Board Supervisor BBS:	Doug Chesser	457-5743
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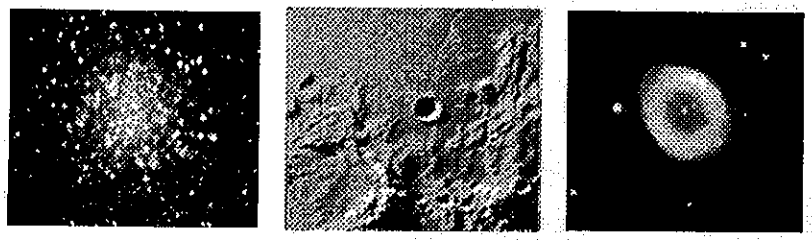
Facilities	Leonard Abbey	634-1222
Light Pollution:	Tom Buchanan	587-0774
Membership:	Terry McHann	441-9097

A CCD SUMMER



While George Roberts is constructing Tim Puckett's 24-inch Ritchey-Chretien reflector, Tim and Jerry Armstrong have been busy tuning up the various CCD cameras which the telescope will eventually carry. Three different models have been in and out of their shop, and some of their test pictures are very impressive. On the left is M22, a globular cluster in Sagittarius. The middle picture shows the difficult rills near Delisle. On the right is the Ring Nebula, M57.

Ten years ago any major observatory would have been proud to claim these images. Now modern electronics has made this capability affordable by even amateur astronomers.

These test exposures were made with a 16" f/4 reflector.

CLUB MEMBER IN PRINT

Club member Bill Black has recently completed his 12½-inch f/5.7 reflector, a project of many months. *Astronomy* magazine will be publishing Bill's account of the telescope, and its innovative mounting, in an upcoming issue. No definite date was given, so be on the lookout for it. We are hoping to see the telescope at an observing party in the near future.

COMING ATTRACTIONS

Club Vice-President Hal Crawford has not been idle this summer. He has labored away lining up interesting speakers far in advance. In October, we can look forward to hearing Dr. Alberto Sadun, director of Bradley Observatory. Dr. Sadun's book on image processing has recently appeared, and he will discuss, and illustrate, the techniques of this highly specialized subject.

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

And later this year, we hope to have a cosmologist who is noted for his new, and highly original, insights into the origin of the universe, Dr. Tom Van Flandern. We will have to catch Tom on his way through town, so this meeting may not be held on

Ask most astrophotographers and they'll tell you - a solid mount makes picture taking much more pleasurable, and the results much better. Here's a checklist of some of the specific features you should look for in a mount:

Equatorial Mount With Clock Drive - Any exposure longer than a fraction of a second (which means most astrophotos) requires that the telescope track the sky to keep the object centered. This means an equatorial mount with a clock drive is a must. Altazimuth or Dobsonian mounts limit you to snapshot exposures of the Moon and Sun.

Worm Gear Drive - The worm-and-wheel type of driving gear is usually better than spur gear drives, though if poorly made, even a worm gear drive will have objectionable driving errors that will blur images during time exposures.

Large Diameter Wheel Gear - The larger the main driving gear (the wheel) the more accurate the drive. It will suffer less from short-term speed variations and mechanical flaws (a stated tracking error of + or -5 to 10 arcseconds is very good), though again, quality of manufacture is more important than sheer size. New "periodic error correction" circuits found on some models of telescopes are excellent aids to astrophotography, but work best if the drive provides a low level of periodic error in the first place.

Mass - The mounting should be beefy, with large but stubby axes placing the mass as close to the center of gravity as possible.

Low Center Of Gravity - A heavy mounting shouldn't sit atop a lightweight tripod or pier; nor should the scope itself sit atop an unnecessarily long axis (a common fault of many German equatorial designs).

Rigid Tripod - A tripod or pier doesn't have to weigh a ton. It just has to be rigid, with a structure that resists flexing in all directions and has no loose connecting points.

No Weak Links - Sometimes otherwise good equatorial mounts are attached to tripods or piers with flimsy connections, with the latitude adjustment point and the tripod often being weak links.

Polar Alignment Adjustments - Mechanisms for moving the mounting head or wedge assembly by small amounts from side-to-side in azimuth and up-and-down in altitude are essential for lining up on the Celestial Pole.

Polar Alignment Scope - Some would argue that these devices located in the polar axis of many German equatorial mounts are not essential, but they certainly don't hurt. In my experience they get you polar aligned close enough to allow exposures up to an hour, especially with short focal-length (under 800 mm) telescopes.

Smooth Slow Motion Controls - These allow you to fine-tune the aim of the telescope, and thus the framing of an object, without shake or backlash. These can be manual or electric, such as the 8X or 16X speeds common on many DC pulse motor drives.

Fast/Slow Buttons - Some means of instantaneously speeding up and slowing down the motor is essential for "guiding" a telescope in right ascension during long exposures. These can be the 2X speed adjustments found on DC drives.

Fine Motion On Declination - The declination slow motion also requires a mechanism capable of fine adjustment (it can be manual or electric).

Speed Range Control - Another nice but non-essential feature is a means of adjusting the driving speed of the motor off the basic sidereal rate in order to match the east-to-west speed of the Moon.

Positive Locks - When you tighten the right ascension and declination lock knobs, the mount shouldn't wander off target.

Ergonomics - It should be possible to reach the slow motion controls and RA

and dec. lock knobs while you're at the camera viewfinder.

Portability - Finally, you have to combine all these features in a mount that breaks down into easily carried components so you can get it out to your favorite site, even if that's only your backyard.

To this list we could also add "versatility." Mounts that allow you to attach a variety of telescope tube assemblies on them (not necessarily all at the same time!) are good choices. If you've chosen the mount correctly you can use the same mount with different optics: long telephotos, wide-field refractors, fast Newtonians, Schmidt cameras, Schmidt-Cassegrains, plus accessory guidescopes - whatever suits the celestial subject.

SELECTING THE RIGHT OPTICS

While one mount can serve you well, there is no single optical system that is best. It may seem contrary to everything you've been told about telescopes, but a bigger telescope is not necessarily a better telescope, at least not for astrophotography. In fact, there's a lot to be said for keeping the telescope small. That places less demand on the mounting, which makes for a sturdier combination.

Now, you're saying, "Wait a minute! Don't larger telescopes have brighter images? Aren't brighter images better for photography?" Yes, on the last point, but wrong on the first point. Brighter images do keep exposure times down, something that is very desirable in just about every form of astrophotography. But in photography, brighter images don't come from aperture. They come from "fast" f/ratios. The f/ratio is the focal length of the telescope divided by the diameter of the lens or mirror. Fast telescopes (those in which the focal length is only 4 to 6 times the lens or mirror diameter, that is f/4 to f/6 systems) produce brighter images than slow systems (f/8 to f/16). This is a real advantage for deep-sky photography; fast scopes keep exposures from becoming arduous endurance trials.

So why not go for the fastest scope you can buy? One reason is that faster scopes have shorter focal lengths; they produce images that are brighter, to be sure, but also smaller. For example, let's take two 6-inch telescopes, one an f/4, the other an f/8. Exposures will be only one-quarter as long with the fast scope; a deep-sky object that takes 10 minutes to record at f/4 will take 40 minutes at f/8 - enough to test your patience. But the f/4 system has a focal length of only 600 mm, versus the 1,200 mm focal length of the f/8 system. This means the field of view of the fast system is twice as wide as in the slow scope. For many large deep-sky targets this can be an asset - but every object is also twice as small. Small image sizes mean image detail can get lost amid film grain.

The pursuit of large, detailed images is the main reason deep-sky photographers endure those long exposures with slow systems. It's also the reason deep-sky photographers lust after larger apertures. Big scopes give them the focal length they're after for recording detail in small objects while still providing fast f/ratios to keep exposure times down. For example, to achieve a 1,200 mm focal length in an f/4 system requires an aperture of 300 mm. That's a 12-inch scope, a monster to mount rigidly let alone transport. For most of us, a 4- to 8-inch aperture scope is far more practical and affordable. (Remember, we're speaking of solid equatorially mounted scopes for photography, not light-bucket Dobsonians designed just for visual use.)

There are applications for which the "speed" of a telescope isn't important. For shots of the Moon, for example, the subject is bright enough that even an f/16 scope works well. In fact, the extra focal length of a slow scope can be an asset, giving a larger lunar disk. Using a focal length of 2,000 mm the Moon's disk just nicely fills a 35 mm film frame.

Planetary photography is the one area in which sheer aperture is helpful. Using only a 3- or 4-inch scope results in very slow "effective f/ratios" with the high

OBSERVATORY REPORT
by Alex Langoussis

"My Telescope Isn't Big Enough!"

How many times have you said those words to yourself? Maybe the only planet you haven't seen yet is Pluto, but your scope isn't big enough. Or you read in *Sky & Telescope* about a great planetary nebula, but it's too dim for your scope. Some of you out there may want to track variable stars, but the minimuma go below your scope's magnitude limit. Or possibly you'd like to see that new comet, but it's not even visible in your scope.

Well, folks, haven't you forgotten about your 20-inch reflector? All members, once they have been checked out on the scope, are free to use it at any time. You don't have to wait for an officer to get back into town. Whether you have a special project in mind, or just want to check on a few objects that sound interesting, *all members have equal access to our observatory.*

I am sure that there are some of you who might feel a bit intimidated going out to use such a large telescope by yourself. If that's the case, and there's something you want to see through the 20-inch, call me. I will try to meet you out there. Also, when you come out to the regular monthly observing sessions, I encourage you to bring a list of some objects that you would like to see through the big scope. Chances are, the objects you choose will be of interest to others, too.

So remember, the next time someone asks what kind of telescope you have, don't forget that *you* have a 20-inch reflector.

And if you can't make it to Villa Rica...we will now be able to do some observing after our meetings! Starting with the September meeting, the 14" Celestron telescope will be open for observing upstairs at Bradley Observatory. Many thanks to Alberto Sadun of Agnes Scott College for making this possible!

September Observing

The next scheduled observing party at Villa Rica is Saturday, September 18. The new crescent Moon will set by 9:30 p.m. Come enjoy the late summer skies.

The weekend of October 14 - 17, which is new Moon, the Georgia Star Party takes place on Lake Burton in the North Georgia mountains. Enjoy the beautiful fall scenery by day, and the dark mountain skies at night. For those of us who will be staying closer to home that weekend, our monthly observing session will be at Villa Rica, the night of October 16.

THE SWAP SHOP

FOR SALE:

Meade 2080 8" SCT.
Excellent condition $600
Steve Bloodworth
594-8553

FOR SALE:

Odyssey compact 10" Dobsonian. Telrad and eyepiece. Pickup only. $300 firm. Doug Chesser 457-5743

AAC ACTIVITIES

SEPTEMBER MEETING

The club's 1993 - 1994 season begins with a bang at 8:00 p.m. on Friday, September 17, at Bradley Observatory. Our speaker will be **Jeff Lichtman,** founder of the Society of Amateur Radio Astronomers (SARA). His subject will be **Radio Astronomy Projects for the Amateur Astronomer.**

Jeff is currently involved in a project sponsored jointly by NASA and SARA, the Gamma-Ray bursts Program. This research is conducted by local SARA members with Georgia Tech's 100-foot parabolic dish radio telescope at Woodbury, Georgia. Very few radio astronomy amateurs have the good luck to have such a large instrument at their disposal.

In the twelve years since its founding, SARA has grown to over 300 members. Ongoing group projects include work on solar and galactic sources, pulsars and emissions from Jupiter.

DOOR PRIZES!

From time to time astronomical publishers and equipment manufacturers make it possible for us to offer door prizes at our meetings. For the September meeting we have an unusually attractive item. It is ***Distant Suns***, one of the leading planetarium-type software packages for the IBM PC, (and clones). This Windows program requires Microsoft Windows 3.1, a 386 or 486 processor, VGA or SVGA monitor, 2 Meg of memory and several megs of space available on a hard drive. A math coprocessor is a definite plus. The program is on 3½-inch disks. Everyone attending the September meeting, members and visitors, will be eligible for the drawing.

RENEWAL NOTICES

Since subscription to *Sky & Telescope* is no longer a membership requirment, we cannot count on S&T renewal notices to remind our members that it is time to renew club membership.

Therefore, beginning with this issue of *The Focal Point*, the date of your last membership renewal will appear at the upper right corner of your mailing label. Add one year to this date to get your expiration date. This date will be highlighted in color for those members who are past due.

magnifications required for good planetary photos. The images on the film are too dim, making for inordinately long exposure times and producing fuzzy images from poor seeing and vibration. A 5-inch scope is the minimum for good planetary shots.

SO WHICH SCOPE IS BEST?

We're juggling a lot of variables here: focal length, speed, field of view, aperture - all optimized into a single telescope that has a solid mount you can carry! Does anyone make such a superscope? No. Every scope is a compromise. But in today's marketplace, you can get very close to an ideal system. Here are some recommendations:

Fast Apochromatic Refractors

Examples: 3- and 4-inch f/5 and f/6 refractors, plus 4- to 8-inch models with f/7 to f/9 focal ratios.

Advantages: They're fast and compact (at least in 3- and 4-inch sizes), have superb optics and a wide field of view; are available with solid, portable mounts; can be used with medium-format cameras (ie. Pentax 645 and 6x7) for even wider fields. Great for deep-sky photography, though the slower f/7 to f/9 models will require long exposures and the possible use of hypersensitized film. However, telecompressors are available to speed these models up to f/6 or so, making exposure times more manageable.

Disadvantages: Short focal length produces small image sizes for the Moon, though focal length can be increased with a Barlow lens; small apertures (3 to 4 inches) produce dim images at magnifications required for planetary photography; high cost; large models (6- to 8-inch) require massive mountings that strain the limits of portability.

Fast Newtonian Reflectors

Examples: 6- to 8-inch f/4 to f/6 Newtonians from a variety of manufacturers, and Takahashi's specialized Hyperbolic Astrographs.

Advantages: They're fast; economical; have a wide field of view; and in 6- to 8-inch sizes the aperture is sufficient for planetary photography. A well-proven instrument used by many astrophotographers over the years.

Disadvantages: Coma at the edge of the field distorts star images in fast systems (faster than f/6), though this problem can be corrected with a $300 coma corrector lens available from Celestron, Lumicon, and TeleVue (the Hyperbolic Astrographs have their own built-in corrector near the focus); fast optics are difficult to make well - poor optics will yield fuzzy images, especially noticeable at high power for planetary work; many astrophotographers find that the standard mounts and drives often need to be upgraded with custom-made mounts and gears.

Schmidt-Cassegrains

Examples: the f/6.3 and f/10 models available in a variety of configurations from Meade and Celestron.

Advantages: They're easy to use; are compact and portable; have sufficient aperture and focal length for lunar and planetary photos; and have readily available photo accessories for every type of astrophotography. The f/6.3 models have good speed for deep-sky photography. The Schmidt-Cassegrains are probably the best all-round affordable choice for astrophotography dabblers.

Disadvantages: The fork mounts can be shaky on the lightweight models; the focus adjustment can be sloppy; inherent curvature of field throws stars at the edges slightly out of focus; speed is slow in f/10 models, though a telecompressor lens accessory can convert these to f/5 or f/6.3 but with a slightly vignetted field.

IS ASTROPHOTOGRAPHY ON THE RISE?

Amateur astronomy goes through cycles of fads and fashions. Interest in astrophotography seemed to reach a peak in the 1970s but then declined. The 1980s saw the rise of the Dobsonian telescope. It represented a return to low-tech, no-frills observing, uncomplicated by equatorial mounts, drives, cameras, guiding accessories, and all the other trappings of the photographer. But after several years of abstinence from technology, backyard astronomers seem to be swinging back the other way. Even loyal Dobsonian fans are putting their scopes on Poncet tracking platforms to follow the stars. And yes, some (gasp!) are even taking pictures through their telescopes. The advent of ultra-fast films like Konica 3200 has brought exposure times down to tolerable levels, enticing more people back into astrophotography. In addition, the demands of today's educated and discriminating buyers has prompted manufacturers to produce a selection of high-quality instruments. Combine the two - the film and the equipment - and you have all you need to get some great photographs you can show with pride.

THIS MONTH'S COVER

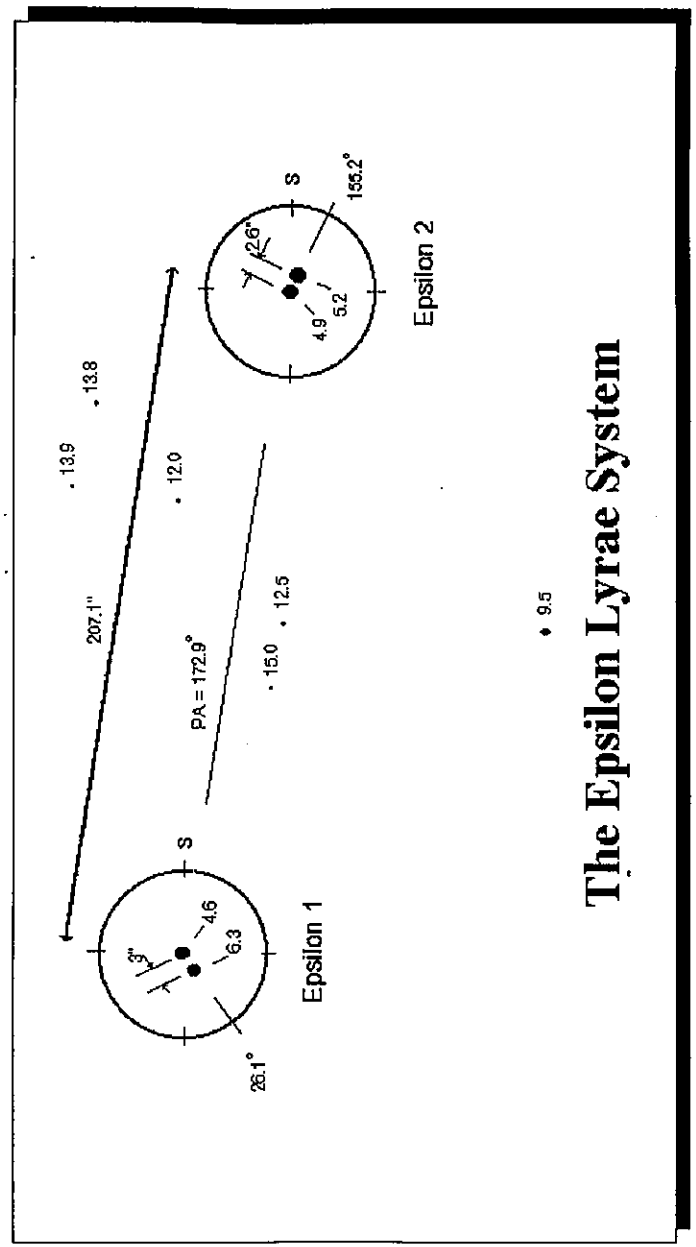
The first reflecting telescope, Sir Isaac Newton's original 1672 design was, at 6 inches, one of the largest instruments of its day. It failed to impress the astronomical establishment because of the aberrations introduced by its spherical mirror. Another century was to elapse before the reflector was accepted as a serious astronomical instrument.

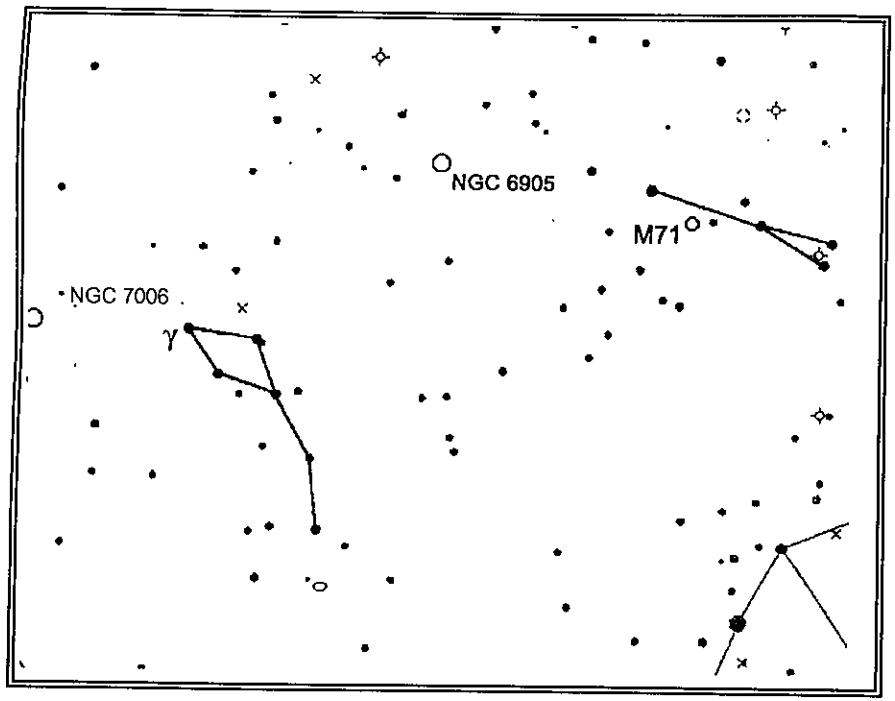
THE CLUB IS NOW ON BITNET

Most members are aware that the club has operated an electronic bulletin board (BBS) for the past year. We are now moving into the world of commercial and academic networks. On September 1 the club assumed management of BITNET's ASTRO List, an astronomy discussion and information service subscribed to by hundreds of professional and amateur astronomers around the world. BITNET is a worldwide network linking over 10,000 mainframe and mini computers in academic and corporate environments.

ASTRO (formerly known as Astronomy@BBN.COM) will provide up-to-date information and discussions on new discoveries, ongoing research, and theoretical issues in the astronomical community. Its archives will contain copies of this publication, as well as bulletins from other clubs, organizations, and societies.

If you have access to BITNET, Usenet, or the Internet, and would like to subscribe to ASTRO, contact the editor at: labbey@gitvm1.gatech.edu. Subscriptions to ASTRO are free.





Delphinus and Sagitta

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 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 Owl Nebula, M97.

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

VIKING PHOTOS SHOW MARS MAY EXPERIENCE FREQUENT QUAKES

by Jim Doyle, JPL, Pasadena

Mars was once very active tectonically and may still be shaken by quakes daily, according to scientists using NASA's Viking Orbiter photos of the red planet's surface.

In a recent science paper, Drs. Matthew Golombek, W. Bruce Banerdt and David M. Tralli of the Jet Propulsion Laboratory and Dr. Kenneth L. Tanaka of the U.S. Geological Survey said Mars is more seismically active than the moon, but less so than Earth.

"Because Mars is smaller than Earth, little more than half the size, a magnitude 6 quake on Mars would have 10 times the effect it would on Earth," Golombek said.

Marsquakes of that magnitude may occur about once every 4 and a half years, he said. A marsquake of about magnitude 4, however, might happen somewhere on the planet once a month on an average. Yet, a quake of magnitude 4 would be detectable throughout the planet, again because of its size and presumed structure.

Tectonic features on Mars are found mostly around the Tharsis region, a large volcanic plateau with associated features that cover the entire western hemisphere of the planet.

Tectonism in that region occurred mainly during two periods in the planet's history -- the earliest possibly as long ago as 4-billion years and the most recent ending possibly less than one-billion years ago.

Features that formed during the first seismic period include many narrow graben or long ditch-like or trough features with faults along their sides. Also formed at that time was a system of concentric wrinkle ridges, larger graben and rifts, and the deep rift valleys of Mars' great 1,860-mile-long (3,000-kilometer) canyon, the Valles Marineris.

During the second period, tectonism caused an enormous set of radial grabens that extend up to thousands of kilometers from the center of the plateau and rift zones of Valles Marineris, along with other prominent features.

Tectonism and seismic activity have decreased from the earlier period to the present, Golombek said, as would be expected if the seismic activity is governed by simple cooling of the lithosphere -- the rigid outer crust and upper part of the mantle -- of the planet.

The scientists said that while Mars is less seismically active than Earth, their studies predict that about two marsquakes of magnitude 5 or greater occur per year, about a hundred quakes of magnitude 3 or greater occur per year.

"That is a promising prospect for seismological investigations on future missions to Mars," Golombek said.

Golombek is the Project Scientist for the Mars Environmental Survey (MESUR) project which would place a network of landers, each with a seismometer, in different locations on the Martian surface. Recordings of marsquakes by seismometers at different locations will help determine the internal structure of the red planet.

The network of instrumented landers is planned to be deployed over three Mars launch opportunities. Four would be sent in 1999, four more in 2001 and the final eight launched with four each on two launch vehicles in 2003.

A precursor mission called MESUR Pathfinder is under study as part of NASA's proposed Discovery Program of small, low-cost planetary missions. MESUR Pathfinder would place a single lander on Mars with a robotic rover deploying, among other

instruments, a seismometer as early as 1996.

The paper, recently published in Science magazine, is entitled "A Prediction of Mars Seismicity from Surface Faulting."

The Discovery Program and the Viking mission are managed by NASA's Office of Space Science and Applications, NASA Headquarters, Washington, D.C.

OVERHEARD ON THE INTERNET

INEXPENSIVE PERFECTION

I want to share an experience which might be interesting for first time telescope buyers.

Together with a friend I own several telescopes (from a 5.1-inch AstroPhysics EDT, to a home-built 12-inch Dobsonian).

Last week we had the opportunity to test a an old 6-inch f/8 Newtonian from Criterion (Dynascope). This taught us that in order to get very good quality images, you really don't need to spend $$$ on an apochromatic refractor.

The 6-inch Newtonian actually showed "more" on Jupiter than our 5-inch apochromatic refractor on several occasions! True, star points and contrast are somewhat better in the refractor, because there is no central obstruction, but in the end it's just the difference between extremely good and excellent ... However with the 6-inch Newtonian, we also split a 0.9 arc second double star in Bootes, with nice diffraction rings (actually, due to the spider of the secondary, you get more or less 3 vanes of diffraction rings).

The 6-inch Newtonian also blew away a C11 on Jupiter and double stars. OK, it wasn't up to the C11 for deep-sky objects, but nevertheless he gave better results as compared to the 5.1-inch Starfire.

A 6-inch f/8 is light enough to fit on a Super Polaris mount. Unfortunately there are not many companies selling a 6-inch f/8 (I believe Meade has one), but I think it is worth the effort to look for one if you are a first-time buyer. But make sure it is f/8, which will gives you the best images because of the small obstruction, and the fact that the image is virtually coma-free.

The 6-inch we used, cost $250, equatorial included. Compare that to the $2100 for the tube assembly of the refractor. So unless you are a perfectionist, consider your chequebook!

Dominique Dierick
Brussels

COLOR CORRECTION MADE EASY

I was testing a surplus aerial camera lens visually once when I happened (don't remember why) to insert a standard photographic 1A (Skylight or UV Haze) filter between the lens and eyepiece. The results were startling! The purple haze vanished without dimming the object much at all!

Apparently, the short cutoff of the 1A is about right to get rid of out-of-focus purple without harming more visible wavelengths.

Now all my paper short-focus refractor designs include a 1A filter. Some day I'll build one of them.

Thomas Clarke
Orlando, Florida

CONSTELLATION OF THE MONTH — THE CYGNUS REGION
by Rick Raasch

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.

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 β Cygni, 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

M57 The Ring Nebula. This one of my favorite objects, and was the first object I looked at through my first telescope, bypassing even Saturn. The ring shape is evident even at low powers, and holds up well to magnification. This showpiece object is bright enough to be seen even in severely light polluted areas.

M56 This is a relatively bright globular cluster, about 5' in diameter, concentrated in the center, and faintly resolved across its face. It is visible in binoculars as a small, unresolved fuzzy spot.

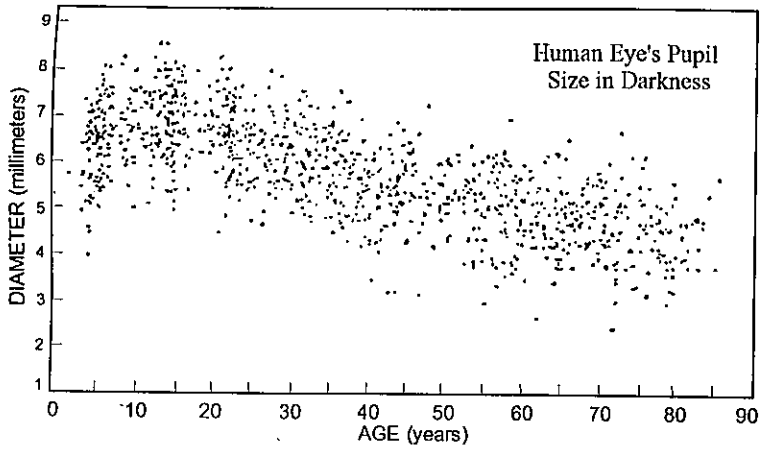
δ Lyr This double star is wide and easy to split, and shows a pretty orange and blue-white pair.

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 Lyr 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.

VULPECULA

M27 The Dumbbell 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



Pupil Size and Aging
by Roger Sinnott, *Sky & Telescope*

A rich-field telescope is one that offers very low magnification, hence a wide field of view packed with the most stars. According to conventional wisdom, 3.5X per inch of aperture is about the lowest useful magnification with a given telescope. Thus a 3-inch instrument can work as low as 10.5X, and a 20-inch, down to 70X.

This is the ratio of magnification to aperture that yields a 7-millimeter exit pupil -- one that presumably matches, and thus fills with starlight, the fully expanded pupil of the human eye.

But is 7 mm the correct value? Not necessarily! People's eyes were found to differ quite a lot in a study by I.E. Loewenfeld, in which 1,263 people were tested in conditions of near darkness (see illustration). Even at age 15, when the pupil size tends to peak, individual values ranged from as small as 5 to as great as 9 mm. After age 30, it's mostly downhill. Some 80-year-olds in the study surpass 5 mm, but 4 was more the rule for them.

These results suggest that 5X per inch of aperture is a better guide to the lowest magnification that an older person should use, assuming he or she expects all the light collected by the telescope to enter the dark-adapted eye.

Loewenfeld's graph is from *Night Vision*, a 335-page softbound book published in 1987 summarizing a symposium at Brooks Air Force Base, San Antonio, Texas. To request a copy, write to Committee on Vision, National Research Council, 2101 Constitution Avenue, NW, Washington, D.C. 20418. The cost is $57 postpaid.

SPLENDOR OF THE HEAVENS
by Dean Williams, Little Rock

As stargazers, we are very richly endowed with a universe whose wonder can be appreciated at various levels. We can, for instance, enjoy a view of the Andromeda Galaxy, knowing only that visually, it is beautiful. From another point of view, an observer can look beyond M31's aesthetic qualities, and can test his powers of comprehension, wondering at the galaxy's incredible distance and size. Generations of stargazers before us were awestruck with the same view of the same galaxy, and yet they were unaware of the object's staggering physical properties.

As if the visual splendor of the heavens were not enough to inspire this awe, our physicists and astronomers have now revealed a physical and philosophical universe which we can only try to comprehend. So-called armchair astronomers take delight in "observing" this side of creation without ever so much as a peep through a telescope.

Most of us fall somewhere between the two extremes of purely visual and armchair observing. I would be entirely content to look only at the aesthetic beauty of the universe for the rest of my life, but how much more wonderful it is to be able to consider not only that M57 is the perfect picture of a celestial smoke ring, but that it is also the sight of a terrific cosmic catastrophe.

This article is a guide to the often overlooked non-visual side of stargazing. Take this page outside with you the next time you observe, and see how many of these amazing facts you can absorb before your poor earthly mind is blown.

Ursa Major

This most familiar of all constellations is much more than a chance alignment in the form of a bear or a dipper. The bright stars of this group are in fact all part of a great nearby cluster. Not all members are within the bear's borders either. Alpha Coronae Borealis is the most distant member of this nearest of all star clusters. The Ursa Major Moving Cluster is some 30 light years long and 18 light-years wide, and the entire group is moving through space at 9 miles per second in our direction.

The Moon

Look at the last quarter moon. You are now looking forward along the earth's orbit. You will be there - out in space at that point where the moon is now - in about 3 1/2 hours.

The Andromeda Galaxy

M31's vital statistics are commonly recited to inquisitive visitors to star parties, but most of us have never stopped to consider these facts ourselves, while looking through the eyepiece. The great galaxy is 2.2 million light years distant. It is 110,000 l.y. wide, and 12,000 l.y. thick. It contains over 300 billion individual stars, and it's mass is equal to about 400 billion Suns. Unlike most galaxies, M31 is approaching us. Each second as you gaze at this island universe, it is getting 300 kilometers closer to you.

Arcturus

Alpha Bootes is a plain star, most often looked at only because it is bright, or to set a right ascension circle. It is worth a longer look however, if you stop to consider it's size. Arcturus is 25 times the diameter of our Sun, and it contains 4 times as much mass. It is one of the few stars whose heat can be measured. The heat output is the same that you would get if you lit a candle and then backed off for 5 miles.

The Companion of Sirius

The "Pup" is a most difficult object to observe, but when the conditions are right, it can be seen in any moderate sized telescope. It is tough enough to concentrate on it's illusive image without a lot of fantastic physics to clutter your mind, but try it anyway. This most famous of the white dwarfs is only 19,000 miles in diameter, and yet it's mass is equal to the Sun's. That's an impressive statistic for a body only 2% the diameter of the Sun. The dog star's pup is also heavy. It is 90,000 times as dense as the Sun, and 125,000 times as dense as water. A cubic inch weighs about 2¼ tons.

Deneb

Deneb is not as large as Arcturus, but it has the herdsman beat for distance. As you look into Cygnus, the light you see from this star has been traveling at 186,000 miles per second for 1,600 years. All just for you to see some summer night! (not really) It is incredible to consider how luminous Deneb must be in order to shine as it does over such a distance. It is, in fact, 60,000 times as luminous as our star, and contains 25 solar masses. The Sun placed at this same distance would appear as a star of magnitude 13.3.

Deneb is the main source of illumination for the famous North America Nebula. In fact, it is lighting up the entire complex of nebulosity that is visible to the unaided eye on any June evening. Alpha Cygni is approaching us at 3 miles per second.

Cygnus X1

Also in Cygnus is an object named HDE226868, or Cygnus X1. There is a 9th magnitude star here, which is an easy target for an amateur telescope. The star is a double system, and it is the invisible companion of this star that is of interest to the philosopher-stargazer. The companion is a black hole, and I need say little more than that to stir interest. Just be careful as you look at this one, or you and your telescope may get sucked up.

The Great Globular Cluster in Hercules

M13 contains 30,000 stars down to the 21st magnitude. These are no little guys either. The Sun at the same distance of 30,000 light years would appear at magnitude 19, so these stars are all very large and very luminous. It is interesting to imagine what the night sky would look like from a planet in orbit around one of M13's central stars. There are half a million such stars here in a great sphere some 200 l.y. in diameter. The whole thing is flying toward us at 150 miles per second. It has been related that if M13's stars were represented as a million grains of sand, each 0.03 inches in diameter, the resulting model would be a sphere 300 miles across, and the individual grains would average 3 miles in separation.

The Lagoon Nebula

This great cloud of gas, dust, and stars measures 60 x 44 light years in volume. It is only 515 light-years distant, and it is receding from us at 5½ miles per second. If you read over the "only" in that last sentence without raising an eyebrow, then you're not in the right spirit for this article. If so, just drive out to M8 and back, and see if you've gained a little more respect for the cosmos.

The Crab Nebula

On the 4th of July in the year 1054, a supernova appeared in Taurus. It was a violent phase in a star's evolution,. and things have calmed down very little since then. Today (in cosmic time-machine terms), the same star that Chinese astronomers recorded over 900 years ago is still being wondered at. It is a super-dense neutron star, composed of a material that we will never be able to see or reproduce. Only in the fantastic conditions of a place like Taurus can this neutron substance exist. The star is spinning around 30 times a second, giving us a flash of radiation with each revolution. The cloud of ex-star

material around it is expanding at 600 miles per second.

It is truly impressive that astronomers can derive all of this without any kind of physical sample or closeup look. They can tell us all of this from 63,000 light years with nothing but some very faint light to work with.

M82

A moderate sized telescope will reveal a mottled structure in this galaxy. Even from your back yard, you can get an idea that something is happening in Ursa Major. The dark lanes that you may observe are not from any spiral structure, but are rather the result of some violent outburst that is (or was) tearing this island universe apart. As the galaxy recedes from us at 240 miles per second, it's own material is hurtling out at another 600 miles per second. Who knows how many civilizations may already be snuffed out in M82?

Well, I must stop sometime, though we haven't yet considered the fascinating mysteries of quasars, or the nature of Sunspots. Suffice it to say that almost anywhere you may look above the horizon, you will find beautiful objects with awe inspiring stories behind them. We mostly ignore this celestial trivia, probably because it is largely beyond mortal understanding, but if you give it a try, you'll soon find yourself exclaiming "WOW!" as you peep into an ocular.

THE EDITOR SAYS...

I haven't edited this bulletin for over twenty years. What I produced then was a single typed page, front and back (almost). It was very chit-chatty, full of local news. I did manage to include lots of graphics, as I was a professional photographer at the time.

Things have really changed since then. About eight years ago, I decided to learn computer programming. Soon, I was infatuated with this ultimate toy!

Now, I can do anything that a large corporation can do. I can process payrolls, I can balance budgets, I can make graphics renditions which Leonardo would swoon over. I can write "official" memos, and I can produce finished books, ready for binding. And all in my basement! The truth is, a computer can do anything except make Béarnaise sauce.

My goal is to produce a publication which will be of interest to any amateur astronomer, club member or not. We have arrangements with *Astronomy* and *Sky & Telescope* magazines to reprint articles which are of interest to our readers. We have contracted with popular authors (who write feature articles for both of the above magazines) for articles which will be written especially for *The Focal Point*. We have found articles in European publications which have not yet been translated into English. Our overseas colleagues are very anxious to have their work printed in the United States.

In short, I am trying to present interesting and original articles to our readers, while having fun with my computer. If you can think of anything I have left out, please tell me about it!