The OBSERVER

The Newsletter of the Twin City Amateur Astronomers, Inc.

July 2003 Volume 28, Number 7

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TCAA Meeting Minutes

—Carl Wenning, Secretary

THE MEMBERSHIP was called to order in the ISU Planetarium at 7:03 PM by TCAA President Daniel Meyer. Sixteen members were in attendance. Dan provided a short summary of recent events. Among these events were the following:

• The June picnic at Sugar Grove Nature Center was attended by about a dozen members. Carl Wenning gave a short presentation dealing with the Challenger Learning Center. Following these events, the membership began an observing session at the observatory that later was attended by additional club members, as well as several individuals from the general public.

• The July public observing session at the SGO was reasonably well attended.

Dan then called for a Treasurer's Report. Treasurer Duane Yockey noted that the treasury is in good condition, with all major bills for the year (insurance, Sky Calendar, Astronomical League, etc.) having been paid. With the balance in the black, Duane noted that the Board of Directors would gladly consider making additional material purchases on behalf of the membership. Members should contact a Board member with requests prior to the next board meeting on August 13th.

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Alignment & Collimation Clinic

Details on P. 3

TCAA Calendar

Saturday, 26 July, 2003, 6:00-8:00 PM, SGO
Alignment and Collimation Clinic (see p. 3 for details)

Monday, 11 August, 2003, 7:00-9:00 PM, ISU Planetarium
TCAA Meeting/Potluck/Movie (see p. 2 for details)

Wednesday, 13 August, 2003, Lewis, Yockey & Brown
TCAA BOD Meeting (see p. 2 for details)

Friday, 22 August, 2003, 6:30-9:30 PM, Panera's & MUO
Field Trip to the Millikin University Observatory (details TBA)

Monday, 30 August, 2003, 8:00 PM, SGO
Special Mars POS (see p. 2 for details)

The Observer

The Newsletter of the TCAA, Inc.

The Observer is a monthly publication of the Twin City Amateur Astronomers, Inc., a non-profit organization of amateur astronomers interested in studying astronomy and sharing their hobby with the public.

TCAA Officers

President	Dan Meyer 309-874-2923 vlf@springnet1.com
Vice-president	Neale Leumkhl 309-378-4335 petrealehm@aol.com
3rd Director	Jim Swindler 309-452-3936 jkswind@ilstu.edu
4th Director	Duane Yockey 309-452-3936 duane@lybinc.com
5th Director	Carl Wenning 309-438-2957 cjwenn@ilstu.edu
Treasurer	Duane Yockey 309-452-3936 duane@lybinc.com
Secretary	Carl Wenning 309-438-2957 cjwennin@ilstu.edu
Property Manager	Sandy McNamara 309-379-2751 SandyMc456@aol.com

The Observer Staff

Editors	Michael Rogers Jean Memken
Production	Benjamin Rogers Sarah Rogers

Editorial Correspondence:
The OBSERVER Editors
2206 Case Drive
Bloomington, IL 61701

Articles, ads, etc., are due by the last weekend of each month. Items may be e-mailed to: mprogers@mac.com, or jmemken@ilstu.edu

Dues

$40.00 per household, per year
$25.00 for members over 60
$25.00 for newsletter only
$ 2.50 for a single newsletter copy

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Dan then announced the following upcoming events:

• Sandy McNamara will hold a telescope alignment and collimation session at SGO on July 26, from 6 to 8 PM. Also addressed will be techniques in the care and management of telescopes. The event will be held rain or shine.

• There will be an Illinois Dark Skies Star Party September 25-28 at the Jim Edgar Panther Creek State Fish and Wildlife Area, 25 miles northwest of Springfield in eastern Cass County. There is a September 1 registration deadline. See http://www.sas-sky.org/ for additional details.

• Astrofest will be held at Kankakee again this year. Astrofest is slated for September 18 - 20, 2003. Additional info can be found online at http://www.chicagoastro.org.

• There will be a joint TCAA/PAS observing session near Mackinaw near the new moon weekend of August 23rd.

• There will be an observing session at Millikin University hosted by Mike Rogers and Dan Miller on Friday, August 22nd. This will replace the members-only observing session held that month.

• With the opposition of Mars on August 27th, the TCAA in conjunction with the ISU Planetarium will sponsor a special public observing session on Saturday, August 30, at SGNC. The beginning time will be 8 PM, and will start with a talk about Mars by Sandy McNamara, perhaps assisted by other members. (Tom Willmitch has consented to the joint venture, and will attempt to garner additional support by holding a special session at the planetarium earlier in the day using, perhaps, the support of a local NASA Solar System Ambassador. Tom will take advantage of the ISU News Service to promote both events.)

• There will be a Board of Directors meeting on August 13, 2003, beginning at 6 PM at the offices of Lewis, Yockey, and Brown at 505 Main Street in Bloomington. The membership is invited to attend, but reminded that their voice is advisory only.

• The next TCAA meeting will be “Dinner and a Movie” to be held in the ISU Physics Department. It will be a potluck, with the TCAA providing the main entrée; Carl Wenning will provide refreshments; Dan Meyer will bring the movie “Forbidden Planet.” The membership will bring a dish to pass, as well as their own dining plates and utensils.

At 7:40 p.m. Carl Wenning, former planetarium director (1978-2001), provided a talk dealing with the summer evening sky constellations. The event came to a close at approximately 8:20 PM.

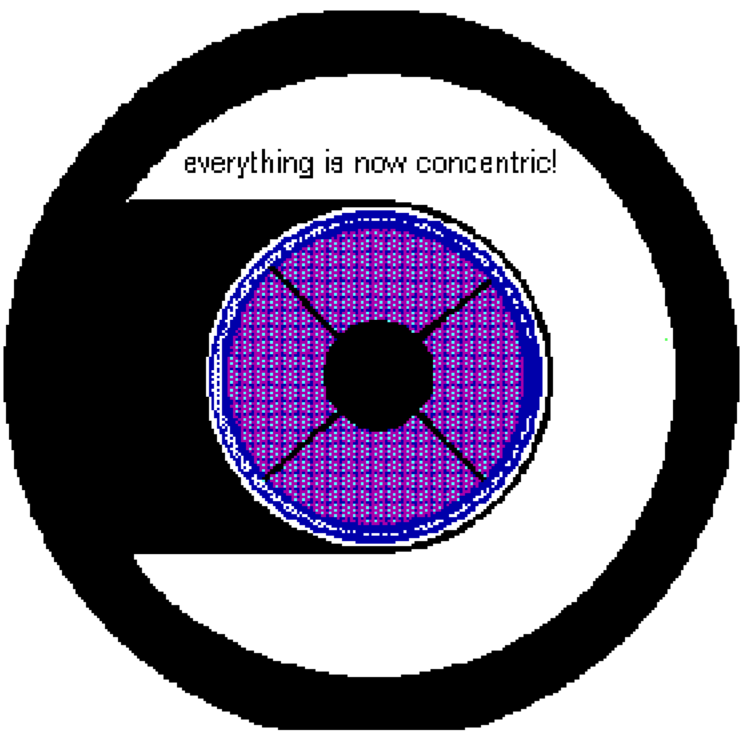
Alignment & Collimation Clinic

Here is a quick quiz to see if you need the A&C Clinic. For each question, give yourself 5 points if you answered a), 10 points for b), and 25 points for c)

1. Do you have trouble aligning your telescope?
a) Yes
b) No
c) What's alignment?

2. Do stars in your telescope look like ellipses?
a) Yes
b) No
c) What does an electronic kiss have to do with astronomy?

Now, total your points from each question. If you scored at least 0, then you need the Alignment and Collimation Clinic, so it's a good thing it's coming right up!



When:	**26 July, 6-8 PM (Rain or Shine)**
Where:	**Sugar Grove Observatory**
Fee:	**Are you kidding?? :-)**
Bring:	**Your telescope (if you have one)**

Dragon Hunting!

— Sandy McNamara

THE CONSTELLATION Draco is a large, winding string of stars that covers much of the northern sky between Cygnus and Ursa Major, almost surrounding the Little Dipper of Ursa Minor. As always, a good star atlas or chart helps to locate the main stars and deep sky objects that follow. Draco, the dragon, has been featured in several popular movies and its meandering star pattern has appeared prominently in some of them. Children, especially those who have seen Braveheart or Harry Potter movies, seem excited when they can find the actual "dragon" in the skies.

Any good tale (or tail?) starts at the beginning and, likewise, the stars that form Draco the Dragon are easiest to trace by starting at its head. Get your bearings by first locating the bright star Vega (almost directly overhead on late July evenings) and gamma UMi (the star marking the outside of the "pan" of the Little Dipper). Almost exactly between them you will find a 4-sided asterism, approximately 4 degrees across in size, which resembles the "keystone" of Hercules. This is the head of Draco, our dragon. Beginners can sometimes confuse the dragon's head with the similar asterism in Hercules -- Hercules's "keystone" is about twice as large and located about 2 fist-widths to the south. From this point, use your star chart to help trace the meandering line of stars north toward Cepheus where it takes a sharp turn at epsilon Dra to head back south and then northwest, curving around the Little Dipper then between the Big and Little Dippers. Draco is a very ancient constellation and has been associated with the biblical snake that tempted Eve and a great dragon worshipped by the Babylonians. He is also the dragon fought by Hercules when he sought the golden apples of Hesperides and in some old star charts, Hercules is depicted with his foot on the head of the dragon.

Aside from its pattern being used for movie scenery, Draco has a place in the history books as the home of **Thuban (alpha Dra)**, which marked the location of the north celestial pole approximately 5000 years ago and during the period when many Egyptian pyramids were being constructed. Due to a phenomenon called "precession" the position of the "north star" changes over the centuries. Actually, the "fixed stars" stay for the most part right where we know them to be today, but the Earth itself tilts to point its north pole (and south pole) to a slightly different place in the sky, like a wobbling toy top, tracing a circle in the sky over a period of approximately 26,000 years. Interestingly, in "only" 15,000 more years, this precession will have continued until the brightest possible "north star" ever will be located near the celestial pole -- the brilliant white Vega, in the constellation Lyra. The Great Pyramid at Gizeh, known for the mathematical and astronomical alignment of its various sections, was constructed in such a way that a shaft in the pyramid is aligned precisely to Thuban on or about 2830 BC. The precision of this alignment of a very narrow and extremely long shaft with what was then the Pole Star is remarkable. To locate Thuban, look for the brightest star half way between the bowl of the Little Dipper (use the star Kochab) and the famous double star Mizar/Alcor at the bend in the handle of the Big Dipper.

For deep sky observers, Draco has a wealth of my two favorite types of observing targets: double stars and galaxies. In addition, it is home for a bright and popular planetary nebula. A sampler for your observing pleasure follows.

The dimmer star at the NW corner of the dragon's head, **nu (24/25) Dra** is a very wide pair that can be split using an 8x50 finderscope or binoculars. About 4 degrees WSW from nu, **mu (21) Dra** is a nice matching double but requires at least 150x to split. Another 4 degrees WSW from mu, **16/17 Dra** is a nice triple star. The distance between star 16 and 17 is 1.5 degrees, easily split into two stars using only binoculars. 17 Dra also has a close companion 3.4" away at position angle 108 degrees that my 8-in telescope shows at 150x. About midway between the dragon's head and the bowl of the Little Dipper is the mag 3 star zeta (22) Draco; its only importance is that it helps to locate the next doubles on our list <g>. **Struve 2155** is an easily split pair of yellow and blue stars found just over 5 degrees due S of zeta, approximately halfway between zeta and 24/25 Dra. To the SW of the double in the same field of view is the orange variable VW Dra which makes a attractive color contrast to the Struve 2155 stars. **Omicron (28) Dra** can be found 4d NE of zeta. Easily split at low power in any telescope, this pair has been reported as orange/green but I see more of a yellow and blue. Heading northward, **Psi-1 (31) Dra** can be found 7 d NNE of zeta, or 3d W of the mag 3.6 star chi (44) Dra. This is a pretty yellow/yellow pair that can be easily split using lower powers. About halfway between Psi-1 Draco and Polaris, **40/41 Dra** are another easily resolvable pair.

NGC 6543, the "cat's eye" nebula, is the showpiece deepsky object in Draco. Look for it 5 degree S of 34 Dra which forms part of a naked eye triangle between Polaris and head of dragon. This planetary nebula is very bright but small - be careful if you are searching with low power because you might breeze past it as a "bright star" if not aware! Its slightly nonfocused appearance and slight bluish color gives it away as our target. In a 6" or 8" telescope at high power, it shows the classic annular planetary nebula shape and reminds me somewhat of the Ring Nebula but twice as bright and only 1/20th the size!

The original "M102" was admitted by Mr. Messier's assistant Mechain to be a duplicate observation of number 101 on his list. **NGC 5866** has been suggested by many observers as a worthy object

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to fill this “missing” spot in the catalog. Located 3 d SW of epsilon Dra, this is one of the fainter Messier objects and can be a challenge in small telescopes. My 8-in telescope shows a small oval galaxy forming a triangle with two stars to its NW and SW; the 12-in telescope more easily shows a bright lens shape.

NGC 5907 (misstated as NGC 5906 in some references) is my favorite type of deep sky object: a bright, extremely edge-on galaxy. You can find it 3 degrees from iota (12) Dra toward Bootes, about 1.5 degrees NE of M102. While beautiful in a 12-inch telescope, this is not extremely bright in an 8-in telescope but you should have no trouble seeing this large lens shaped galaxy as a dim needle of light stretching across your eyepiece field of view.

NGC 5982 is a small, roundish galaxy located sl N of the midpoint between iota and theta Dra. The brightest in an E-W galaxy row it forms with NGC 5981 6’ to its west and NGC 5985 7‘ to its east; the two fainter galaxies usually require dark skies and at least an 8-in telescope for easy visibility. NGC 5982 itself shows up in my 8” telescope as a small round faint nebulosity gradually brightening to a sl brighter condensed core. I had difficulty seeing NGC 5981 in an 8-in telescope under semi-rural skies but **NGC 5985** was visible as an oval nebulosity just E of 5982 in same field of view. It is almost 3x larger but only half as bright as 5982 so may be a challenge in smaller telescopes or more urban skies.

NGC 3147 is a magnitude 11.3 almost face-on galaxy located most easily by moving 4d NE of bright galaxy M82 in UMa, it lies less than 1/2 degree north of a bright mag 6 field star. Look for a small sl oval glow that might be faint in small (4 to 6-in telescopes) but moderately bright in anything larger.

This Hubble telescope image shows one of the most complex planetary nebulae ever seen, NGC 6543, nicknamed the “Cat’s Eye Nebula.” Hubble reveals surprisingly intricate structures including concentric gas shells, jets of high-speed gas, and unusual shock-induced knots of gas. Estimated to be 1,000 years old, the nebula is a visual “fossil record” of the dynamics and late evolution of a dying star. A preliminary interpretation suggests that the object might be a double-star system. The dynamical effects of two stars orbiting one another most easily explains the intricate structures, which are much more complicated than features seen in most planetary nebulae. The two stars are too close together to be individually resolved by Hubble and instead appear as a single point of light at the center of the nebula.

Technical Stuff

Object	Type	RA	DEC	Mag	Size/Sep	Notes
NGC 3147	Gal	10h 17m	+73d 39’	10.7	3’ X 2.3’	
NGC 5866	Gal	15h 07m	+55d 45’	10.0	5.2’ x 2.3’	M102
NGC 5907	Gal	15h 16m	+56d 19’	10.2	12.3’ x 1.8’	
NGC 5982	Gal	15h 39m	+59d 21’	11.1	1.2’ x 0.8’	
NGC 5985	Gal	15h 40m	+59d 20’	11.0	5.5’ x 3.2’	
16/17 Dra	DS	16h 36m	+52d 55’	5.4/5.5	90.0”	PA 194
17 Dra	DS	16h 36m	+52d 55’	5.4/6.4	3.4”	PA 108
Mu (21) Dra	DS	17h 05m	+54d 28’	5.7/5.7	2.0”	PA 42
Struve 2155	DS	17h 16m	+60d 43’	6.8/10.1	9.8”	PA 114
Nu (24/25) Dra	DS	17h 32m	+54d 11’	4.9/4.9	62.0”	PA 312
Omicron (28) Dra	DS	17H 37M	+68D 45’	4.6/7.6	34”	PA 335
Psi-1 (31) Dra	DS	17h 42m	+72d 09’	4.9/6.1	30.3”	PA 15
NGC 6503	Gal	17h 49m	+70d 09’	10.2	6.2’ x 2.3’	
NGC 6543	PN	17h 59m	+66d 38’	8.1	22” X 16”	Cat’s Eye
40/41 Dra	DS	18h 00m	+80d 0’	5.7/6.1	19.3”	PA 232

For those working on varied observing projects: NGC 5866 is on the Messier list. NGC 5907 is on the Universe Club list. Stars 16/17, 17, mu, nu, psi-1, and 40/41 are on the AL Double Star list. NGC 3147, 5866, 5907,5982 are on the Herschel 400 list.

Illinois Dark Skies Star Party, Sep 25-28
— Sandy McNamara

THE SECOND ANNUAL Illinois Dark Skies Party will be held September 25-28, 2003, at the Jim Edgar Panther Creek State Fish and Wildlife Area (JPEC), 25 miles NW of Springfield, Illinois in eastern Cass County, just west of New Salem State Park in Petersburg. This is a fairly new event but people around the central US have been getting excited about it and talking about it possibly replacing Astrofest in the future as a premier dark sky party. Less than a 2 hour drive from Bloomington, it is the closest major star party to our location.

This area boasts some of Illinois' darkest skies. Naked eye views of 6+ magnitude objects are not uncommon. Plans for star party events include guest speakers and presentations, and ATM astrophotography contests. Daytime activities at the park include hiking, biking, fishing, boating, and horseback riding; many of the Lincoln Heritage sites are also nearby. JPEC is also just minutes away from grocery stores, restaurants and shops in the small nearby communities of Ashland, Chandlerville, Newmansville, and Petersburg.

Registration fees of $35/person (age 13 and over; children 12 & under are free) or $55/family must be received prior to September 1, 2003. Attendance will be limited 1000. No registrations will accepted after Sep 1 and no on-site registrations are available. Registration includes the cost of tent camping only at the group camp sites; these sites are non-electric sites. A limited number of cabin bunks are available at $21/person for the weekend. The campground adjacent to the general observing field has 18 sites with electricity and water; another 80 sites have electric only. In order to reserve these particular sites, you must reserve them and pre-register with the Illinois Dept of Natural Resources (DNR). DNR can be contacted at 217-452-7741 or by visiting www.dnr.state.il.us. Please note that the general observing field has NO electric service. Electric is only available at the cabins and RV sites.

Registration forms will be available at the July and August TCAA meetings, at SGO, and can also be downloaded from www.sas-sky.org. More details about the Illinois Skies Star Party, including star party rules, planned events, directions, and information about JPEC, can be found at www.sas-sky.org.

Telescope Collimation
— TelescopeHome.com

TELESCOPE COLLIMATION is the process by which an instruments optical components are brought into precise alignment with its optical axis and mechanical axis.

In other words, telescope collimation is all about mirrors and/or lenses being centered and angled so that light entering the telescope forms a sharp image precisely in the center of the eyepiece. If the optics are not properly aligned, stars will appear not as pinpoints, as they should, but rather as flared, teardrop-shaped "comets".

Collimation Fundamentals

Refractor and Maksutov telescopes are collimated at the factory and generally should not need further adjustment. If collimation does become necessary later, it is best to have it done at the factory, since these telescopes usually possess no user-adjustable collimation settings.

Telescope collimation is more of an issue with Newtonian Reflectors and Schmidt-Cassegrain. Good telescope collimation is particularly critical for "faster" Newtonians, those with f-ratios of f/6 or lower. Once the telescope collimation is set, it will hold if care is taken in transporting and handling the optical tube. However, any sharp jolts can knock the mirrors out of alignment, as can jostling of the scope in the trunk of a car or temperature changes over a period of time. Fortunately, these telescopes are equipped with adjustment screws that permit easy telescope re-collimation.

A common way of telescope collimation is the quick method. This is to simply remove the eyepiece and look down the focuser tube to center the mirror reflections. Unfortunately this is not accurate or a reliable method. For one thing, there is no way to know whether you are looking straight down the focuser tube; your line of sight could be off by a degree or two. Another problem is knowing when the reflections of the mirrors are exactly centered. Just "eyeballing it" isn't precise enough; the reflections may appear to be centered when in fact they are not.

The Collimating Eyepiece will take care of both of these problems, allowing you to achieve precise collimation without "guessing", and thus improve your telescope's performance. You can buy a Celestron Collimating Eyepiece at Adorama for around $34.95.

Testing Telescope Collimation

You can quickly determine whether your telescope is properly collimated. Just point it at a bright star and slowly rack the image out of focus with the focusing knob. If the telescope is correctly collimated, the expanding disk should be a perfect circle. If it is unsymmetrical, the telescope is out of collimation. In reflectors and

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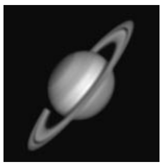
Schmidt-Cassegrain, the dark shadow cast by the secondary mirror should appear in the very center of the out-of-focus circle, like the hole in a doughnut. If the “hole” appears off-center, the telescope is out of collimation.



Collimating a Schmidt-Cassegrain

With Schmidt-Cassegrain telescopes, collimation is best performed using a “star test” but reasonable collimation can be achieved with the Collimating Eyepiece. There is only one collimation adjustment for Schmidt-Cassegrain: the tilt of the secondary mirror. Insert the Collimating Eyepiece directly into the visual back of the telescope.

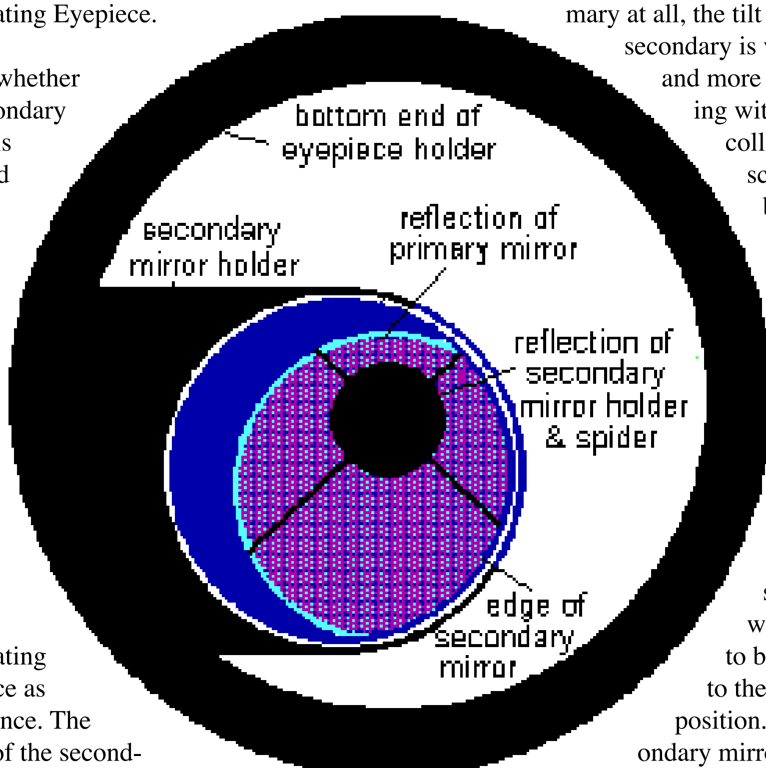
The shadow of the secondary mirror will appear as a dark circle near the middle of the field-of-view. Adjust the three Allen-head screws located in the center of the front corrector plate to center the secondary mirror on the crosshairs. Do not loosen the screws more than two turns, or the secondary mirror could fall off its mount! Likewise, do not adjust the screw in the middle of the secondary mirror cell. It holds the mirror in place.

Collimating a Newtonian Reflectors

With the telescope pointed away from the Sun, look into the front of the telescope tube. Check that the secondary (or diagonal) mirror is positioned in the center of the tube; use a ruler if necessary to measure the distance from the center of the secondary mirror holder to the inside of the tube on different sides. You may have to adjust the spider vanes or stalk. Also, check to see that the primary mirror is centered in the optical tube. A quick visual inspection usually suffices. If the primary is obviously not centered, it will need to be repositioned in its mirror cell.

Next, remove the eyepiece from the telescope. Look down into the open focuser tube. You will see the secondary mirror and mirror holder as well as reflections of the secondary mirror and its holder, the primary mirror, and your eye. It’s pretty confusing. Refer to figure 1 below.

Now insert the telescope Collimating Eyepiece into the focuser and look into the sight hole. You’ll notice that the field of view is narrower than it was when you were looking through the open focuser tube. You’ll also notice that instead of seeing a reflection of your eye, you now see a bright annulus in the reflection of the secondary mirror. The annulus is the reflection of the polished 45-degree flat of the Collimating Eyepiece.



Check whether the secondary mirror is centered underneath the focuser. Use the crosshairs at the bottom of the Collimating Eyepiece as a reference. The center of the secondary mirror should lie right at the intersection of the crosshairs. If it doesn’t, adjust the position of the mirror holder until it is centered. For “spider-type” holders, this is usually done by turning the threaded rod that the secondary mirror mount is attached to. For single stalk-type holders, you may have to bend the stalk to center the mirror. Refer to your telescope’s manual for more specific instructions.

Now you need to adjust the tilt of the secondary mirror so that the entire reflection of the primary mirror is precisely centered in the secondary mirror (and, thus, also on the crosshairs of the Collimating Eyepiece). Use the three telescope collimation screws on the secondary holder to adjust the tilt. The reflection of the primary mirror is centered when there is an even ring of space between it and the outer edge of the secondary mirror. Don’t worry that the reflection of the secondary mirror is off-center; you’ll fix that in the next step. If you do not see the reflection of the primary at all, the tilt of the secondary is way off, and more tinkering with the collimation screws will be necessary. If the mount is a single stalk, you will have to bend it to the correct position. The secondary mirror is now concentric, but the other rings are not concentric. Refer to figure 2 on the next page.

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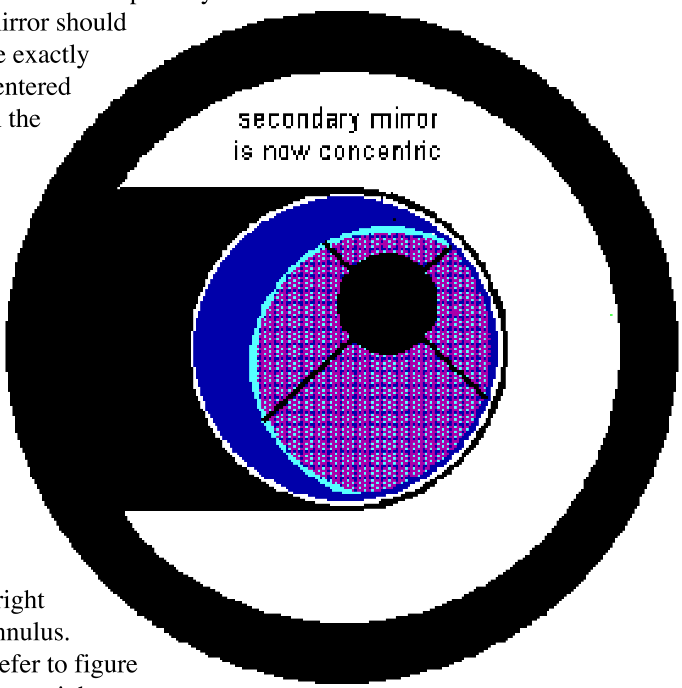
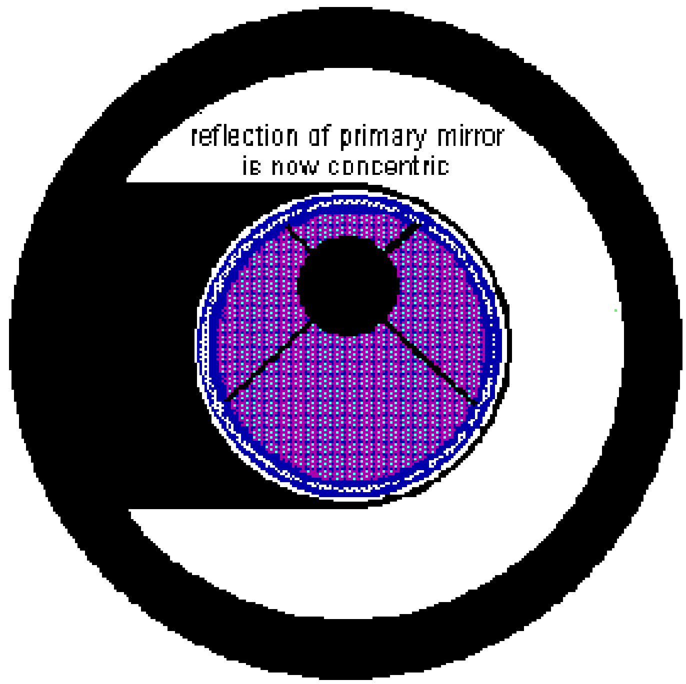
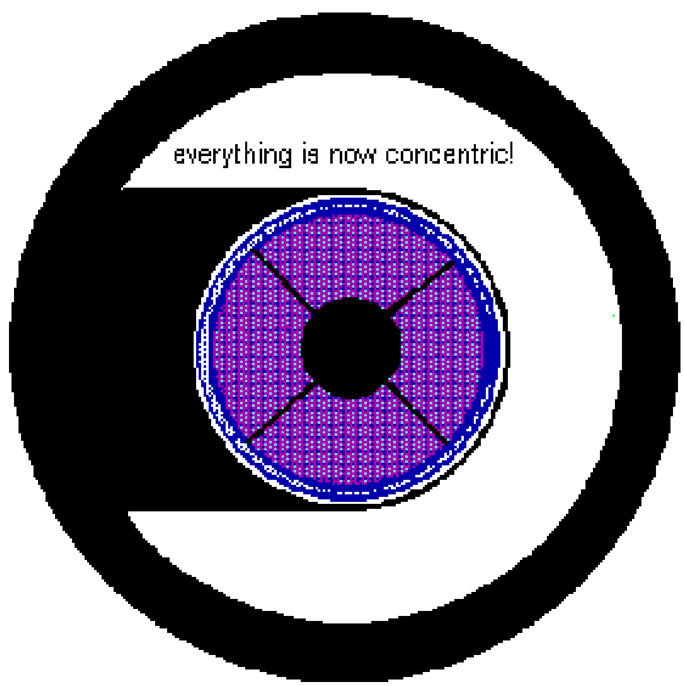
Now it's time to adjust the tilt of the primary mirror. Using the three collimation bolts at the bottom of the optical tube, located behind the primary mirror, turn one at a time until the secondary mirror reflection moves into the center of the primary mirror reflection. The spot in the middle of the primary mirror should be exactly centered in the bright annulus. Refer to figure 3, top right.





Now, the view through the Collimating Eyepiece should resemble the diagram below. The reflection of the primary mirror is centered in the secondary mirror, and the reflection of the secondary mirror is centered in the reflection of the primary mirror. If everything is centered on the crosshairs of the Collimating Eyepiece, the telescope is in collimation -- tuned up and ready for action! The telescope is now properly collimated. All rings are concentric. Refer to figure 4, at bottom right..



Collimating your telescope's optics will become second nature to you when you perform this task on a regular basis.

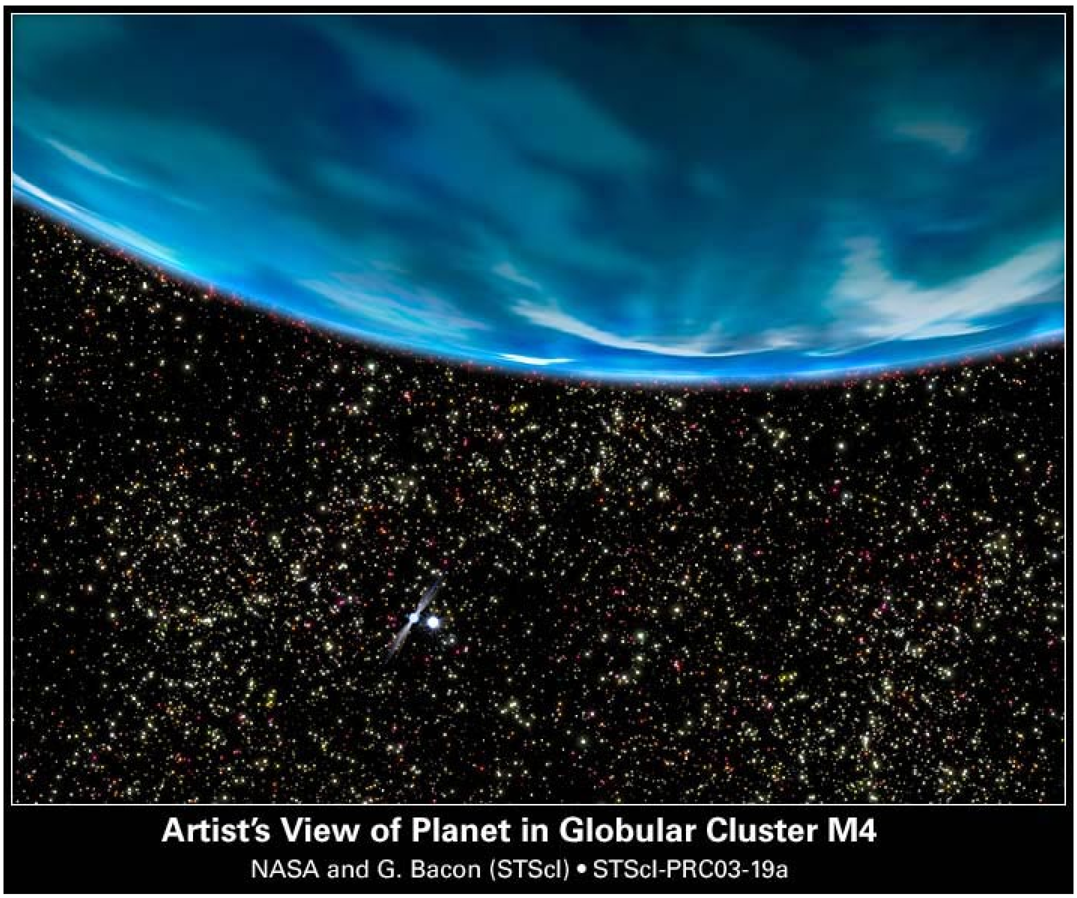
Oldest Known Planet
— StScI

LONG BEFORE our Sun and Earth ever existed, a Jupiter-sized planet formed around a sun-like star. Now, 13 billion years later, NASA's Hubble Space Telescope has precisely measured the mass of this farthest and oldest known planet. The ancient planet has had a remarkable history because it has wound up in an unlikely, rough neighborhood. It orbits a peculiar pair of burned-out stars in the crowded core of a globular star cluster.

The new Hubble findings close a decade of speculation and debate as to the true nature of this ancient world, which takes a century to complete each orbit. The planet is 2.5 times the mass of Jupiter. Its very existence provides tantalizing evidence that the first planets were formed rapidly, within a billion years of the Big Bang, leading astronomers to conclude that planets may be very abundant in the universe.

The planet now lies in the core of the ancient globular star cluster M4, located 5,600 light-years away in the summer constellation Scorpius. Globular clusters are deficient in heavier elements because they formed so early in the universe that heavier elements had not been cooked up in abundance in the nuclear furnaces of stars. Some astronomers have therefore argued that globular clusters cannot contain planets. This conclusion was bolstered in 1999 when Hubble failed to find close-orbiting "hot Jupiter"-type planets around the stars of the globular cluster 47 Tucanae. Now, it seems that astronomers were just looking in the wrong place, and that gas-giant worlds orbiting at greater distances from their stars could be common in globular clusters.

"Our Hubble measurement offers tantalizing evidence that planet formation processes are quite robust and efficient at making use of a small amount of heavier elements. This implies that planet formation happened very early in the universe," says Steinn Sigurdsson of Pennsylvania State University.



A rich starry sky fills the view from an ancient gas-giant planet in the core of the globular star cluster M4, as imagined in this artist's concept. The 13-billion-year-old planet orbits a helium white-dwarf star and the millisecond pulsar B1620-26, seen at lower left. The globular cluster is deficient in heavier elements for making planets, so the existence of such a world implies that planet formation may have been quite efficient and common in the early universe.

"This is tremendously encouraging that planets are probably abundant in globular star clusters," says Harvey Richer of the University of British Columbia. He bases this conclusion on the fact that a planet was uncovered in such an unlikely place, orbiting two captured stars — a helium white dwarf and a rapidly spinning neutron star — near the crowded core of a globular cluster, where fragile planetary systems tend to be ripped apart due to gravitational interactions with neighboring stars.

The story of this planet's discovery began in 1988, when the pulsar, called PSR B1620-26, was discovered in M4. It is a neutron star spinning just under 100 times per second and emitting regular radio pulses like a lighthouse beam. The white dwarf was quickly found through its effect on the clock-like pulsar, as the two stars orbited each other twice per year. Sometime later, astronomers noticed further irregularities in the pulsar that

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implied that a third object was orbiting the others. This new object was suspected to be a planet, but it could also be a brown dwarf or a low-mass star. Debate over its true identity continued through the 1990s.

Sigurdsson, Richer, and their co-investigators settled the debate by at last measuring the planet's actual mass through some ingenious celestial detective work. They had exquisite Hubble data from the mid-1990s, taken to study white dwarfs in M4. Sifting through these observations, they were able to detect the white dwarf orbiting the pulsar and measure its color and temperature. Using evolutionary models computed by Brad Hansen of the University of California, Los Angeles, the astronomers estimated the white dwarf's mass. This in turn was compared to the amount of wobble in the pulsar's signal, allowing the astronomers to calculate the tilt of the white dwarf's orbit as seen from Earth. When combined with the radio studies of the wobbling pulsar, this critical piece of evidence told them the tilt of the planet's orbit, too, and so the precise mass could at last be known. With a mass of only 2.5 Jupiters, the object is too small to be a star or brown dwarf, and must instead be a planet.

The planet has had a rough road over the last 13 billion years. When it was born, it probably orbited its youthful yellow sun at approximately the same distance Jupiter is from our Sun. The planet survived blistering ultraviolet radiation, supernova radiation, and shockwaves, which must have ravaged the young globular cluster in a furious firestorm of star birth in its early days. Around the time multi-celled life appeared on Earth, the planet and star were plunging into the core of M4. In this densely crowded region, the planet and its sun passed close to an ancient pulsar, formed in a supernova when the cluster was young, that had its own stellar companion. In a slow-motion gravitational dance, the sun and planet were captured by the pulsar, whose original companion was ejected into space and lost. The pulsar, sun, and planet were themselves flung by gravitational recoil into the less-dense outer regions of the cluster. Eventually, as the star aged it ballooned to a red giant and spilled matter onto the pulsar. The momentum carried with this matter caused the neutron star to "spin-up" and re-awaken as a millisecond pulsar. Meanwhile, the planet continued on its leisurely orbit at a distance of about 2 billion miles from the pair (approximately the same distance Uranus is from our Sun).

It is likely that the planet is a gas giant, without a solid surface like the Earth. Because it was formed so early in the life of the universe, it probably doesn't have abundant quantities of elements such as carbon and oxygen. For these reasons, it is very improbable the planet would host life. Even if life arose on, for example, a solid moon orbiting the planet, it is unlikely to have survived the intense X-ray blast that would have accompanied the spin-up of the pulsar. Regrettably, it is unlikely that any civilization witnessed and recorded the dramatic history of this planet, which began at nearly the beginning of time itself.

The full team involved in this discovery is composed of Brad Hansen (UCLA), Harvey Richer (UBC), Steinn Sigurdsson (Penn State), Ingrid Stairs (UBC), and Stephen Thorsett (UCSC).

TCAA Treasurer's Report — June, 2003

— L. Duane Yockey, Treasurer

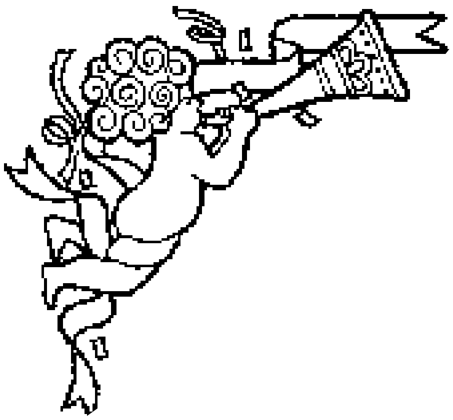
OPERATING FUND BALANCE – May 31, 2003 -		$ 1,182.81
Income		
James Stanlaw (dues renewal) -	$ 40.00	
Gerry Schroeder (dues renewal -	$ 40.00	
Expenses		
Abrams Planetarium (sky calendars) -	$ 211.20	
Astronomical League (annual dues) -	$ 195.50	
OPERATING FUND BALANCE – June 30, 2003 -		$ 856.11

OBSERVATORY FUND BALANCE – May 31, 2003 -		$ 753.91
Income		
Interest (April, May & June) -	$ 0.73	
Expenses		
None	$ 0.00	
OBSERVATORY FUND BALANCE – June 30, 2003 -		$ 754.64

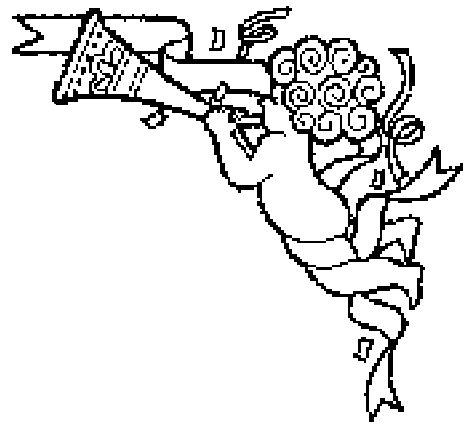
TOTAL TCAA FUNDS – June 30, 2003 - $ 1,610.75

The Welcome Mat

We have new members! We have new members! Did I mention that we have new members? Please give a warm round of applause to yet more Stanfordians...



Forest and Geraldine Appleton
Stanford, IL



The OBSERVER
The Newsletter of the Twin City Amateur Astronomers, Inc.

Michael Rogers & Jean Memken, Editors
2206 Case Drive
Bloomington, IL 61701

Dues Due? ☐

The Dues Blues

If you see a check in the box above, it means **your dues are due.** To retain membership -- and with a new observatory, why quit now??? -- please send $40 to our esteemed treasurer:

Duane Yockey
508 Normal Avenue
Normal, IL, 61761

As always, thank you for your support!!