The OBSERVER

The Newsletter of the Twin City Amateur Astronomers, Inc.

December 2001 Volume 26, Number 12

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Club Notes

— Sandy McNamara

THANK YOU - To Vic & Cindy Connor for hosting the TCAA holiday party. Only a half dozen members were able to attend but all present seemed to have a very enjoyable time.

ANNUAL BANQUET - The annual February banquet was discussed at the December member meeting. It was decided to have the affair at the Sugar Grove Nature Center. The building is being promoted by the SGNC for such purposes and is equipped with all we might need. The banquet will be held in mid-February (on a Saturday date to be determined soon); the main dish will be provided by the TCAA with attendees bringing a side dish to pass. Long time ISU planetarium director and TCAA member Carl Wenning has agreed to give the keynote speech on the fascinating astronomy of Christopher Columbus.

Banquet Keynote Speaker Carl Wenning

ANNUAL ELECTIONS - Don't forget that February is also the time when official yearly election to select the new TCAA board of directors is held. Nominations are being accepted and may be communicated to any TCAA officer. There is no special "expertise" needed to serve on the BOD, merely a willingness to contribute a small amount of time. New members especially are encouraged to consider serving a term your fresh insight is often what is needed to achieve our science education goals

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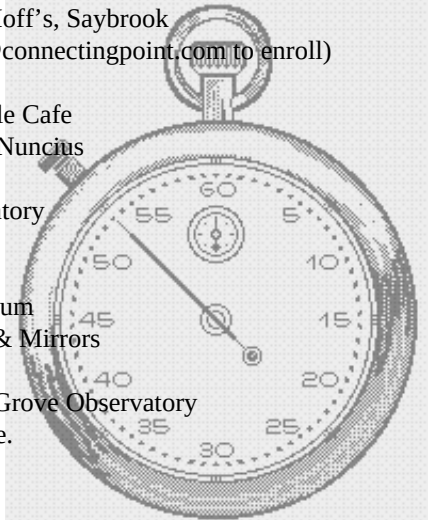
TCAA Calendar



Sunday, 23 December, 7:00 PM, Joseph DeHoff's, Saybrook
ATM Class —"B" Group; Contact josephd@connectingpoint.com to enroll)

Monday, 7 January, 7:30 PM, Barnes & Noble Cafe
TCAA Reading Group: Selection: Siderius Nuncius

Saturday, 12 Jan Dusk, Sugar Grove Observatory
Members Only Observing Session

Monday, 14 January, 7:00 PM, ISU Planetarium
TCAA Monthly Meeting. Topic: Numbers & Mirrors

Saturday, 9 or 16 February, 5:00 PM, Sugar Grove Observatory
TCAA Annual Banquet. Details in next issue.

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.

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Articles, ads, etc., are due by the 1st weekend of each month. Items may be e-mailed to: mprogers@mail.millikin.edu, or jmemken@ilstu.edu

Dues

$25.00 per household, per year
$15.00 for members over 60
$12.00 for newsletter only
$ 1.25 for a single newsletter copy

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while ensuring that the TCAA is meeting the personal needs and desires of its members.

SGO UPDATE - Plans are progressing to replace the aged C14 in the observatory building. Observatory manager Dan Miller is beginning a promotion to raise funds for the purchase and significant donations have already been promised. If you wish to contribute any amount, please contact Dan or treasurer, Duane Yockey. Remember that many companies have matching fund policies for donations to charitable organizations. If you need a receipt for your company to make the matching donation or a letter certifying the TCAA's non-profit organization status, please contact myself, Dan, or treasurer Duane Yockey.

GENERAL MONTHLY MEETING - Meetings are held on the second Monday of each month beginning at 7 PM at the ISU Planetarium. The December meeting was well attended and almost everyone got involved in the lively debate when Vic Connor spoke on the often controversial subject of UFO sightings. The next meeting will be held on Jan 14 when our guest speaker will be Joseph DeHoff of Rabbit Hill Optics. Joe will try to demystify for us the numbers associated with describing optical systems or evaluating telescope mirrors. Even if you don't plan on making telescopes or grinding mirrors, this should help everyone understand what manufacturers are really saying in their advertising claims

TCAARG - The TCAA Reading Group is finishing The Sidereal Messenger by Galileo Galilei and will probably be choosing a new topic at the next gathering. The TCAARG meets the first Monday of each month at the Barnes and Noble coffee shop starting at 7:30 PM; the next meeting will be January 7. Having read the selected book is NOT a prerequisite for joining this informal discussion group.

MOOS The Member Only Observing Sessions are held at Sugar Grove on the weekend nearest new moon. Cold weather will soon be here and the C14 in the domed observatory is a perfect solution for when it might be too snowy to set up your own telescope. If you wish to become a keyholder for the observatory, please contact Sandy McNamara to schedule a training session in use of the observatory and operation of the C14 telescope. There is a minimal $10 keyholder fee which covers the cost of making keys and other small expenses associated with use of the observatory.

POS It was decided at the last member meeting to schedule the Public Observing Sessions (held at SGO on the Saturday closest to first quarter moon) for each month of the year. The availability of the heated facilities at the Nature Center can allow us to present a program even if the weather is not favorable. Attendance at the POS always increases during the season and it is disappointing that we often have to tell those who only discover us in the fall that we are soon stopping for the

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In Memorial

Evelyn Timke, mother of stalwart member Al Timke, passed away on December 4, 2001. Our sincere condolences to Al.

Memorials in Mrs. Timke's name can be made to:

TCAA Observatory Fund
c/o Duane Yockey
508 Normal Avenue
Normal, IL 61701

or

St. John's Lutheran Church
13443 Townline Road
Green Valley, Illinois 61534

This Old Scope: Part I

— Darren Hennig, M.Sc.

If friends are leaving "Please Wash Me" messages on your telescope's mirror or correcting-plate, than you need this article!

IN THIS two-part series on how to breathe new life into old equipment, I will cover such topics as cleaning and reconditioning optical surfaces, cleaning and recoating interior surfaces of telescopes and binoculars, and the introduction of baffling in older scopes, to name a few. I hope this information will be of value to those of you who enjoy a challenge in keeping up older equipment, or properly maintaining existing newer or home-built units as well. Any additional questions regarding the techniques outlined in this series, or any additional information that I might find useful may be sent to me at: dhennig@sprint.ca.

Part 1 - Proper Cleaning of Older Optical Surfaces.

As an amateur astronomy enthusiast of many years, I always try to find new and better ways to improve on many aspects of my hobby. One area which I came into almost right away was "reconditioning" several older telescopes that I received as gifts from family members and friends. As a young lad of 14, my financial resources were, understandably limited, and I needed a way to enhance the equipment I had on hand.

To ensure optimal performance of any telescope system, clean and dust-free surfaces are essential. Every telescope, particularly older ones, have optical surface considerations that make it important to identify which type of cleaning procedure is applicable.

In general, a good to excellent-quality scope has low dispersion glass or fluorite for refractors, or high reflectance aluminum mirrors in Newtonians or catadioptrics. Many of the more modern designs have varying degrees of coatings to enhance light transmission and minimize chromatic aberrations; these coatings also provide additional protection of the optical surfaces. Older equipment may not have this luxury, or the coatings are not as extensive. Vacuum-deposition and sintering have come a long way in 60 years!

The most important first step before attempting a thorough cleaning of your system is to identify (if possible) the type of lens or mirror materials, and whether or not there is some form of coating on them. For refractors, coatings usually appear as a deep bluish-purple color when the lenses are viewed in low light, or at an angle from the optical axis. The deeper the color, the more extensive the coating usually is. For reflectors, the mirrors usually have aluminum coatings, and they may be of the enhanced-reflectivity type - some very old systems may employ silver coatings. Uncoated silver mirrors will exhibit a faint greyish or grey-brown color with time. This is simply oxidation, or "tarnishing" of the surfaces with extended exposure to the atmosphere, and will rapidly degrade the performance of a home-built scope over many years if left unchecked. Cheaper systems may employ acrylic-based "plexiglass" lenses, or have very uncoated aluminum mirrors. If you are not sure of the type of material your equipment has, it is best to consult the manufacturer (if possible), or consult a good camera shop or telescope vendor - they usually have well qualified personnel to assist you in identifying the materials used for the optics of your system.

..Now on to the good stuff - eyepiece and objective lenses first!

The best way to clean your system, once you know what you've got, is to remove the surface(s) you wish to clean, and inspect them thoroughly. Does it have flaws? Are there any obvious scratches or blemishes on the surfaces? It may well be that an older scope may have some "personality", especially if it was poorly treated by its previous owner. Make a note of the wheres and whats for the flaws: they will tell you pretty quickly whether it is worth the attempt. But you'd be surprised what you can do with "old glass"!

For most eyepieces and lens materials made of glass (or better), I recommend using initially a mild soap solution. A good quality dish soap or liquid soap works very well. You may apply the soap directly to the optical surface by pouring it on the surface - DO NOT RUB!! Rinse the surface under a steady low pressure stream of luke-warm tap or bottled water (if your local supply is quite "hard"). Eyepieces usually come in sealed cells - don't open them if it's not necessary! They are usually set up for optimal alignment of the lens components. Run the water over the OUTSIDE top surface first, after applying the soap solution, then gently shake the excess off. Let dry. If an eyepiece has some "fog" after this treatment, some of the moisture may have gotten into the lens cell itself. If the rinsing is performed quickly and carefully, usually

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Fundraising Notes

— Observer Staff

THE club is currently seeking donations towards the purchase of a new telescope for the observatory, a 12" Meade LX-200 GPS. According to chief fundraiser Dan Miller, we have commitments totalling $1,000, or 25% of our goal. If you would like t help in this worthy cause (and remember, we are a registered 501(c)(3) organization, so donations are fully tax-deductible!), please contact Dan Miller (damiller@mail.millikin.edu, or 309-473-3465), or send a check to the TCAA Observatory Fund c/o Duane Yockey (508 Normal Avenue, Normal, IL 61761).

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no hassles are encountered. If you see some "fog", most of this moisture will go away after about 1 hour. If not, apply a low power hair dryer along the body of the cell in a sweeping motion [DO NOT APPLY TO THE LENS DIRECTLY!!]. This should heat up the air inside the cell and should remove the dew on the inside lens surfaces. Hold the freshly-cleaned and dried lens to a small light, or well-lit window: It should be clear of most specks. If the fog or dew remains, the cell should be opened CAREFULLY with a small blade screwdriver (The jewelry types are best). Apply the blade to one of the edge notches of the rear portion of the cell - there are usually between two and three of these on a threaded ring insert on the underside of the cell. Keep firm pressure on the driver and ensure a smooth turning motion of the in Counter-clockwise motion shou loosen the assembly. Slight heat the cell may be necessary to loo ring. Just loosen the insert ring s ly, and allow about 1 hour to see if the fog has disappeared. If not, Then the lens cell should be carefully opened, and the lenses should be GENTLY set onto a generous piece of new, dry, high quality lens paper. [DO NOT TOUCH THE GLASS SURFACES IF AT ALL POSSIBLE!]. If the lens is tricky, or you feel that you won't be able to remove the lenses without touching them, then use a piece of moist lens paper between your fingers and the surface of the lens when removing it.

Kimwipes, used for cleaning of scientific-grade optical surfaces works better than standard lens paper and is the best; This product can be obtained by a local laboratory supply company at a reasonable price. Don't skimp on the lens paper - cheaper, poor quality products tend to pill and collect dust, and may actually scratch the lens or embed small specks that may be difficult to remove. Do not use a soft cotton cloth, or any other fabric either!

Also, make sure you have a clean, large and fairly dust-free working area; no sense going to all this trouble in your garage if a you bump a wrench and have it smash your glass! Take your time, and work carefully. You normally only need to do this extensive cleaning every 10-15 years if necessary, so take the time to do this properly. It IS worth it, especially with uncoated older optics!

When disassembling a lens cell, make sure to set the lens components EXACTLY as they are on the lens paper - this will ensure that you can re-assemble the lens the way it was! If interior surfaces were still foggy, or had specks of dust on them, then apply soap to all surfaces and rinse gently, holding the

rinsing, and allow to dry on a fresh piece of lens paper. Inspect them under light carefully. If some of the surfaces are still "speckled", or have a filmy appearance, then lightly soak a piece of lens paper with a soap solution and GENTLY run it along the surface of the lens, then re-rinse. Most larger dust and grit should have been removed by the initial rinse, so this should remove 95% of the remaining grime on the lens. If you suspect that the grit poses a threat to the integrity of the surface, then repeat the general rinse step again. Use your judgement and some common sense.

After the surfaces are dry, obtain 99% Isopropyl alcohol**, and apply a generous portion over the surfaces of the lens components. If you did not have to disassemble the lens, only apply this on the outside surfaces you have just rinsed with soap and water after allowing to dry for about 15 minutes.

**I recommend using ONLY 99% Medical-grade Isopropyl (rubbing) alcohol as a drying and de-greasing agent; It absorbs excess moisture very well, reduces spotting and streaking, is virtually non-destructive to most plastics and external components of the cell body, and should not degrade the coatings on optics. 70% Isopropyl tends to leave streaks, and ethanol (also labeled as rubbing alcohol) can damage or soften some the plastic housings of some lens cells, and tends to lighten or smear any paint labels on the y. Get the good stuff - read the abel carefully!

After rinsing with the 99% alcohol, allow to dry in air for about 15-20 minutes. The lens surfaces should be VERY clean and free of treaks and smudges. If there are me residual smears, use a lens * [recommended] or a fresh new e of lens paper. Breathe over the ace lightly to fog it slightly, and apply the pen or paper to the area of concern and rub in a small circular motion. Reassemble as necessary. Your lenses are now as clean as they can get without getting them professionally done, for less than $20!!

*the lens pen is an invaluable tool for general maintenance of your optical surfaces, new or old. They run about $10-12, and will provide years of service. Celestron, Optex, and several other companies offer this product, and it is available at most camera shops. It is AWESOME for cleaning virtually any optical surface - if you don't have one, I strongly recommend that you get one!

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Prisms, color filters and binocular optics can be cleaned as above, but I recommend removal of the binocular objective lenses prior to extensive cleaning - it may be difficult to remove any moisture inside the tube assembly, unless the unit is waterproof! I often clean any new optics as well (before using them). Then I'm certain of their condition prior to use.

...Now, for all you Newtonian fans - Mirrors!

The procedures described above are applicable to mirrors as well - the exception to this is applying a lens pen after the 99% isopropyl alcohol treatment. I recommend AT LEAST two good medium-pressure soap and water rinses for very dirty aluminum-coated mirrors before the alcohol. If after the soap rinses there are still "schmootz" on the surface, moisten a fresh piece of lens paper or KimWipe with clean soapy water, and apply to the surface gently. Leave this on the surface for about 10 minutes, then remove it carefully, and rinse. If the spots are very stubborn, then VERY GENTLY run a moist [and soapy] fresh piece of lens paper over the surface. I must emphasize that most mirrors are not heavily coated, and may be scratched much more easily than lenses. Use your common sense and discretion with the last procedure, but if done with "TLC", this should work very well for 99% of those stubborn spots. Apply 99% isopropyl alcohol after allowing to dry for 10-15 minutes, shaking off the excess carefully.

The Subaru telescope, on Mauna Kea, being cleaned using $C0_2$ (don't try this at home, kids!). This monthly procedure is necessary to safely remove volcanic ash.

Aluminum-coated mirrors of virtually any age and type should be extremely clean and free of blemishes after this treatment. If any residue still remains after the above procedure, use EXTREME caution with a lens paper or lens pen in removing the smudge. Breathe lightly on the area of concern, and rub carefully the area, again using small circular motions.

For you "do-it-yourselfers", and those with silver-coated primary mirrors, I recommend a different procedure:

First, rinse the surface with soap and water, and rinse. Allow to dry. Repeat as necessary to remove dust and dirt from the surface. Next, obtain a clean ALUMINUM cake pan, wide and deep enough to immerse the mirror assembly up to the middle of the glass body of the mirror. Use a kettle to heat water almost to boiling, and pour into the pan. Add a water-softening agent, such as Calgon, into the water and stir. Let cool for about 2 minutes. SLOWLY immerse the mirror, ensuring that the outside edge of the surface comes into contact with the aluminum pan. If you have a glass one, clean it first, then use a generous amount of ALUMINUM foil. Pre-rinse the foil with soap and water and take care to keep it as flat as possible. lay it in the pan gently to ensure the surface of the foil (dim side up) won't scratch the mirror surface when it is resting on it! Leave the whole mess for about 5 minutes. Some bubbling of the solution may occur. This is natural, so don't panic! Depending on the degree of tarnishing, you may even notice a slight sulfur smell - this is normal. What is happening is that you've created a galvanic cell: The oxide and sulfides of sulfur are being reduced back to metallic silver, and the aluminum in contact with the mirror is being oxidized. The Calgon is complexing with the aluminum and sulfide ions, keeping them in solution. Electron transfer is occurring at the junction of the two surfaces! The higher the water temperature, the faster the reaction, but given the fact that you don't want to crack the mirror blank, you may only want to use warm water; 40 to 50 degrees Celsius works well. Then inspect the mirror - any grey silver sulfide (tarnish) should have been removed, and you should have an optically sound mirror again. If you need to repeat the procedure for a heavily-tarnished mirror, go ahead. You are not losing silver, but preserving it. Rinse clean after the process has com-

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A Holiday Sky Tour

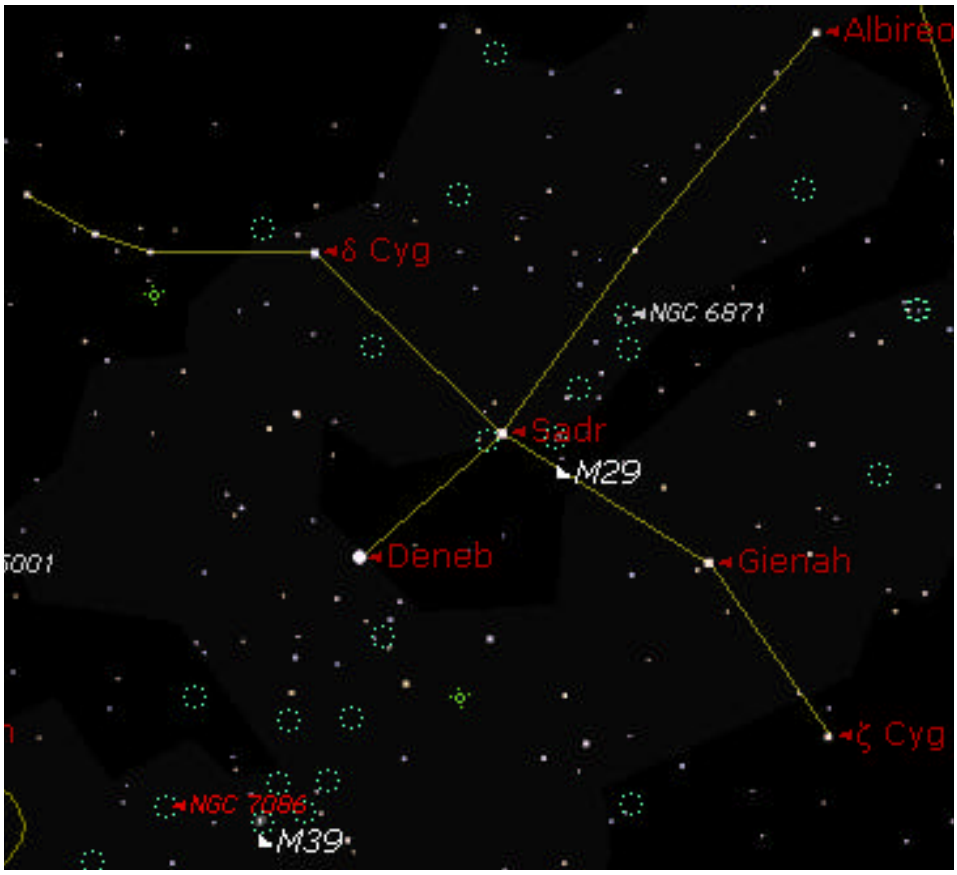
— Sandy McNamara

THE CONSTELLATION Cygnus is often called the Northern Cross. The symbolism is particularly appropriate during the Christmas season when the cross stands upright in the evening on the northwestern horizon. M 29 can be found about 1 degree below and left of the middle of the cross. It should be visible in binoculars as a small fuzzy spot almost lost in the Milky Way. Easily resolved with any telescope, I see its brighter stars in a double arc forming an "X" form that somewhat resembles a butterfly.

M39 is a large open cluster that I think is more attractive in binoculars than through the telescope. Approximately 10° NE of Deneb (or almost straight "up" as it sits on our winter horizon), at the end of an arcing line of 3 mod bright stars. In the telescope, this is a pretty cluster of fairly bright stars that will fill much of the field of view in a mod power eyepiece.

While in the area, move 3° north of M39 to locate NGC 7086. Using binoculars or a magnifying finderscope, you should be able to pick out what appears to be a small knot in the Milky Way. My 8-in telescope at 68 x shows a loose open cluster of 50+ faint stars in an irregular pattern covering almost 1/4 the field of view.

Possibly related to reindeer and as invisible as Santa Claus in the night sky is the constellation Monoceros, the unicorn, located just east of Orion. I guess it might be appropriate that it is here we find the



Christmas Tree Cluster, NGC 2264. Point your telescope with a low power eyepiece just north of the midpoint between alpha CMi (Procyon) and alpha Ori (Betelgeuse) to find this open cluster/nebula. Although best known as the Christmas Tree Cluster, I see this large, loose grouping of 40+ stars as looking more like an acorn. Three main lines form the nut of the acorn with a cap to the north. I usually cannot see the associated Cone Nebula in our local skies.

We wind up our holiday tour by turning toward the constellation Cancer, rising in the east around 7 PM on Christmas Day and high in the sky by the time Santa makes his rounds after midnight. The crab hosts another object appropriate for the season. Visible to the naked eye as a misty spot about 15° east of Gemini's twins Castor and Pollux, this open cluster was the only universally recognized "nebula" before Galileo turned his new telescope on it and revealed its stellar nature. Comprised of over 350 stars, the most popular name for this pretty group is the "beehive" but its proper name is Praesepe (pree-SEE-pee) which means "manger". The two nearby stars (to the NE and NW) are called "the donkeys", presumably eating hay from the manger. Due to its large size, this cluster is best viewed with binoculars, which is good because I, for one, am freezing by this time!

Object	Con	Type	RA	DEC	Mag	Size
NGC 6913, M29	Cyg	OC	20h 24m	38d 32m	6.6	7'
NGC 7086	Cyg	OC	21h 31m	51d 35m	8.4	9.0'
NGC 7092, M39	Cyg	OC	21h 32m	48d 26m	4.6	30.0'
NGC 2264	Mon	C/N	06h 41m	09d 63m	3.9	20'
NGC 2632, M44	Cnc	OC	08h 40m	19d 59m	3.1	95.0'

Note for those of you working on various observing projects: NGC 6913, NGC 7086, and NGC 2632 are on the Messier and binocular Messier lists. NGC 2264, NGC 2632, and NGC 7092 are on the Urban observing list. NGC 2264 is on the Deep Sky Binocular observing list. NGC 2264 and NGC 7086 are on the Herschel 400 observing list.

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pleted to satisfaction, then rinse immediately with generous amounts of 99% isopropyl alcohol. Let dry. Awesome, hey?! Try it!

The general populous tends to want to repolish a surface. This practice removes the silver, often reduces the quality of the surface finish, and eventually recoating becomes necessary. This cleaning and maintenance procedure should provide many more years of service from a silver mirror, but eventually, some polishing and recoating may be eventually necessary (the cons of a silver mirror!)

..Finally, Plastic or Plexiglass optics!

These surfaces should be cleaned with soap and water, then dried. Light dusting with a lens pen or paper can be done, but lower-quality plastic lenses tend to fog permanently with repeated applications of alcohol, especially ethanol and methanol. Don't attempt this if you are unsure! You may permanently degrade the performance of the scope or binocular, making it less than fun to use!

I hope these techniques will provide all enthusiasts of the hobby many years of enjoying "optimally clean" optics. The proof of these procedures is in the pudding: I continue to use a 48 year old 100mm reflector at near theoretical resolution. When I got the scope, the mirror had about 4mm of dirt and dust on the surface; the eyepieces (minimal coatings!) were dirty, and had dust specks inside the lens cell assembly. Both are as good as new, and continue to add to my enjoyment of the hobby. I also re-conditioned several old silver mirrors, all of which performed better than when I first got them! What can I say?!

Finally, I would like to say that cleaning of optical surfaces is always important for continued satisfaction of use for observing equipment. Although the above techniques are somewhat labour and time intensive, they ARE worth the effort in the long-term. It may only be necessary to perform this level of cleaning once every 5-15 years, depending on the upkeep of the equipment and how it is stored when not in use. Regular general maintenance should involve lightly blowing dust off the optics, occasional use of a lens pen to remove small smudges on eyepieces, and perhaps annual rinsing of Newtonian mirrors. Once clean, much less effort is then required for regular upkeep. I must emphasize that being over-zealous on keeping optics clean can be worse than doing nothing at all - do what is necessary, then relax and enjoy! Nothing can be done about heavily-damaged or scratched surfaces, however, and sometimes these must be accepted as is - I have noticed a definite improvement in performance of a mid-priced refractor with slight scratches on the objective lens after proper cleaning!

...That 'old glass' may still have some gas...

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year. 2002 will be a test year in that we will be seeing if we can bring enough members of both the club and the public out to continue our presentations in colder weather. Next year's schedule will be published soon and members asked to volunteer specific dates to help coordinate having enough members and telescopes on hand to hold the presentations.

The (Unofficial) TCAA Membership List

— Observer Staff

THIS the December issue, which means its time to publish the (unofficial) TCAA membership list, so you can see who your fellow TCAAers are, and how to get in touch with them in case, swept up in the spirit of the season, you feel the urge to send them expensive holiday gifts (or just want to go observing, as you see fit). The list is unofficial, because it is based on the Observer mailing list; the official TCAA list is maintained by our esteemed secretary, Duane Yockey. If you happen to notice any errors or omissions, please let one of the editors know, so that we can make the appropriate corrections.

Just to save you the trouble of counting, there are 77 subscriptions, including 2 complementary ones.

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Letters to the Editor

— Observer Readers

Need to get something off your chest? Drop us a line!

The Observer Editors,
2206 Case Drive,
Bloomington, IL 61701-1474

or mprogers@mac.com

Buy, Sell & Rent: The TCAA Classifieds

For Sale: Orion Explorer 90mm Altazimuth Refractor

Looking for a (very) last minute holiday gift, or something exciting with which to ring in the new year? Consider a 7 month old, *mint condition* Orion Explorer 90 mm.

This f/10, 910 mm focal length telescope comes with

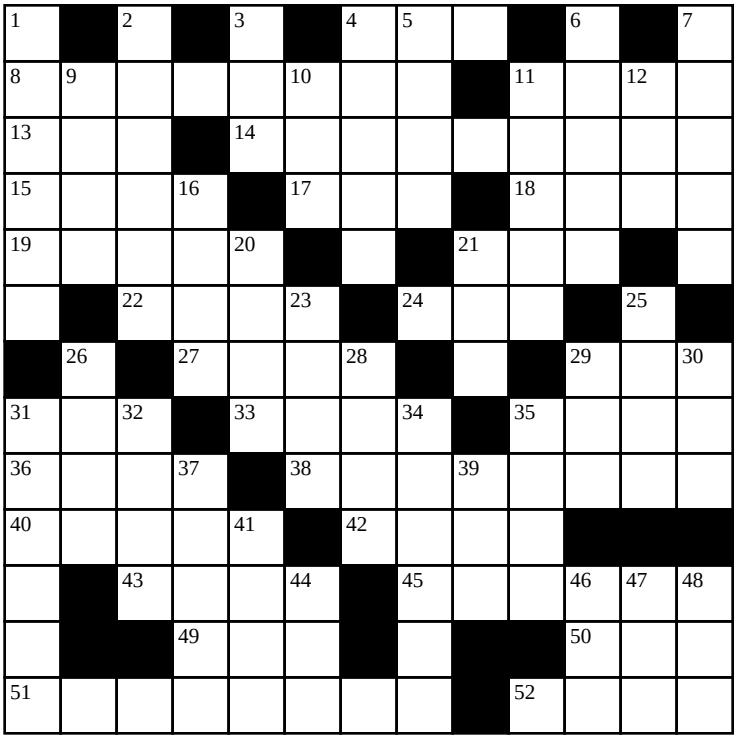
- 45• correct-image prism diagonal
- two fully coated 1.25" Kellner eyepieces of 25mm & 10mm (36x and 91x)
- aluminum dew/glare shield
- dust cap
- cast-aluminum tube rings
- adjustable aluminum tripod w/ stabilizing center brace/accessory tray
- weight: 15.8 lbs

Price? New: $299. Asking: $200

For further info contact Kal Kumar (kalyanaraman.kumar.h2ou@statefarm.com)

The Observer Crossword

—Observer Staff



ACROSS
4 Pull laboriously
8 A country founded by Lu; the length of a complete lunar cycle
11 Sound of a cat
13 Globe
14 The study of inflection
15 Reddish brown chalcedony
17 Consume
18 Authenticating mark
19 Snow conveyance
21 Watch pocket
22 Fresh-water fish
24 An atom bought with a Mastercard?
27 Tibetan oxen
29 Speak
31 An urban area
33 2nd Greek letter
35 Spherical cloud surrounding the head of a comet
36 Narcotics agent
38 Portable electric jigsaw
40 Expression peculiar to a language
42 2nd Greek letter
43 Send forth
45 Loose outer garment
49 Period of history
50 Anglo-Australian Observatory, for short
51 The nearest star - Alpha ...
52 Booth

DOWN
1 Eyepiece of Austrian origins
2 Not mated
3 7th Greek letter
4 The Milky Way belongs to this group
5 Single entity
6 aka Alpha Cygni
7 Bulge
9 Mountain range
10 Frozen water
11 One of the families of sub-nuclear particles
12 Wood sorrel
16 June 6, 1944
20 Strike breaker
21 Enemy
23 Supplements
25 Ancient town in N Africa
26 Toward the mouth
28 Thrust with a knife
29 Distress signal
30 Brief deviation from a straight course
31 Uniting
32 Soft cheese
34 Italian solar physicist, director of the Arcetri Observatory
35 A complaining nebula
37 Heavenly body having a tail
39 7th Greek letter
41 Gigantic star in Cetus
44 19th Greek letter
46 Anglo-Australian Observatory, for short
47 Worthless piece of cloth
48 Female deer

The Welcome Mat

Three new members swell the ranks to... well, a really large number! A warm December welcome to...

John & Sue Rehtmeyer
McLean, IL

Rachel Jannusch
Shirley, IL

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

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

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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 $25 to our esteemed treasurer:

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As always, thank you for your support!!