

The OBSERVER



The Newsletter of the Twin City Amateur Astronomers, Inc.

May 2001 Volume 26, Number 5

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Three is the perfect number...

Beginner's Corner **Variable Stars I**

—Michael P. Rogers

As with most Beginner's Corner articles, this is geared towards the novice astronomer. It is an elaboration of a lecture delivered to the Society of Physics Students at Millikin University on May 11, 2001.

SINCE time immemorial, people have been cognizant of changes in the night sky. Some of these changes are stately and predictable: the moon's phases, and the planets' positions, for instance. Other changes are more dramatic and seemingly unpredictable:



the appearance of comets or meteors, or an occasional "guest star" or nova. But stars form the preponderance of objects in the night sky — and these seem to be glued in place, like jewels on a transpar-

ent sphere, swept along with machine-like precision across the night sky over the course of the night and over the years.

Not all stars appear to move in the night sky, however. One star in particular appears to be fixed in place. When Mark Antony

continued on p. 6

June + Ants + Bullwinkle
= TCAA Picnic/MOOS Extravangaza!

p. 3

TCAA Calendar

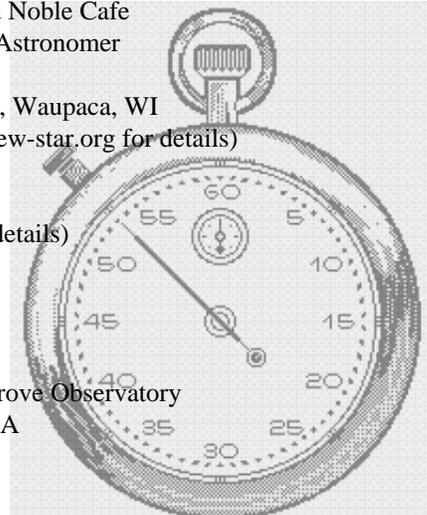
Monday, 4 June, 7:30 - 9:00 PM, Barnes and Noble Cafe
TCAA Reading Group. Selection: Brother Astronomer

June 15-17, 2001, Hartman Creek State Park, Waupaca, WI
Wisconsin Observers Weekend (See www.new-star.org for details)

Saturday, 16 June, 2001, 5:00 PM, SGO
TCAA Annual Summer Picnic (see p. 3 for details)

Saturday, 16 June, 2001, Sundown, SGO
Members Only Observing Session (MOOS).

Saturday, 23 June, 9:00- 11:30 PM, Sugar Grove Observatory
Public Observing Session. Coordinator: TBA



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

Messiers for May

— Sandy McNamara

AT LAST, warm nights are back with us. With luck, we will receive all of the rain we need for the local crops and gardens in nice little showers between 8 AM and Noon (we can dream, can't we?). This time of year, you can find the "winter" constellations in the western sky at sunset, the "spring" constellations up high in the south, and the "summer constellations rising in the east before bedtime. Unearth your planisphere or beginner's star map and see how many you can trace out across the skies. With the telescope this month, we're merely going to hunt up a few Messier objects. Then I suggest you simply sit back and enjoy the pleasant late spring night while you identify all of the constellations you may have not said hello to in awhile.

May is still prime galaxy season but we're going to avoid the dimmer galaxies cluttering the main Coma/Virgo area for the moment. First, you need to identify the main stars in western Virgo. Find bright Spica (remember: "Arc to Arcturus and Spike to Spica"?); you will notice that it falls at the bottom of a large "Y" of naked eye stars which heads north and west. The star that joins the two arms of the "Y" is gamma VIR. Moving up the eastern (left) arm of the Y, the brighter naked eye stars fall almost evenly about one fist length apart and are, in order, delta VIR, epsilon VIR, and alpha COM.

To find galaxy M49, start at epsilon VIR then move 5 degrees W to rho VIR, a wide finder scope double star with 27 VIR to its NW. M49 is 3d W and 2d S of rho VIR; look for a bright, moderately large, round glow. Galaxy M61 is 2d W and 3d S of M49. While in the area, move another 1d NNE from M61 and check out the double 17 VIR; what color would you call the fainter companion?

One of the few non-galaxies in this area, globular cluster M53, may be found 1d NE of alpha COM. A welcome break

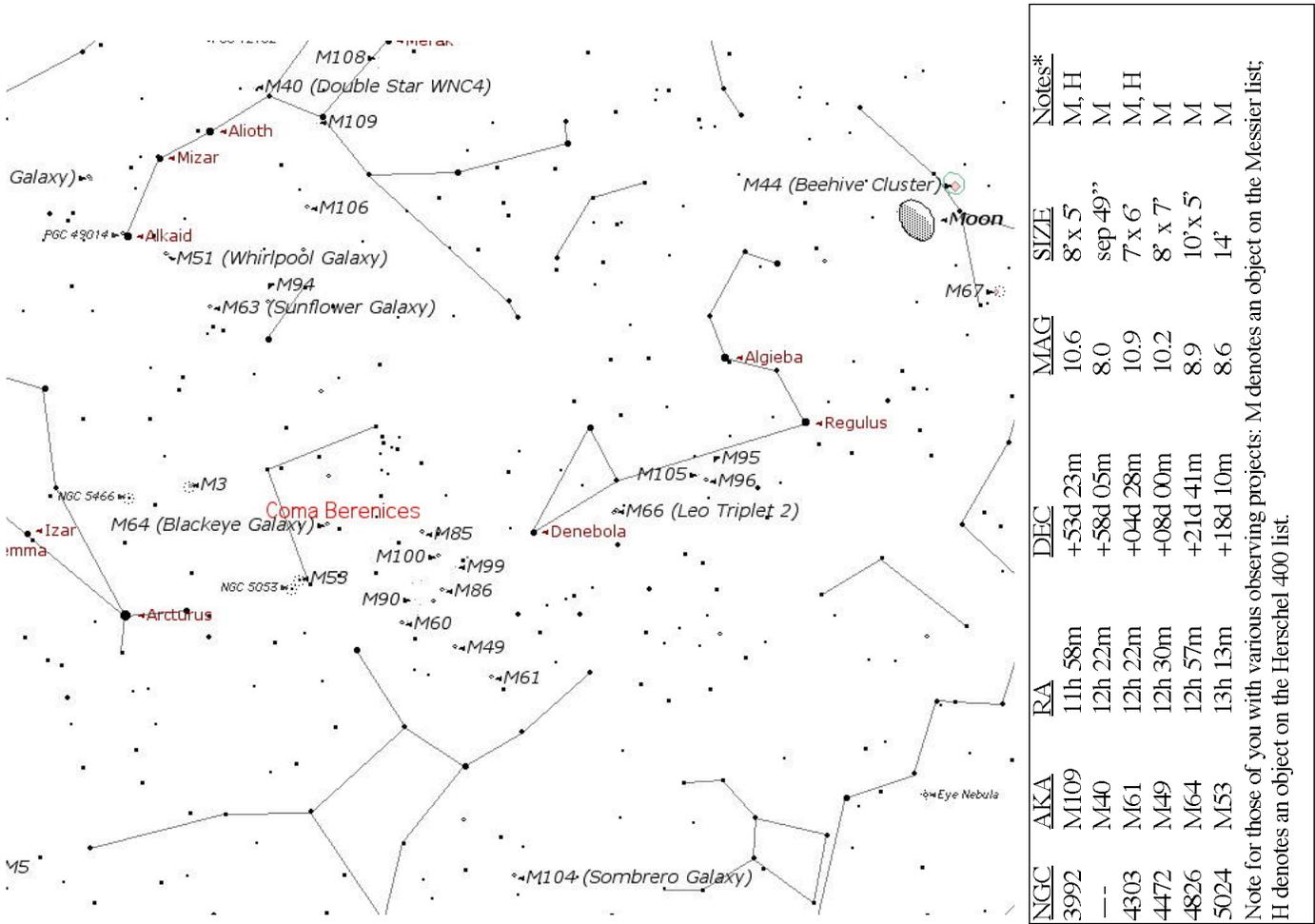
from dim galaxies, this shows up easily as a dim fuzzy spot in an 8x50 finder scope or binoculars. Half the size and 2/3 as bright as spectacular globular M3, a moderate sized (6 to 8-inch) telescope should show a round glow, brighter toward the center with a semi-resolved granular texture and possibly a few stars resolved around the edges. M64, the "black eye galaxy", may be found 3d W and 2d N of alpha COM; don't expect to see the dark lane giving this galaxy its name unless you are using a large telescope. My notes describe it as moderately large and bright, elongated NW-SE.

We have two not-too-difficult challenges this month. M40 consists of only a pair of stars located 0.5d NE of the 5th magnitude star 70 UMA (in turn found about 1d NE of delta UMA, the star which joins the pan of the Big Dipper to the handle). The duo is of little astronomical interest, but see if you can find them if only to be able to brag that you completed the ENTIRE Messier list. With a separation of 49 arc seconds, this pair of 9th magnitude stars with the fainter of the pair to the east is split easily using a 3-in telescope at 36x. Our buddy Chuck (Messier) admitted that he saw nothing nebulous here, but put it in his catalog simply because earlier observers had listed something fuzzy here and he wanted to clarify that it was NOT.

The galaxy M109 may be found 1d SSE of gamma UMA (the lower left star in the "pan" of the Big Dipper) and, contrary to some reports, it *was* still there the last time I looked <g>. M109 is one of the more difficult Messier galaxies to observe due to its low surface brightness and almost face-on orientation. However, you don't need a large telescope but only dark skies and good dark adaptation to spot its dim glow; be sure bright gamma UMA is outside of your eyepiece field of view. My 8-inch shows a sl irregular oval glow oriented ENE-WSW.

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TCAA Annual Picnic

What: Annual TCAA Summer Picnic

When: Saturday, June 16, 5 PM (Pre-MOOS)

Where: Sugar Grove Nature Center:

Why: Because we need the rain :-)

Please bring your own dinnerware, and a side dish or dessert to share. TCAA will provide drinks, and hot charcoal grills for you to cook your own hamburger, soyburger, filet mignon, or whatever you wish to bring. The picnic will be held rain or shine since a nice shelter is available. If skies are clear, it is hoped that everyone can stay to enjoy the MOOS.



Astronomy Day Roundup

- Michael P. Rogers

ANOTHER successful Astronomy Day has come and gone, but unfortunately the images on these pages do not do it justice. For not only did we put on a stellar presentation at the mall, but during the evening we hosted an observing session at the Sugar Grove Observatory, that turned out to be one of the best attended regular sessions in recent memory. Whether it was the good weather, the brochures that we handed out at the mall, or Tom's efforts at the ISU Planetarium, we were absolutely, positively, swamped — hundreds of people showed up (yes, you read that number correctly). It is true that we have attracted more people when a comet was in the sky, but this surely set a record for regular sessions. Kudos to everyone who helped out throughout the day and night — you know who you are — to make this one of our best Astronomy Days ever!

And now, one sad coda to this happy day. We had to adopt, adapt and improve, as the saying goes, during the “Who Wants To Be An Astronomaire?” contest. Consequently, at Jim's behest, we, ahem, gave away a few too many t-shirts — including those promised to members. What's worse, CTee's didn't give us exactly what we ordered. When the dust settled, I was left with 3 large black t-shirts, 1 black x-large polo shirt, and 1 red large polo shirt.

So, if you ordered one of these, let me know and I can deliver it; if you ordered something else and didn't get it, please fill in the form on p. 8 and I'll place another order shortly. You can get a hold of me via e-mail (mprogers@mail.millikin.edu) or via telephone (309-828-8655).

Sorry for the confusion — but at the end of the semester, it's a miracle that I even remembered to *order* them .



A bountiful collection of telescopes, tastefully arranged, attracted visitors' attention.



A few quiet moments before the mall opened.

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The software corner never fails to attract attention...



... nor does Joseph DeHoff, mirror-grinder extraordinaire!



WGLT's Jim Browne, grilling a "Who Wants To Be An Astronomaire?" contestant



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described Caesar “as constant as the Northern Star”, he was referring to the fact that this one star, also known as Polaris, does not appear to move; and that all the other stars pivot around it.

But, there is an irony to Shakespeare’s statement for two reasons. First, although Polaris appears to be fixed in position, it does not form the exact center about which all stars rotate; and secondly, although Polaris appears to look the same from night to night, it varies, ever so slightly, in brightness. Polaris is a minor example of what is known as a variable star.

What is a variable star? For the record, “variable” means something that is “likely to change or vary; subject to variation; changeable; and “star” means “a self luminous celestial body consisting of a mass of gas held together by its own gravity in which the energy generated by nuclear reactions in the interior is balanced by the outflow of energy to the surface...”. Put these two together and you have a variable star — a star that changes in brightness over *time*.

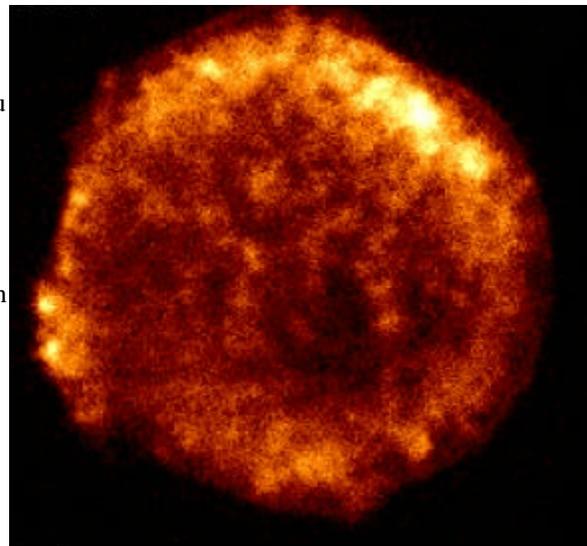
There are two main types of variable stars. The first we will call aperiodic stars, stars that vary in brightness in an irregular fashion.

Perhaps one of the earliest recorded examples is known as Tycho’s star. In 1572, an astonishing and nearly unprecedented event occurred — a new star appeared in the constellation Cassiopeia. This undoubtedly unsettling phenomenon was dutifully studied by no less a luminary than Tycho Brahe — a

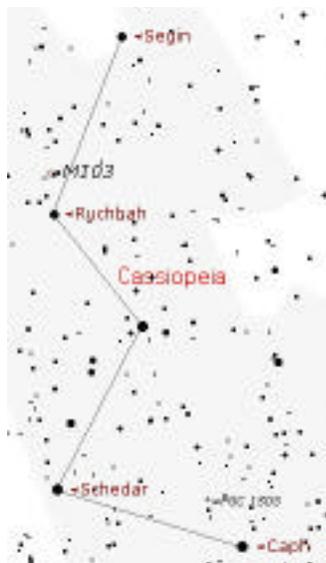
renowned astronomer whose observations of planetary positions enabled Kepler to deduce the true nature of planetary orbits (ellipses, not perfect circles). As it transpired, one did not need to be a renowned astronomer to see this star — it was bright enough to be seen in full daylight. After 16 months, it faded out of sight, never to be seen again with the naked eye.

If you were to look today at where Tycho’s Star appeared, you would see “Tycho’s SNR”, shown here as imaged by the ROSAT HRI. Just to keep you in suspense, I won’t yet divulge the meaning of “SNR”. ROSAT HRI is an acronym for the Rontgen Satellite’s High Resolution Imager.

ROSAT was designed to observe in x-ray wavelengths.



Tycho’s SNR, as imaged by ROSAT HRI



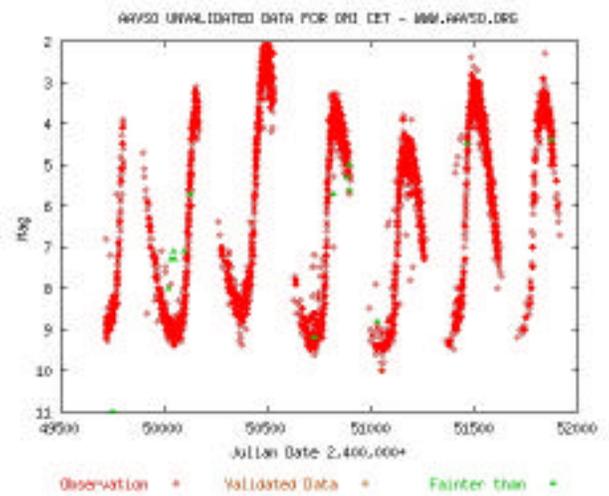
Cassiopeia, home to Tycho’s SNR

Twenty four years after the appearance of Tycho’s SNR, a friend of his, David Fabricius, saw a new star in Cetus, which vanished... but then came back! Omicron Ceti, aka Mira (short for “Miracle”) disappears and reappears on an approximately yearly

basis. In fact, it is possible to plot Mira’s brightness, and the periodic nature of its variability becomes clear. Mira is an example of a *periodic* variable star.

A word or two about this plot. It represents data from January 1, 1995, to January 1, 2001. Most of the data you see here was amassed by amateur astronomers, and compiled by the American Association of Variable Star Observers (AAVSO), about which we will have more to say later.

One of, if not the most important of the periodic variable stars, is a particular subspecies known as a

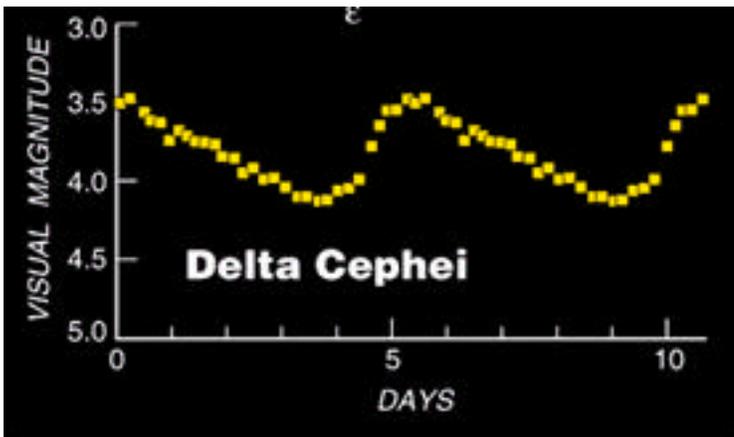


Mira’s Light Curve

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Cepheid Variable. The prototypical Cepheid variable was Delta Cephei, discovered in 1784 by John Goodricke. This star changes only by a magnitude, and never disappears. It might seem uninteresting, yet it profoundly altered the course of astronomy, as we shall see.



The light curve shown here indicates that Delta Cephei, over the course of 5 days, diminishes in brightness by half a magnitude. But what does that mean, exactly? We've been discussing brightness and magnitude in an informal sense, but now we need to pin those terms down.

Brightness means exactly what you were taught in grade school. To quantify brightness we use *magnitude*, a measure of brightness that comes in two varieties: apparent magnitude (*m*) and absolute magnitude (*M*). Apparent magnitude is the brightness that a star appears to have, and that, obviously, depends on distance. A star that appears moderately bright might emit prodigious amounts of energy, but be diminished by tremendous distance; or, it might be quite feeble but rather close. To bring this concept down to Earth, a moderately bright pinpoint of light seen at night might be a halogen monster flashlight twenty kilometres distant, or a small penlight flashlight a metre from your nose.

Because apparent magnitude depends on distance, to study the properties of stars

we need some sort of standardization. Hence absolute magnitude, the magnitude of a star if it were positioned exactly 10 parsecs, or 32.6 light years, distant. This puts all stars on an even footing, so to speak, so absolute magnitude is really a measure of a star's true luminosity — how much energy it emits.

Magnitude is quantifiable, based on a scale fashioned by the Greek astronomer Hipparchus. In 130 BC he classified stars into one of 6 numbered categories — 1 representing the brightest stars, 2 the second brightest, all the way down to 6 for the dimmest perceivable stars. It was discovered much

later that magnitude 1 stars were approximately 100 times brighter than magnitude 6 stars, and that each magnitude was therefore 2.512 times brighter than the next.

Since Hipparchus' time the scale has been expanded, so that very bright objects receive a 0 or even negative magnitude; and telescopes can visualize

objects much dimmer than those of 6th magnitude.

The table below shows the magnitudes of some representative objects. We see, for

Object	M	m	d(ly)
Sun	4.85	-26.72	0.0
Full Moon	---	-12.5	0.0
Venus	---	-4.4	0.0
P. Centauri	15.45	11.01	4.22
Sirius	1.45	-1.44	8.6
Polaris	-3.65	1.96	432.0

example that the sun, in spite of its hype, is a rather unassuming star. True, it will sear your retinas if you look at it, but that is merely because it is so close; at 10 parsecs, its magnitude is a more modest 4.85. Venus, the goddess of beauty and inspiration for innumerable UFO sightings, is also quite bright; but that is all reflected light, and at 10 parsecs, away from any

star, would be undetectable. Proxima Centauri may be the second closest star to Earth, but it is invisible to the naked eye. Sirius, in Canis Major, is the brightest star visible in the northern hemisphere. Many observers, when they first see Polaris, are surprised that it is so unassuming, considering its reputation. Its relatively large distance ameliorates its brightness.



Hipparchus, on the job!

**TO BE
CONTINUED...**

TCAA Garb Order Form

Instructions:

1. Read the article on the next page. None of this will make any sense until you have done so.
2. Boy you're a fast reader!
3. Fill out this form, and return it, along with a check, to:

Michael Rogers
 2206 Case Drive
 Bloomington, IL 61701-1474

Make your check payable to me. I promise not to abscond with the funds to my secret hideaway in the Carribbean. Oh drat, so much for secrecy...

4. T-shirts are available in Black, Red, Royal (blue), Burgundy, Evergreen, Forest, Navy, Purple, Earth (dark brown), Moss (dark green with yellow), Shale (dark gray), and Denim (dark blue, lighter than navy); Sweatshirts are available in all of the preceding colors except Earth, Moss, Shale, and Denim; Polo shirts are available in all of the preceding colors except Evergreen, Earth, Moss, Shale, and Denim

Name: _____

Phone #: _____ (W) _____ (H)

Item	Size	Color	Unit Cost	# of Items	Total Cost
_____	_____	_____	_____	_____	_____
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_____	_____	_____	_____	_____	_____
Subtotal:					_____
Sales Tax (7.25%)					_____
Grand Total:					_____

T-Shirts & More

— Michael P. Rogers

AS MENTIONED elsewhere in this issue, we inadvertently gave away too many t-shirts during the WWTBAA contest. So, in the interests of accomodating those people who had ordered but were stiffed, not to mention the many new members who have joined since the club last produced t-shirts and sweatshirts, we present this splendid opportunity in sartorial splendor — a chance to order TCAA Garb!

Our customized clothing vendor of choice, C Tees, offers a very nice price on t-shirts, polo shirts, and sweatshirts:

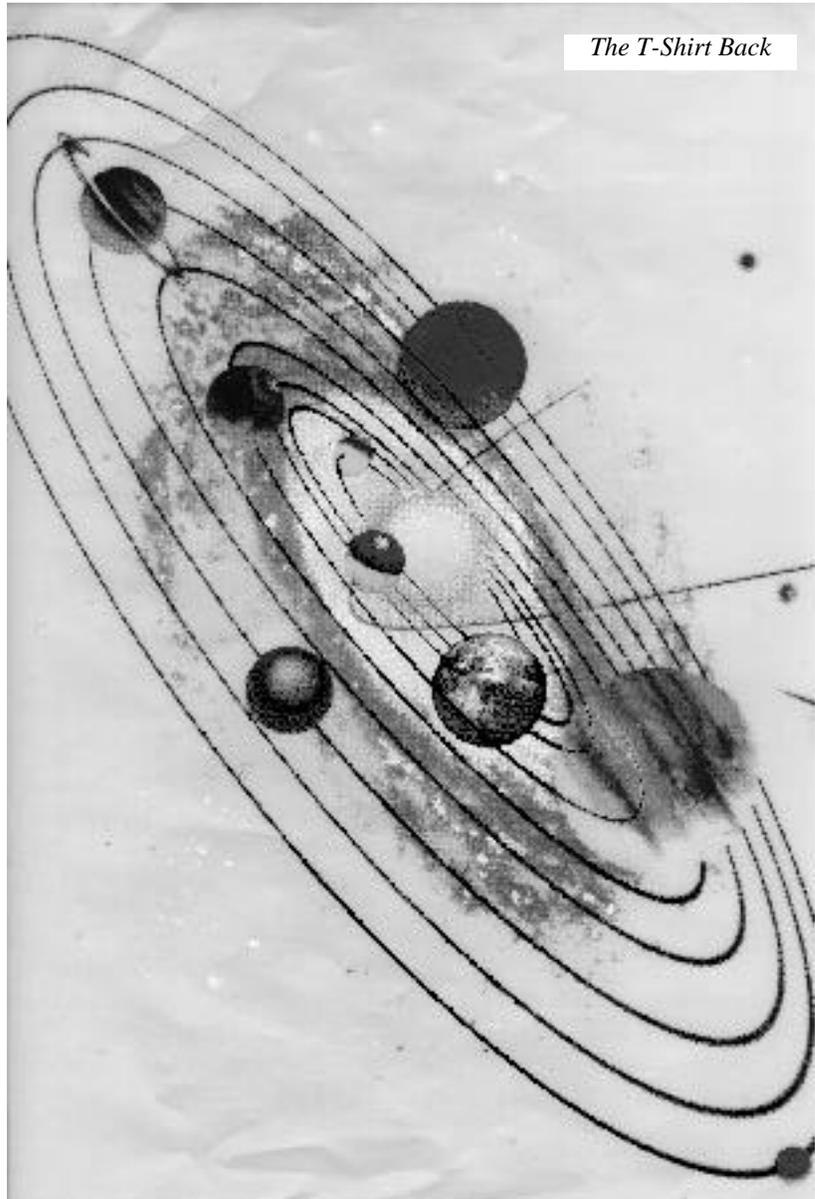
<u>Item</u>	<u>Size</u>	<u>Cost</u>
T-shirt	SM-XI	\$10.55
	XX	\$11.85
	XXX	\$12.70
Polo Shirts	SM-XL	\$16.00
	XX	\$17.40
	XXX	\$18.60
Sweatshirt	SM-XL	\$18.20
	XX	\$18.90
	XXX	\$19.15

Prices include a silk screen of the TCAA logo (the web site version) over the left breast on the front, and a museum-quality transfer of the solar system (superimposed over a spiral galaxy) on the back. The transfer probably looks best on black, but any dark color should do.

If you are interested in the above, then all you need to do is return the enclosed order form, with a check payable to me; I'll put all the checks together and pay CTees.

The deadline for ordering is 30 June, 2001. We will need a minimum of 12 orders, otherwise I'll just return the checks.

Questions: mprogers@mail.millikin.edu.



The T-Shirt Back



The T-Shirt Front

Treasurer's Report — April 2001

— Duane A. Yockey, Treasurer

OPERATING FUND BALANCE – March 31, 2001 -		\$1,447.89
Income		
Jay Freeman (dues) -	\$ 25.00	
Brian Barling (dues renewal) -	\$ 25.00	
Kim Kruse (dues renewal) -	\$ 15.00	
Expenses		
Secretary of State	\$ 5.00	
OPERATING FUND BALANCE – April 30, 2001 -		\$1,507.89

OBSERVATORY FUND BALANCE – March 31, 2001 -		\$ 341.31
Income		
Jim Swindler (Key)	\$ 10.00	
Duane Yockey (Key)	\$ 10.00	
Expenses		
None		
OBSERVATORY FUND BALANCE – April 30, 2001 -		\$ 361.31

TOTAL TCAA FUNDS – April 30, 2001 -		\$1,869.20

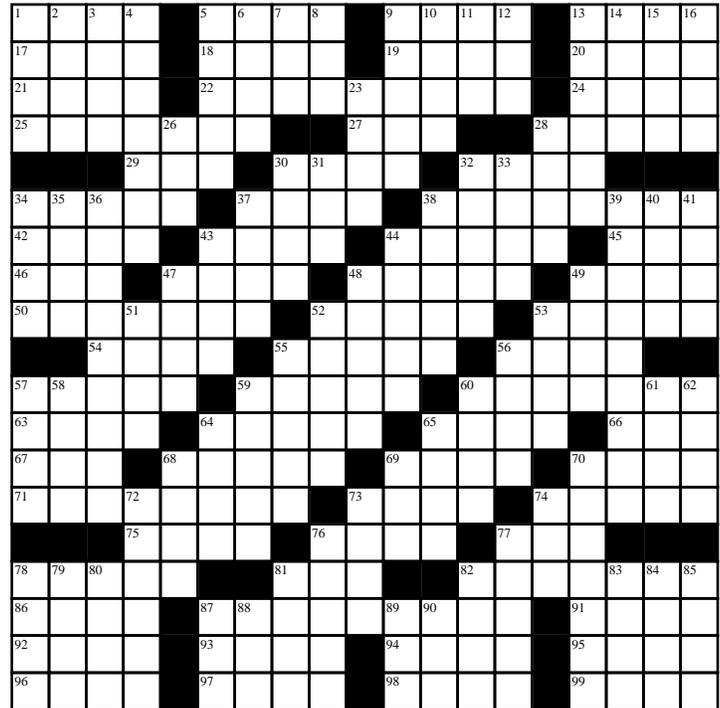
The Observer Crossword

—Observer Staff

ACROSS

- 1 Penzias' proof
 5 Of thou
 9 So be it
 13 Sacks
 17 Horse of mixed color
 18 9th Greek letter
 19 Persian fairy
 20 Reflected sound
 21 Islamic call to prayer
 22 Active at night
 24 Moon of Saturn discovered in 1672
 25 Greatly loved
 27 Incline head
 28 Analgesic/system to assign Greek letters to stars
 29 Bleat of a sheep
 30 Corn powder
 32 Scheme
 34 Breathing organs of fish
 37 Trial
 38 Befitting a maiden
 42 On sheltered side
 43 2nd Greek letter
 44 A golf score
 45 Anglo-Australian Observatory, for short
 46 Mouthpiece of a bridle
 47 Distinctive quality
 48 Refuge
 49 Famous initials in CCD
 50 Worship of Yahweh
 52 Natives of Poland
 53 Ornamental coronet
 54 Disk on which 84% of star's light is concentrated
 55 The physical unit measured in coulombs per volt
 56 Thermal energy
 57 Person employed by a carnival
 59 Assumed name
 60 Village near the Matterhorn
 63 Energy units
 64 Use again
 65 Faculty head
 66 Organ of hearing
 67 Wreath of flowers
 68 Operatic feature/bright region on Mars
 69 Authenticating mark
 70 Small yeast cake
 71 Powerful, rapidly varying infrared source
 73 Carbonized fuel
 74 Robust
 75 Greek goddess of the earth
 76 Spawning area of salmon
 77 To be unwell
 78 aka Alpha Cygni
 81 Goad for driving cattle
 82 Vapid
 86 Employs
 87 Logo
 91 Turbine blade
 92 The Orient
 93 9th Greek letter
 94 Gemstone
 95 Skin eruption
 96 Ruined city in W Iran

- 97 Sly look
 98 Sandy tract
 99 Coarse file
- ### DOWN
- 1 A complaining nebula
 2 Exude slowly
 3 False god
 4 Dignify
 5 Fungal infection
 6 Covering for the head
 7 And so on
 8 Consume
 9 Worn to protect the clothing
 10 Set right
 11 Period of history
 12 Naught
 13 Rebuke
 14 Having aches
 15 Clarified butter
 16 Fly
 23 Single entity
 26 Vessel or duct
 28 A corpse
 30 6th Greek letter
 31 Ariane's developer (abbr)
 32 Boy attendants
 33 Mortgage
 34 Fool
 35 Hip bones
 36 Drowsy
 37 Division of a school year
 38 Shifted
 39 Form of Aramaic
 40 Den
 41 Indian exercise method
 43 Actively engaged
 44 Red variety of spinel
 47 Disk on which 84% of star's light is concentrated



- 48 Greek goddesses of the seasons
 49 Former name of Thailand
 51 Triumphs
 52 Monetary unit of India
 53 Web-footed aquatic bird
 55 Material in the form of a liquid or a gas
 56 Make healthy
 57 Prison room
 58 Extent of space
 59 Operatic feature/bright region on Mars
 60 Ardor
 61 Labels
 62 Salver
 64 Network of nerves
 65 No longer living
 68 Bedouin
 69 Turf
 70 Monetary unit of Venezuela
 72 Excrement
 73 To yield
 74 Sister
 76 Radio location system
 77 Slender part of the leg
 78 Membership fees
 79 Son of Isaac and Rebekah
 80 Promontory
 81 Movable barrier
 82 Republic in SW Asia
 83 Large almost tailless rodent
 84 Taverns
 85 Low in pitch
 87 Sesame plant
 88 Fish eggs
 89 Very modern
 90 Monkey

See p. 5 for the solution to this puzzle.

The Welcome Mat

The cherubs, worn out after Astronomy Day but recovering fast, are pleased to announce 3 new members:



Jay Freeman
Normal, IL

Kristin Johnston
Normal, IL

Matt Weber,
Pontiac 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 \$25 to our esteemed treasurer:

Duane Yockey
508 Normal Avenue
Normal, IL, 61761

As always, thank you for your support!!