The OBSERVER

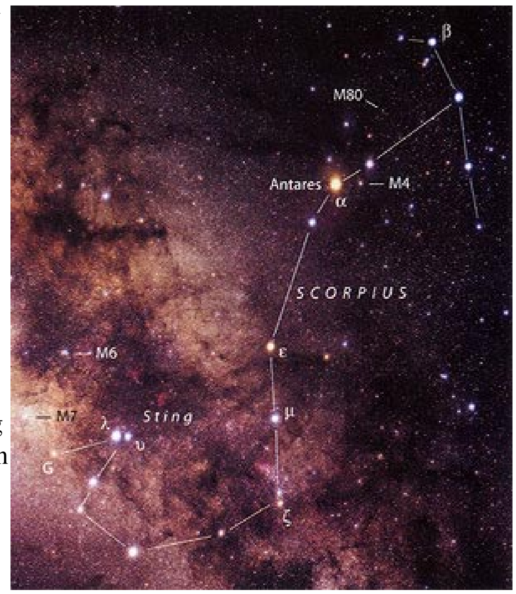
The Newsletter of the Twin City Amateur Astronomers, Inc.

June 2003 Volume 28, Number 6

In This Issue:

Observing With Scorpions
—Sandy McNamara

SCORPIUS IS ONE OF THE FEW constellations that appears like its namesake, the scorpion. Few regions can match Scorpius for the number and quality of deep sky objects, but unfortunately for observers at our midnorthern latitude, Scorpius is so low in the south that it's gone before you know it. It puts on a good evening appearance only in June and July.



Alpha Sco or Antares is the brightest star of Scorpius and marks the scorpion's heart. A red supergiant located about 600 light years from us, Antares is a slowly irregular variable star of spectral type M1. Its position near the ecliptic (the band within which the planets roam), its brightness, and the distinctive ruddy color common to M-class stars leads to its name, which translates from the Greek as "Rival of Mars". Antares is a famous, but difficult, double star, with a 5.4 magnitude companion 2.7" to its west. The companion is often seen as green, probably due to its color contrast with Antares. This separation might seem enough to separate with most telescopes at high power but Antares is so bright that its light generally overwhelms the fainter star. While an 8-inch telescope can split these two, it takes steady skies to do so. Don't be misled by atmospheric dispersion: when any bright star is low in the sky, its image

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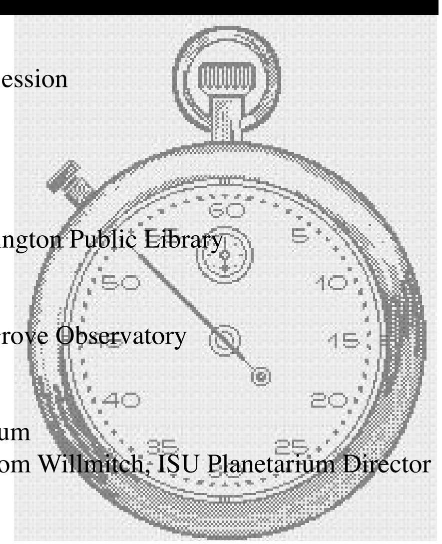
TCAA Calendar



Thursday, 19 June, 2003, 9:00-10:00, SGO
Ecology Action Center/Girl Scouts Observing Session

Saturday, 28 June, 2003, Dusk-???, SGO
Members-Only Observing Session

Wednesday, 2 July, 2003 7:00-7:45 PM, Bloomington Public Library
Public Presentation (Details TBA)

Saturday, 5 July, 2003, 9:00-11:30 PM, Sugar Grove Observatory
Public Observing Session

Monday, 14 July, 2003, 7:00 PM, ISU Planetarium
TCAA Meeting. Topic: Cosmos. Presenter: Tom Willmitch, ISU Planetarium Director

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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is drawn out into a tiny spectrum with red at the bottom and blue-green on top. This “green flash” above Antares can be mistaken for a glimpse of its companion; remember that the companion is due west. Some observers say searching for the companion during twilight, using a light blue filter, or using a deep sky nebula filter can help by suppressing some of the glare from Antares.

Beta, Delta, and Pi Sco form the traditional head of the scorpion. Normally all three are about the same magnitude but about 3 years ago Delta underwent a dramatic outburst that left it a full magnitude brighter than the other two. Fading now, it is still much brighter than normal and remains the second brightest star in the constellation. Beta Scorpii, the easternmost one in the lineup, is a nice double star, easily split in a small telescope at about 50x.

Nu Scorpii, the southern sky’s answer to the Double-Double in Lyra, is located 1.6d east of Beta. A small telescope can easily split Nu’s “AB” pair from the fainter “CD” showing a white/tawny double star. Splitting each of these into their respective components will require steady skies. The C and D pair are 2.3” apart and can usually be separated by most telescopes. The AB pair are much more difficult due to both a smaller separation and differing magnitudes so require at least an 8-inch telescope used at high magnification.

Xi Sco is a mag 4.3 star located 8.5 degrees north of Beta Scorpii. A triple system, stars “A” and “C” can be separated easily in most telescopes. While a challenge, the “AB” pair is usually not difficult to split but 2003 finds the two components near the closest approach in their 46 year highly eccentric orbit around each other, so will appear as a single star in any telescope smaller than 12-inches. Four arcminutes south of Xi and in the same field of view is **Struve 1999**, now thought to be part of the Xi system. It is easily split at 50x. Together, they form a beautiful and complex multiple star system.

Return to Antares and scan just over a degree west to locate the bright globular cluster, **M4** (NGC 6121). The easiest way to find it is to center Antares in a low power eyepiece then nudge the telescope little by little toward the right. Visible in binoculars as a large, round, even glow of light, my 8-inch telescope shows a loose globular cluster of stars almost resembling a tight open cluster. Globular clusters are round balls scattered around the rim of our galaxy (and other galaxies also) which contain thousands to millions of densely packed stars and are very different from the open clusters sprinkled throughout the galaxy’s arms. GCs contain many more stars, are farther away (usually thousands of light-years away), and have some of the oldest stars in the galaxy in them. M4 contains more than 10,000 known stars and at a distance of 1.8 kiloparsecs (about 6000 light years), is one of the closest globulars to our solar system.

Return to Antares then move 1/2° NW to find the smaller and dimmer globular cluster **NGC 6144**. As when observing any deep sky object near one much brighter, it helps to move the brighter one, Antares in this case, out of the field of view if possible. With the exception of a brighter star on its western edge, I could only semi-resolve this GC in a 12-in telescope.

NGC 6093, aka M80, is located midway between Antares and Beta Sco. A small, condensed globular cluster, it can resemble an out-of-focus “star” in binoculars or small telescopes. One of the densest GC in our galaxy, M80 is difficult to resolve in smaller telescopes; my 8-in telescope just begins to resolve stars around the edges. M80 lies about 12,000 light years

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Through the Looking Glass: Reflections on the History of Astronomy

Kepler's Kinematics

Jim Swindler

FROM HIS CONVERSION to the new astronomy as a young student, to his preoccupation with astrology, to his discovery of the basic laws of planetary motion, Johann Kepler's lifelong ambition was to discover the inner coherence of the Copernican system. He sought a mathematical explanation of why there were exactly six planets and why they were at just their relative distances from the sun. He dreamed up many alternative explanations and patiently checked these by sifting through the best collection of known facts. Though mired in medieval mysticism, he a great modern scientist.

Born in Württemburg, Germany in 1571, smallpox crippled his hands at three, so he was given a religious education and was initially bound for the protestant ministry. At the University of Tubingen he converted to Copernicanism, graduated in 1588 and took his master's degree in 1591. He was a brilliant mathematician and forsook the ministry to teach science at the University of Graz in Austria. He entered an unhappy marriage in 1594 that nevertheless produced five children before his wife died in 1612. This was a time of great stress between Catholics and Pro-testants, and he and his family were driven from Graz on religious grounds in 1598.

Kepler earned his living mostly from doing horoscopes. He was a very famous astrologer in his time and worked in this capacity for Emperor Rudolph, General Wallenstein and other celebrities, earning himself a measure of protection during the horrors of the 30 Years War (1618-1648). He tried to make astrology into a genuinely mathematical science by grounding it in Greek astronomy. He not only believed events in his own life were predictable by astrology, he used it to interpret the bible, fixing on 3992 b.c. as the date of creation.

Johann Kepler

But his mysticism ran much deeper than astrology. In studying Greek astronomy, he had become a Pythagorean and believed in the "music of the spheres," an association of each planet with a musical tone separated from the others by set intervals. More important, perhaps, is his Pythagorean conviction (shared by Copernicus) that nature is simple, in particular that each planet would have a single orbit rather than circles on top of circles as in Ptolemy's scheme. He set about constructing a model of the solar system first using arithmetic, then plane geometry, then solid geometry. He was deeply attracted to idea that Plato's five regular solids (cube, tetrahedron, etc.) governed the relations he sought, with each planetary sphere surrounded by one of these so that its vertices just touched the next higher sphere counting from the sun (six planets took five interplanetary solids). He worked on this by trial and error and at length realized that it could not be done. Kepler was nothing if not honest and thorough in reporting his failures. All this appeared in his first book Mysterium Cosmographicum published in 1596.

Despite its null results, the book caught the eye of Tycho Brahe and sparked a correspondence. Working in a private observatory in Denmark, Tycho had for many years added great detail to planetary data by recording his observations of planetary positions night by night and not just at so-called "stationary points" (where

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planets reverse their motion among the stars) as was the custom. Notably, Tycho had observed a supernova in 1572 and was able to show that it was among the "fixed stars" and he showed by trigonometry that a comet of 1577 was moving among the planets. These discoveries cast serious doubt on the old idea that the planets ride on mechanical spheres. Tycho offered Kepler an assistantship and, after leaving Graz, Kepler moved to Prague to work with him. By then Tycho had amassed the most accurate collection of data on planetary motion in history. He was a master instrument maker and a decade before Galileo turned his telescope to the skies, Tycho's instruments had plotted the paths of the planets to an accuracy of 1/10 of a degree or better. Kepler's interest was peaked because the planetary motions were so important in his horoscopes and because the Copernican predictions of the positions of Mars were more than 1/2 degree off. Kepler's relation with Tycho was stormy but when Tycho died in 1601, Kepler inherited his data, perhaps the most fortuitous bequest in the history of astronomy.

It is impossible to exaggerate the service Kepler performed for science by dedicating himself tirelessly to eight years of mind-numbing calculations of planetary orbits. (In those days, the man, not his tools, was called a "calculator" or "computer.") With his failed attempts behind him, Kepler finally gave up on the spheres and started trying to fit other shapes to Tycho's data. He favored an egg-shaped orbit for physical reasons but settled finally on the ellipse because it alone saved Tycho's data. The mathematics of the ellipse, among the other conic sections, (figures formed by slicing a cone) had been worked out by the Greeks. The familiar flattened oval of the ellipse can be drawn by looping a chord loosely around two points (the foci) and drawing it taut to a third point off the major axis, then revolving it. If the foci coincide, the result is the special case of the circle. Miraculously, placing the sun at one focus made the last discrepancies between the egg-shape and Tycho's disappear completely. The other planets fit as well and in 1609 Kepler published his results, as usual along with an account of his failed trials, in <u>Astronomia Nova</u>.This was Kepler's first law of motion: planetary orbits are ellipses. But he didn't stop there. He had noted that the closer a planet is to the sun, the faster it moves. This led him to his second law: a line from a planet to the sun sweeps out equal areas of its ellipse in equal times.

These two laws undercut forever the Greek obsession with the circle as the only shape fit for the heavens as well as the requirement that the planets ride on spheres, though Kepler himself continued to believe that the stars were held in place by a two-mile thick celestial sphere at much great distance from the sun. If celestial spheres did not hold planets, what did? Kepler concluded from the fact that the sun is always at one focus of the planetary ellipse (hence always in the orbital plane) and that the planets speed up as they approach the sun, that therefore the sun is in control of the planets' motion, acting on the planets across space with mutual gravitational attraction. This insight paved the way for Newton's great synthesis three quarters of a century later.

Kepler successfully applied the second law to the moons of Jupiter (which he named "satellites"), recently discovered by Galileo. Such were their jealousies that he didn't believe the moons were real until Galileo sent him a telescope so he could see for himself. For his part, and to his lasting chagrin, Galileo ignored Kepler's laws as astrological ravings (even though Galileo himself was not above selling horoscopes) and continued to believe in Copernican circular orbits. The two corresponded no more after 1610. Still, Galileo's telescope got Kepler excited about optics and he gave the first halting explanation of focus as the result of the refraction of light. He improved telescope design by replacing the concave with a convex eyepiece positioned behind the focus, enlarging the field of view and increasing possible magnification by 1000 times. He also showed how a parabolic mirror focuses light, laying a basis for Newton's reflecting telescope.

Kepler returned to trying to explain mathematically the number of planets and the proportions of their distances from the sun, comparing the sun's force to that of the lever, to magnetism and to musical notation. In 1619, Kepler published another mystical tome, <u>Epitome Astronmiae</u>. Buried deep within his astrological ramblings in a single paragraph Kepler stated his third law: the square of a planet's period is proportional to the cube of its distance from the sun.

Kepler remarried in 1612, this time happily, and fathered thirteen more children. Emperor Rudolph's successor Matthias continued to maintain and protect Kepler even after his mother was arrested as a witch in 1618 and Kepler had to use his influence to get her released. In 1627 he published his "Rudolphine Tables" of planetary motion based on Tycho's data, his own laws of planetary motion and Napier's newly conceived logarithms, which made his calculations much easier. He included Tycho's great star map, updated. He calculated the solar transits of Mercury and Venus and these were confirmed by Gassendi in 1631 shortly after Kepler died of a fever.

Isaac Asimov counts Kepler as the inventor of science fiction since he wrote a story about a trip to the moon describing the lunar surface as it actually is. However that may be, Kepler was certainly the first to apply mathematics empirically to derive confirmable laws of celestial motion and his success laid the foundation for all later work on celestial mechanics.

The Challenger Learning Center

—Carl J. Wenning

WELCOME TO PROJECT 2003, the Prairie Aviation Museum expansion project at the Central Illinois Regional Airport. This exciting project begins with Phase I, the installation and December 2003 dedication of a Challenger Learning Center for all of Central Illinois. The project continues with Phase II, the construction of new museum facility. While the Challenger Learning Center will be located at the former airport terminal building in Bloomington, it will serve all of Central Illinois. The citizens of Central Illinois will call this CLC their own.

Prairie Aviation Museum established the Project 2003 Task Force in November 1999. Very appropriately, the Task Force plans to have a formal dedication during December 2003 -- the 100th anniversary of the Wright Brother's first flights. What is a Challenger Learning Center? It could be called a miniature "space camp," but it's more than that because the CLC offers in-depth mission experiences where the total "EdVenture" could extend over two months. The CLC experience includes mission preparation, space flight simulation, and follow-up activities. The mission is the culmination of lots of hard work.

CLC's are state-of-the-art educational simulators that offer a variety of exciting activities and experiences. The futuristic setting and realistic scenarios allow teams to work together to solve problems associated with an overall mission goal. High tech computer systems drive the space simulation, with each mission representing one of a host of possibilities. Whether sharing the thrill of flying to Mars, or rendezvousing with a comet streaking through outer space, the Challenger Learning Center participants share the experience of a simulated space mission.

Each CLC has two units. Mission Control is based on the NASA center in Houston, Texas, and the spacecraft simulator is designed to represent the deck of a futuristic star ship. Participants experience both settings in each mission, and will take home memories they will treasure and benefit from for years to come. Working by themselves and in conjunction with a trained flight director, perform a variety of tasks when in the CLC. For instance, a flight director might work with a student to solve a problem relating to the use of an isolation chamber. Team members could work together to design and assemble a space probe. A student might perform an experiment guaranteeing the "safety" of the space station atmosphere. A student could find him or herself working at a console in Mission Control to make certain that his counterparts in space are doing their work according to specific procedures.

Mission Control and the spacecraft simulator are both outfitted with eight work stations, each suitable for one or two students. When fully utilized, the CLC simulator incorporates 32 students. Students working in the spacecraft are always matched up with facilitators in Mission Control, all benefiting from team work. Working with their counterparts at various work stations, students team up to solve a wide variety of problems associated with the mission goal. The communications team manages all conversations between Mission Control and the spacecraft; the medical team monitors and analyzes response times, respiration, skin temperature, and heart rates of various spacecraft personnel; the isolation team collects and analyzes data from meteoroids and "hazardous" materials; the life support team monitors spacecraft water and atmosphere; the data team is responsible for video and data links between Mission Control and the spacecraft; the navigation team searches for, locates, and pilots the spacecraft to a passing comet; and the probe team designs and assembles a space probe to visit the comet and return samples. All eight teams work cooperatively to assure that the mission is a success.

While target groups for CLC's are fifth through eight grade students, there will be ample opportunities for individuals,

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The Challenger Learning Center in Peoria, Arizona

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families, and social and business groups to experience a mission. Prairie Aviation Museum volunteers and middle school teacher candidates from the area's universities will form the heart of a volunteer corps that will benefit both themselves and mission participants greatly.

The CLC program, designed by the Challenger Center for Space Science Education, is a world class educational program. Each CLC offers complex and highly realistic missions that are designed by professional educators with the guidance of NASA scientists. Each year over 500,000 school children attend missions in Challenger Learning Centers. CLC's are staffed by certified and experienced school teachers who have been trained to serve as flight directors. There are currently about 50 CLC's located around the United States, as well as in Canada and Great Britain. The CLC of Central Illinois received its charter during October, 2001.

Why should Central Illinois go to the effort and expense of establishing a Challenger Learning Center? One of the best answers is the changing nature of education. The State of Illinois is now operating a standards-driven educational system. Illinois Learning Standards were adopted in 1987, and today serve as the guide for all public schools in Illinois. The Standards define what all students should know and be able to do. They also serve as the basis for measuring student achievement over time. The traditional textbook-driven educational system of yesterday is not capable of keeping pace with the needs of our students. Today's standards-based educational system is predicated on the belief that all children can learn. Education suitable to achieving this goal must be available to students if we expect to see significant gains.

Taking four to six weeks to incorporate a CLC mission into the school curriculum

Mission Control at the Challenger Learning Center, Oakland, California

might lead an Illinois educator to wonder how Illinois Learning Standards (ILS) are going to be addressed. It should be noted that the mission activities address content knowledge in more than 60 Illinois Learning Standards in the areas of science, mathematics, language arts, fine arts, health, and social studies. This also includes critical intellectual and group process skills contained in the equally important ILS Applications of Learning -- working on teams, solving problems, using technology, making connections, and communicating results. The basic idea behind standard-based science education is to enhance scientific literacy, and foster long-term interest in science, mathematics, and technology. We all learn best when we see a purpose to our work. It makes us work harder to achieve our goals. The CLC of Central Illinois can be part of that effort.

The CLC mission is the culminating experience that follows four to six weeks of intense classroom preparation. In order for teachers and their students to gain the greatest possible benefit from their mission, teachers are required to attend an educators' workshop where they are trained in the use of classroom materials. To make room in the school curriculum, teachers need to identify and remove activities that target such lower-level thinking activities such as memorization. Teachers replace those parts of the curriculum that promote critical higher-level thinking skills, in-depth understanding, active problem solving, and cooperative learning.

While there are two sections in every CLC -- Mission Control and the spacecraft simulator -- students will spend equal time in both units. When working in Mission Control, controllers guide "astronauts" as they complete various tasks associated with their particular problem. While in the spacecraft, astronauts are performing hands-on, minds-on problem solving. Team players swap positions halfway through the simulation to help them gain a better understanding of the

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problems associated with space flight and problem solving. Missions are typically two hours long with a short "debriefing" session at the midpoint when student teams exchange information and change positions with their counterparts.

The mission has not ended once the students depart the CLC. The mission continues for another two weeks as students analyze data collected "in orbit," interpret that data, draw conclusions from the evidence, and communicate their results. They might go so far as to hold a "press conference" to describe their findings. CLC-provided follow-up activities help students transfer what they have learned during their experiences to real-world situations. Pursuing additional space adventures, students might visit an aviation museum for a broader aviation experience (e.g., Prairie Aviation Museum in Bloomington, or the Octave Chanute Aerospace Museum in Rantoul), a planetarium for a star show (e.g., Normal's ISU Planetarium, Peoria's Lakeview Museum Planetarium, or Champaign's Staerkel Planetarium at Parkland Community College), or even an observatory for a special night time viewing session (e.g., public observatories in Bloomington, Peoria, Urbana and Champaign).

The CLC missions offer very significant educational benefits. Students are fully engaged in active problem solving, and come away with enhanced scientific knowledge, intellectual and interpersonal skills, and positive attitudes toward science and technology in particular, and toward learning in general. Research has been conducted to evaluate student learning using the CLC flight simulator environment. Convincing evidence of the educational value of the CLC experience has been documented.*

The projected cost for the two-hour missions at the CLC of Central Illinois is approximately $600. This might seem like a large amount of money, but it really is not if one considers all the services, materials, and educational benefits associated with mission experiences. Students will experience some eight weeks of inquiry-oriented classroom activities. Students will "pilot" a mission using a simulator costing nearly a million dollars and staffed by educational experts. Students will experience and perform activities prepared by master teachers and examined for accuracy by NASA scientists. We believe that the $20 to $40 per student (depending upon group size) is money well spent. Creative fund raising activities can teach much about working together to make dreams become reality.

It is important to emphasize that the CLC in Bloomington will be the CLC for all of Central Illinois. Challenger Learning Centers are strategically located and regulated so that they don't compete with one another. All schools in 18-county service area will have equal access to CLC simulations. We are only a phone call away. All teachers will have equal opportunity to participate in educational training and to schedule missions for their students.

While CLC's are often found in schools, on university and community college campuses, and in science centers and museums, our CLC will be temporarily housed in the original terminal building of the Central Illinois Regional Airport in Bloomington. As mentioned previously, the Challenger Learning Center of Central Illinois is the project of the Prairie Aviation Museum in Bloomington, IL, and the Project 2003 Task Force. The Task Force has set a goal of raising 1.5 million dollars to fund this exciting project. The CLC is, in fact, only Phase I of a two-phase expansion effort that ultimately will see the CLC of Central Illinois housed in a new 49,000 square foot facility also to be located at Central Illinois Regional Airport.

The world is changing, and we are doing a disservice to students and to ourselves if we don't become more proactive in helping all students to achieve education and career goals in this technologically-oriented, competitive world. If we are bold enough to ask children, teachers, and school administrators to rise to meet the standards, then we must rise to help them meet that challenge. Everyone needs to become active members of the learning community through direct involvement in the educational process. As parents shouldn't we want the very best in education for our children? As community and business leaders, shouldn't we want the best educated citizens and workers capable of working on teams, solving problems, and communicating results? Education is everybody's business; make it your business today. We can all work with the Prairie Aviation Museum to support this effort.

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from the center of the galaxy and nearly three times that far from Earth.
Skip down the scorpion's body (ignoring a multitude of wonderful double stars and deep sky objects we don't have room for here today) to end up at the bright "stinger" stars (lambda and upsilon Sco) at the end of the flipping up tail. Left of the stinger stars, about midway between them and the tip of the neighboring "teapot's" spout, you might see a small glow visible to the naked eye. This is M7, mentioned by Ptolemy on star charts as early as the 2nd century. M6 and M7 are two large open clusters at this location which can be seen in the same binocular or finderscope field of view, M7 being the larger and brighter of the two toward the south.

NGC 6475, aka M7, is a large open cluster almost 1 1/2 degrees across which fills the field of view in most low power eyepieces. Even binoculars will reveal 20+ brighter stars clustered toward center with 20+ additional loosely clustered around the somewhat tighter central group. An 8-inch telescope shows more than 65 bright and well spaced stars filling the field of view.

NGC 6405, aka M6, is often called the "Butterfly Cluster" for the way its stars are grouped: the brighter stars in the central area form a squared off section with arms seeming to spread toward the edges of the field. On nights of poor seeing, the butterfly shape may not be obvious and the brighter stars form a "W" shaped pattern. Sweep just 4 degrees NW of M7 to find M6. Even a very small telescope resolves the stars of this bright cluster spreading over 1/2 degree. With 80+ stars, M6 contains almost twice as many stars as M7 but lies twice as far away so the stars are fainter and cover half the space. M6 contains the irregular variable orange star BM Sco, ranging in magnitude from 6.0 to 8.1 over a period of roughly 850 days. If you are interested in variable star observing, following BM Sco's unpredictable pattern of variation makes a good project.

NGC 6441 is an easy star hop sl over 2d SSW from M7; in line with the stars of teapot base and just east of the 3.5 mag star G Sco. This little globular has a high surface brightness, but is partially faded out by the bright star practically lying on top of it. I can semi-resolve stars around the edges using a 12-in telescope. NGC 6441 is one of only four GC known to contain a planetary nebula but you'll need at least a 25-in or larger telescope to spot it!

4 1/2 degrees north of M7, our last stop in Scorpius is often easier to locate by star hopping 2.5 degrees west from gamma Sgr (the tip of the teapot "spout"). **NGC 6451** is an open cluster containing approximately 80 stars of magnitude 12 or dimmer. My 8-inch telescope reveals a shallow U of brighter stars which hold an almost nebulous "dusty" looking group of semi-resolved stars. A cup of stardust? As a point of interest, if you look less than 2 degrees NW of this cluster, you are looking toward the center of our own Milky Way galaxy.

CHALLENGE: I often try to find at least one galaxy an evening, but the thick interstellar dust in the direction of our galaxy's center blocks our view of most galaxies in this direction. As a substitute, I present as a challenge a unique bipolar planetary nebula that *looks* somewhat like a galaxy through the telescope. **NGC**

Technical Data

Object	Type	RA	DEC	Mag	Size/Sep	Notes
Xi Sco						
(A/C)	DS	16h 04m	-11d 27'	4.8/7.2	7.4" at PA 52"	
(A/B)				4.8/5.1	0.4"	
Struve 1999	DS	16h 04m	-11d 27'	7.4/8.1	11.6" at PA 99	SAO 159668
Beta (8) Sco	DS	16h 05m	-19d 48'	2.6/4.9	13.6" at PA 23	Graffias
Nu (14) Sco						
(AB/CD)	DS	16h 12m	-19d 28'	4.3/6.4	41.1" at PA 336	
(C/D)				6.9/7.9	2.3" at PA 51	
(A/B)				4.3/6.8	0.9" at PA 3	
NGC 6093 (M80)	GC	16h 17m	-22d 59'	7.3	5.1	class 2
NGC 6121 (M4)	GC	16h 24m	-26d 32'	5.9	26'	class 9
NGC 6144	GC	16h 27m	-26d 02'	9.1	9'	class 11
Alpha (21) Sco	DS	16h 29m	-26d 26'	1.0/5.4	2.5" at PA 273	Antares
NGC 6302	PN	17h 14m	-37d 06'	12.8	45"	Bug Nebula
NGC 6405 (M6)	OC	17h 40m	-32d 13'	4.2	15'	Butterfly CLl
NGC 6441	GC	17h 50m	-37d 03'	8.9	3'	class 3
NGC 6451	OC	17h 51m	-30d 13'	8.2	8'	
NGC 6475 (M7)	OC	17h 53m	-34d 49'	3.3	80'	Ptolemy's CL

Xi Sco, Struve 1999, Beta Sco, and Nu Sco are on the AL's double star observing award list. NGC 6144, 6451, and 6441, and 6441 are included in the Herschel 400 observing list. NGC 6441 is included with the Universe Club. NGC 6093, 6121, 6405, and 6475 are included in the Messier listing. NGC 6302 is number 69 in the Caldwell catalog of Patrick Moore favorites.

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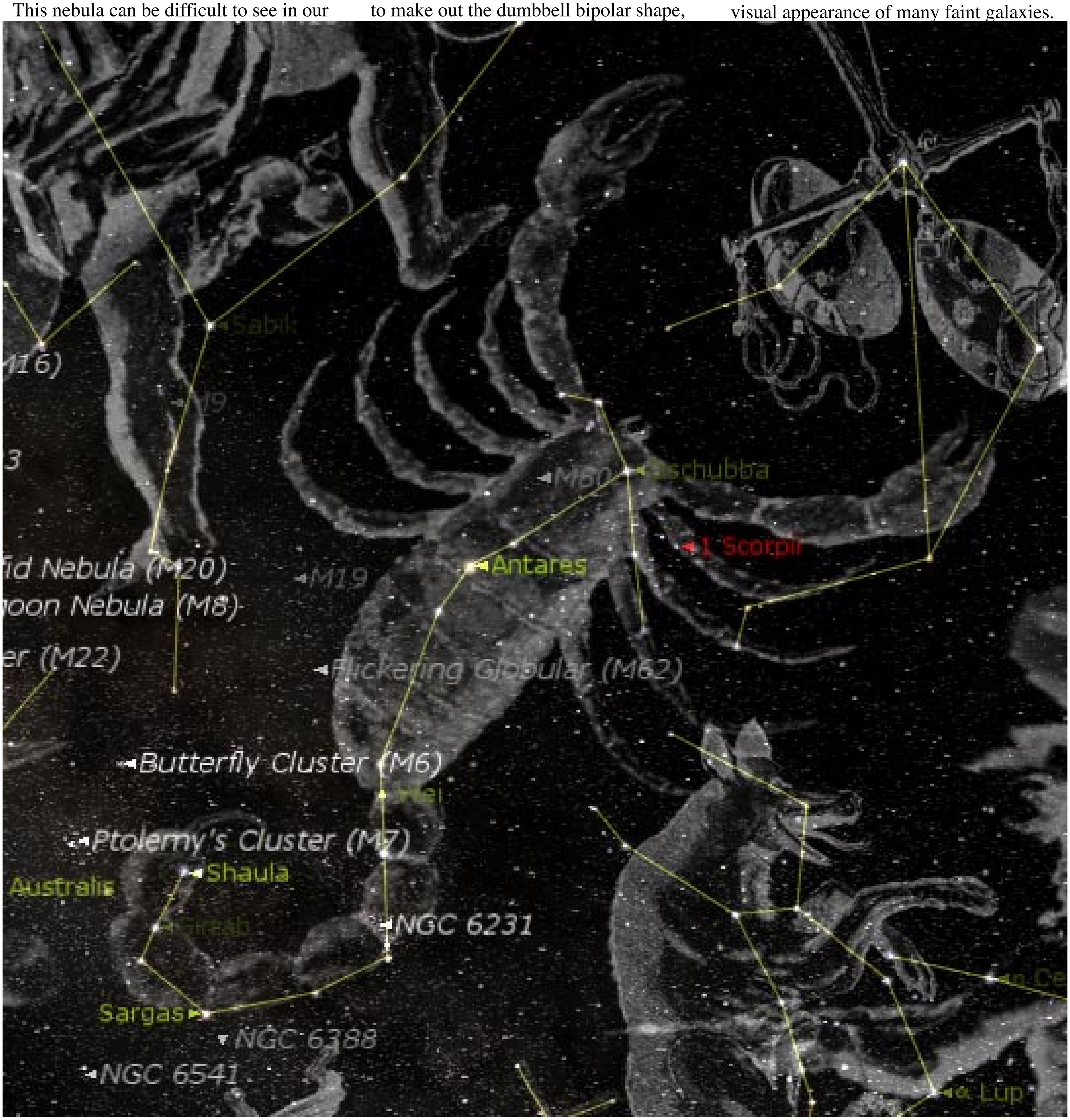
6302, the "Bug Nebula", is located 4d west of the Scorpion's stinger, about half-way between lambda Sco and mu Sco. This nebula can be difficult to see in our central Illinois skies but was moderately bright even without a filter using a 12-in telescope under dark skies. I am unable to make out the dumbbell bipolar shape, merely an elongated profile with a slightly condensed broad central area and faint outer halo of nebulosity resembling the visual appearance of many faint galaxies.



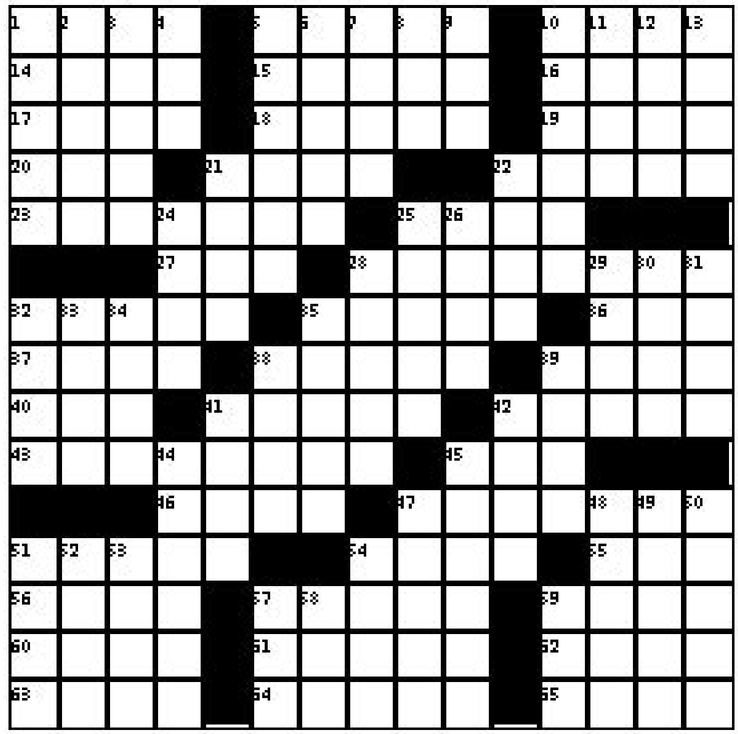
TCAA Treasurer's Report — April, 2003

— L. Duane Yockey, Treasurer

OPERATING FUND BALANCE – March 31, 2003 -		$ 852.81
Income		
Kal Kumar (dues renewal, Sept. 2002) -	$ 25.00	
Antionette Wudtke (dues, Sept. 2002) -	$ 25.00	
Scott Kuntzleman (dues, Dec. 2002) -	$ 25.00	
Mark Cabaj (dues renewal, Jan. 2003) -	$ 25.00	
Lucinda Cabaj (dues renewal, Feb. 2003) -	$ 25.00	
Murray Carlson (dues renewal, Jan. 2003) -	$ 25.00	
Lyle Rich (dues renewal, Feb. 2003) -	$ 25.00	
Steve & Patty Blair (dues renewal) -	$ 40.00	
Michael Rogers & Jean Memken (dues renewal)	$ 40.00	
Expenses		
Secr. of State (Annual Report filing fee) -	$ 5.00	
OPERATING FUND BALANCE – April 30, 2003 -		$ 1,102.81
OBSERVATORY FUND BALANCE – March 31, 2003 -		$ 743.91
Income		
None	$ 0.00	
Expenses		
None	$ 0.00	
OBSERVATORY FUND BALANCE – April 30, 2003 -		$ 743.91
TOTAL TCAA FUNDS – April 30, 2003 -		$ 1,846.72

The Observer Crossword

—Observer Staff

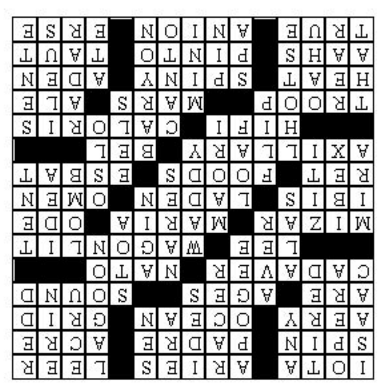


ACROSS

1 9th Greek letter
5 Constellation : The ram
10 Sly look
14 Whirl
15 Military chaplain
16 Land measure
17 Ethereal
18 Body of salt water
19 Grating
20 Part of verb to be
21 Matures
22 The sense of hearing responds to this
23 Corpse
25 Western pact
27 Shelter
28 Railroad sleeping car
32 A cheap star?
35 Lunar 'seas'
36 Lyric poem
37 Large wading bird
38 Burdened
39 Augury
40 Soak
41 Nourishment
42 Convocation of witches
43 Pertaining to the axilla
45 Ten decibels
46 High fidelity
47 Major Mercurian feature
51 Band
54 The red planet
55 Malt beverage
56 Thermal energy
57 Thorny
59 Capital of Yemen
60 Exclamations of surprise
61 Mottled
62 Tense
63 Authentic
64 Negatively charged ion
65 Scottish Gaelic

DOWN

1 British scientist ... Newton
2 Musical drama
3 Exhausted
4 Some
5 When the moon is hardest to reach
6 One who races
7 Ancient Roman days
8 Period of history
9 Monetary unit of Japan
10 A wet nebula?
11 Beige
12 Ireland
13 Spawning area of salmon
21 Affirm with confidence
22 Portico
24 Exclamation to express sorrow
25 Nostrils
26 Against
28 Australian Aboriginal war club
29 The other binocular twin?
30 Notion
31 Portable shelter
32 Gigantic star in Cetus
33 Mountain goat
34 Tubular pasta in short pieces
35 New Zealand aboriginal
38 Idle away time
39 Capital of Norway
41 Turn over
42 Long fish
44 Fourth highest peak in the world
45 Bary when he is performing/Family of atomic particles
47 Division of a long poem
48 Radio location system
49 Intestinal obstruction
50 Monetary unit of Lesotho
51 Demonstrative pronoun
52 The back of
53 Island of Hawaii
54 Prefix for small
57 Mineral spring
58 Slender metal fastener
59 Consumed



One Last Shot

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

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

Dues Due? ☐

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