

# *Inside Orbit*

Volume XXXXI - Number IV  
Winter 2005-06

\$1.00

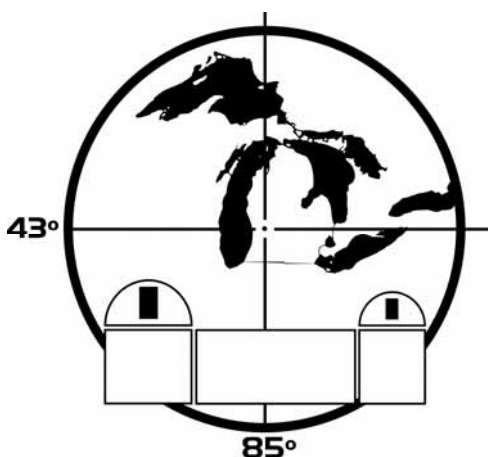
A Publication of the Grand Rapids Amateur Astronomical Association



## **This Issue:**

- ☆ The Deed is Done
- ☆ A Dark Sky Observatory is Here
- ☆ What Good is a Computer?
- ☆ NASA's Space Place
- ☆ The Alpha Stars
- ☆ Beginning the Adventure
- ☆ The Solar System - Winter 2005-06
- ☆ Calendar of Events & News Notes
- ☆ Planetarium Show Listings
- ☆ New Astronomy Book Announcement





50 Years 1955 - 2005

# Inside Orbit

A Publication of the  
Grand Rapids Amateur  
Astronomical Association

The **Inside Orbit** is mailed quarterly to all members of the Grand Rapids Amateur Astronomical Association. Individual copies are available at the James C. Veen Observatory during Visitors' Nights. Non-member subscriptions are \$5.00 annually.

The **Grand Rapids Amateur Astronomical Association** consists of over 200 members of all ages and levels on interest. The Association owns and operated the James C. Veen Observatory, an extensive observation and educational center. 2005 marks the 50th Anniversary of the GRAAA.

For further information, contact any of the people listed below; the GRAAA Starwatch number (897-7065), or the Association's website. Association brochures and applications are available upon request, or via the website.

Any view and opinions expressed by the authors in this publication are not necessarily those of the GRAAA or its members.

## GRAAA OFFICERS

President	Kevin Jung	774-0877
Vice-President	Jeff Kozarski	784-9127
Treasurer	Jerry Persha	897-9351
Secretary	Gary Ross	897-5713

## GRAAA BOARD OF DIRECTORS

Paula Blumm	897-5157	Evelyn Marron	897-7880
David DeBruyn	957-0769	Jim Marron	897-7880
Caroline Dellenbusch	225-1547	Will Millar	698-2130
		Ron Vander Werff	942-2669

## Inside Orbit Staff

Editor-In-Chief	Will Millar
Editing, Layout & Graphics	Kevin Jung
Contributing Authors	Jeff Kozarski, Fritz Lowe
Contributing Authors (this edition)	Dave DeBruyn, Jim Foerch, Gary Ross
Production Staff	Kevin Jung Paula Blumm

## GRAAA Website

[www.graaa.org](http://www.graaa.org)

## Mailing Address:

Inside Orbit  
3308 Kissing Rock Rd SE  
Lowell, MI 49331

## Cover Photos:

Kropscott Farm sign courtesy Steve Wessling

Ray Larson cutting ribbon courtesy Steve Wessling

Ray Larson grinding original mirror courtesy GRAAA archives



## The Deed Is Done

by G.M. Ross

At the high noon of the present year our Astronomical Association brought to completion a "good work" as known in Catholicism. 22 June 2005 is now enscribed not only in the astronomy history of this part of Michigan, but the cultural history. The Raymond B. Larson Telescope was planted in its new home, so we have reached the End of History. We have contributed to a magnificent enterprise by our neighbours in Newaygo County. First, some self-aggrandisement.

It was a fantastic day, very clear, and of moderate temperature, the kind on which Chaucer would set a trip to Canterbury -- except his was in April. The G.R.A.A.A. dispatched a work crew more like a college of cardinals to Newaygo County, led by David L. ("the Curator") DeBruyn. It included James Steele ("Professor") Foerch, John ("Investigator") Foerch, and this writer whose qualities need no elaboration. The erudition in the motorcar certainly exceeded the road's load limit. Straight north out of Fremont runs Stone Road on a more or less gentle rise of miles through the best farming in the county. Finally -- there it was in the late afternoon sunlight -- distantly small but gleaming, like Reagan's "City on a Hill": The Kropscott Environmental Center and its temple, the Stephen F. Wessling Observatory.

The history and institutional arrangements are beyond this discussion. In brief, the Center is the former Kropscott Farm which Earl and Millie donated to the Newaygo Conservation District. The Centennial Farm commanded the heights where "you can see forever, and ever, and ever... more." One is entitled to opine that the District, with its consortium and contributors, has undertaken the most unique project of any in the State.

Enter Raymond B. ("the Ancient One") Larson, now of White Cloud, and the Grand Rapids society which he helped create in the first Eisenhower administration. He is one of the Builders, that title given to those who worked on the Veen Observatory in the Heroic Era, whose efforts were not solely on the building, but also the

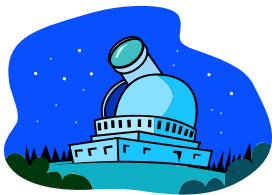
great 12.5" Borr Reflector. This fine and efficacious instrument now bears his name in spite of his protest that others, well, helped.



Larson's house was where the grinding of the mirror took place in the middle 1960s. Meanwhile, the massive mount was built off hours at the R and R Machine Shop, courtesy of Roger Reed, proprietor, and his father, Fay. Names from the Association's glorious past, Joe Guston, John Holmquist, Ed Bullock, laboured to refashion a truck axle for the mount, which involved among other tasks the challenging modification from journal bearings to thrust bearings. They needed R and R's commercial tumbler for the machine parts, and naturally the working space of a factory. Larson ultimately assembled the tube, actually heavy strutwork, at his house under the loving eye of Dorothy. The Borr Reflector, as it would be known in a few years' time, was "built to last," tube and plate, aluminum and steel.

Verily it has. The instrument was decommissioned and removed from the Veen Observatory with much ceremony in January, 2000. After purgatorial years in the barn at Kissing Rock Farm, the reflector was refit in the Public Museum through the good offices of its semi-retired (?) ex-Chief (?) Curator, the afore-mentioned DeBruyn. No one there is entirely sure of his status and he shares the confusion

*(Continued on page 7)*



# A Dark Sky Observatory Is Here

by David L. DeBruyn

In the Winter 2003-04 issue of *Inside Orbit*, I penned an article entitled *A Dark Sky Observatory Is Coming*. Two years later, I can enthusiastically write this follow up. On October 1st, a splendidly balmy evening splashed by the golden rays of a setting autumn sun, about two dozen people, comprising members of the GRAAA, Muskegon Astronomical Society, and newly formed Newaygo County Dark Sky Astronomers, gathered at the Steven F. Wessling Observatory at the Kropscott Farm Environmental Center north of Fremont. They were there for dedication of the facility's first permanent instrument, the Raymond B. Larson Telescope.

Elsewhere in this issue, the inimitable Gary M. Ross describes that event and the instrument's namesake in a style only one person is capable of. Be both amused and informed as you delve into that unique bit of creativity. What follows is a more conventional summary of an arduous project now nearly complete, with emphasis on the hectic eight months immediately preceding that memorable fall evening.

In the original article of two years ago, I explained the background of the GRAAA's involvement in this project. Its seeds were planted back in the 1980's when there was talk amongst board members about establishing a dark sky observatory for use by our membership. Retired engineer Warren Beecher did a thorough study of area light pollution and designated an area in northern Newaygo County as the only spot within a fifty mile radius of Grand Rapids that showed promise. There was little follow up and initial enthusiasm waned.

Then one day very late in the 20th century, Newaygo County school teacher/amateur astronomer Steve Wessling walked into my office to tell about his brainchild of establishing an observatory as the "crown jewel" of an environmental education center on a donated working farm north of Fremont. Lo and behold! This location was not far from the area Warren had zeroed in on as most practical for a dark sky observatory.

An opportunity awaited due to the coincidental confluence of two projects. As the advisory committee was being formed under the Newaygo County Conservation District to develop the new observatory, the venerable twelve and one half inch reflecting telescope that had stood in the west dome of Veen Observatory for close to three decades was being dismantled in favor of a high tech replacement.

As both a steering committee member for the Kropscott Farm project and longtime board member of GRAAA, I was in a favorable position to provide a guiding hand to a collaboration. Our board agreed to financially support complete refurbishing of the original Jeffrey Borr Telescope, and to provide the human resources to do the work. In return, the Newaygo County Conservation District, administrative body for the Environmental Center and proposed observatory, agreed to provide access to the telescope to GRAAA members. From all appearances, it was a win-win situation. The GRAAA had access to an old friend under a darker sky, and the new observatory had a user friendly and low maintenance telescope with decent optics for use by a new generation of amateur astronomers.

Following careful planning for the twenty by forty foot observatory structure with a roll off roof, led by Steve Wessling, ground was broken in June of 2004. Earl and Millie Kropscott, donors of the land, a farmhouse, and a historic barn and windmill, beamed as plans for a full scale development were described. When a sign was unveiled adjacent to where the first shovel full of earth had been turned, a visibly moved Steve Wessling found out that the new observatory would be named in his honor.

In the hands of a capable construction contractor, the building came together quickly on a picturesque knoll overlooking rolling farm country. As autumn set in last year, the observatory structure was already nearing completion. It became obvious it would soon be ready to house instruments. Foundations were built for three permanently mounted telescopes, with plenty of



surrounding floor space and outside platforms for portable instruments. The layout was well conceived, with carpeted floor, unobtrusive low level LED red floor lighting, and access for wheelchairs. Adjacent to the observing floor is a heated control room/library and restroom. Other support facilities, including possible sleeping accommodations for weary observers, may eventually be established in the nearby farmhouse or a proposed educational activities building.

As winter of 2004-05 set in, it was apparent that the GRAAA would soon have to make good on its promise to restore the telescope. During the previous summer, the tube, base, fork mount and miscellaneous parts had been retrieved from G.M. Ross' barn, where they had languished for several years. It was obvious that considerable deterioration from the elements had taken place. Happily, the optics and more precision components were in secure storage at the Public Museum of Grand Rapids, where they had been earlier taken during the disassembly process.



The restoration would be challenging but doable. The holidays came and went, and other projects took up most of January. By February, it was crucial that we get started if a working instrument were to be delivered by spring as promised.

The Museum's exhibits and building maintenance staff were helpful in getting the massive components transferred from our storage and archival facility at the site of the old museum on Jefferson Street to an available workspace on the fourth floor of Van Andel Museum Center. Underwriting from two donations, one from GRAAA charter member and Veen Observatory

visionary Ray Larson, and the other from myself, financed the arduous project.

Mike Murphy took all the bearings (which seemed in excellent shape) home to be cleaned and lubricated. Craig Priebe agreed to rebuild the primary mirror cell, and Larry Campbell carried off the setting circles, diagonal mount and other attachments for refurbishing in his home workshop.

To these individuals and their backup crew, consisting of Nick Bourjaily, Jerry Willette, Jon Lawrence, myself, and from time to time several others, fell the decidedly uninviting task of removing several coats of paint that had been applied over the years. The process of getting down to bare metal was tiring, dirty, and seemingly endless, requiring many nights and weekends over more than a month. Even the counterweights and minor components were not overlooked during this grueling effort. The Museum's tool arsenal, including several power sanders, a grinding wheel, and even a HiLo to move things around, proved invaluable.

Finally, by late March, we were ready for the painting and re-assembly process. Enter Jim Forch and his son John, who comprised the expert painting duo with a little help from their friends. Fortunately, Jim and John had access to the Museum's well equipped spray painting booth, complete with compressed air and a powerful exhaust fan. The venerable old telescope would glisten with a light blue-gray enamel finish once we figured out how everything fit back together. Added equipment would include a new erect field elbow finder from University Optics and Telerad sighting device.

There were some fitful moments, but by early May, the refurbished instrument was ready for packing and shipment. The fork and base (housing the right ascension axis) were mated together as one very heavy unit, requiring the HiLo for transfer from the fourth floor assembly room to the loading dock via the Museum's freight elevator. Crawlers sufficed for the tube and smaller components. Many of the Museum's packing blankets were employed while carefully loading the precious cargo onto Larry Campbell's pickup for the trip north.

Some hefty Wessling Observatory neighbors and other friends of the project had been mustered and were waiting for Larry and I upon arri-

val on a pleasant mid-May evening. They made quick work of unloading the components and depositing them safely onto the freshly carpeted observing floor of the new observatory. We discussed the modifications to the pier foundation that would be required to correctly mount the telescope and told the Kropscott gang we would be back with a crew to set the telescope up as soon as this work had been accomplished.

Several weeks later we got the word that all was in readiness, setting the stage for that memorable summer evening just after the solstice. There was a sense of anticipation as G.M. Ross, Jim and John Foerch and I drove north out of Fremont along Stone Road as the sun drifted toward the northwest in a brilliantly clean sky. About eight miles down the gently rising rural road, we spotted the observatory on a ridge in front of us, a low slung structure designed to blend in with surrounding farm buildings.

In his article, Gary eloquently alludes to the monumental challenge of first hoisting the axis-fork combination into place and then mating the square tube to it via sixteen small bolts that had to line up perfectly. Allow me to retell it in plain English. This process proved one of the most difficult and frustrating of the entire project, complete with grunts, groans, and a few words inappropriate for this lofty publication. We were fortunate to have had with us that evening a young and wiry new GRAAA member in the person of Paul Mann. Somehow, he contorted his body enough to get his head inside the tube in order to guide the screw hole alignment process along.

Fortune smiled and we managed to get the framework standing on its own with minimum of nicks and scrapes to the fresh paint. The fruits of several month's hard labor glinted in the golden white rays of a setting sun, needing only optics, ac-



cessories and alignment to spring back to life. Sitting nearby was beaming octogenarian Ray Larson, the mastermind behind the inception of this instrument four decades ago.



Gratified that the instrument appeared to move easily and smoothly in both right ascension and declination once the primary and secondary mirrors were in place, we turned Jim and John Foerch loose with their laser eyepiece tools in order to establish optical alignment. This was achieved with only moderate difficulty and fretting. Next, in the gathering twilight, came the finder, Telrad, and various counterweights to create a preliminary balance. Jupiter was emerging in the southwestern sky, and low to the northwest, in the lingering glow, Venus was cavorting with both Mercury and Saturn.



As the first stars appeared, the rejuvenated instrument was poised to receive "first light" for



the second time in its long history. Soon, astronomy enthusiasts would again have an opportunity to enjoy this easy to use telescope, just as scores of star gazers had over its many years at Veen. Sensing the significance of the coming moment, the jovial astronomers gathered there were geeked with excitement.

I asked to be the first to direct the resurrected telescope to its initial target -- and chose Jupiter. Balance was less than ideal and the new finder woefully off alignment as I groped around in the southwestern sky for the sought after target. I thought I had it and looked into the eyepiece. Instead of the planetary orb, I had snared the star "Porrima," Gamma Virginis, which at that time was located very close to Jupiter. So it is that this nondescript third magnitude star will long live in the annals of West Michigan astronomy as the first captured in what would several months later be christened the Raymond B. Larson telescope.



The image was crisp and clean, reassuring us that the above average optics had weathered their long layoff well. This finding was confirmed by Ray himself, who, once Jupiter was secured, became the second person to look through the scope.

Refinements to both the building and its first working telescope would take place over the rest of the summer, setting the stage for the dedication ceremony on October 1st. Fittingly, for a project upon which the muses had smiled; the evening was clear and mild. Many of the principals in the refurbishing effort made it, along with friends from among the GRAAA membership.

They were joined by members of the Muskegon Astronomical Society, Steve Wessling's home club, and charter members of the newly formed Newaygo Dark Sky Observers. About twenty-five persons in all assembled on the observing floor to reminisce about the past, take pictures, and look to the future.



As Ray Larson cut the ribbon, officially christening the telescope fittingly named in his honor, he remarked that he might now get a chance to actually get to use the telescope he helped build. All who know and respect him hope that proves to be the case.

All members of the GRAAA who are interested in doing so will be able to apply for access, once details of the collaborative arrangement are worked out. An orientation session will be required, scheduled by Steve Wessling, Observatory Coordinator, beginning in early spring. In the meantime, if you can't wait to check out the new observatory and refurbished telescope, perhaps Steve can accommodate you. Contact him at 231-924-4274, or [frogger@ncats.net](mailto:frogger@ncats.net).

The drive is from an hour to an hour and a half depending on where you are in Grand Rapids. I have done it in an hour and fifteen minutes from my home in Cascade Township. I recommend Alpine Avenue (M37) to the junction with M46 at Casnovia. Keep on M37 north to Newaygo and then on to White Cloud. Just past the village, turn left onto M20 and continue about ten miles to Stone Road. Go left on Stone Road less than a mile to Baseline Road and turn right. The Kropscott Farm Environmental Center and Wessling Observatory are on the northwest corner of Stone and Baseline Roads.



# What Good is a Computer?

by Thomas E. McCormick

*(Note: This article appeared in the 1975 Winter Edition of the Inside Orbit. Now that we all have our own PC's, it's an interesting read on the thinking thirty years ago)*

(EDITOR'S NOTE {from 1975}: Tom McCormick is a new and very active member of the G.R.A.A.A. who will be contributing regularly to the Inside Orbit. Mr. McCormick works with computers and is well qualified to discuss the capabilities and limitations of one of the modern astronomer's most important tools.)

Each generation has its magic words. The word "computer" is a magic word for our generation. The myths and misconceptions about computers are widespread. Use of the word implies that something is accurate and important beyond question. It implies that these machines are more intelligent than people. It casts doubt on information NOT processed by computer. It suggests that people who use computer produced information should be believed above others. It suggests that theories which include computer processed information must be better theories. Most of these myths seem to assign capabilities to machines which they cannot possess; i.e. "logic", "memory", "decisions", etc. These terms are used by computer people, but they are not taken to mean anywhere near what they mean when referring to persons. For example, we can say that a washing machine "remembers" to do the wash cycle before the rinse cycle. We do not mean to suggest that the washing machine "remembers" as a person might.

The washing machine is an example of a programmed machine; the computer is another example. Truly, they are both just dumb robots grinding away as their human masters have directed them to do. Why then do computers command so much more respect? I believe there are many reasons, but the biggest is that people seem to know that computers can extend man's abilities, where washing machines can only relieve him of some work. The human mind is the great thing here; a computing machine's speed

and consistency is set to work to serve the human mind. Unfortunately, many people see the computer in control, or they see some sort of partnership between man and machine. They fail to see the master/slave relationship - with man always the master.

Here are a few observations based upon several years of running a computer facility.

1. If it cannot be done without a computer, then it cannot be done with a computer. Computers only follow their program's instructions. These programs are written by people. The programs are the absolute extent of a computer's capabilities. Computers cannot possibly "know" more than the people who program them.
2. Just because something can be done with a computer does not mean that it should be done with a computer..
3. No computer can "correct" errors given to it any more than a desk top adding machine can "fix up" an incorrect entry. An old computer proverb goes: "Garbage in; garbage out."

Each tool that modern scientists use can extend the search for truth. Computers do have great potential for extending precision, extensive manipulation of variables in complex formulas, data enhancement, rapid search and recall from historical data, and for reducing some types of human errors that arise from boredom, interruptions, and arithmetic errors during tedious calculations. Small computers can serve well for reliable guiding/tracking tasks.

Following are some good uses for computers:

1. Calculations involving very complex formulas, such as celestial mechanics.
2. Very rapid calculations when persons simply cannot wait, i.e. during reentry, during a transit, etc.
3. Producing great precision even with very large numbers.
4. Performing voluminous and repetitive calculations.



tions.

5. Testing all conceivable alternatives rather than being limited to speed and costs of doing things manually.
6. Regression analysis; looking for subtle relationships or similarities among diverse historical data. For example, relating sunspot activity to weather.
7. Reducing typographical errors when revising or printing atlases, directories, etc. Generally, we need only scrutinize those items being added or changed; unchanged items need not be entered or typeset again.
8. Graphic output such as bar graphs and scattergrams are easily and economically produced from data already in a computer.
9. Listings in various sequences or groupings. For example, the NGC (New General Catalogue) could be listed by right ascension and declination, or in order of field size, or in order of average magnitude, etc.
10. Listings of only certain items rather than complete listings. These are called "exception reports" when they report only the unusual items. This can save valuable time scanning through droves of details.
11. Enhancement of emission image receptions; photographs, X-ray, UV, IR, etc. This proce-

dures is becoming well established in the 1970s, and promises great advances in our understanding of the universe when coupled with extra-terrestrial telescopes and other equipment.

12. Historical data saved on computer magnetic tape permits subsequent fast retrieval in future research, and the data will be uniformly readable and consistent.
13. Saving data on computer magnetic tape makes it easy to reproduce copies; this makes it easy for researchers to exchange data.
14. Duplicate data are easily detected and reported by the computer. Several other techniques are in use which improve the value of computer stored data.

Combinations of the above items can multiply the benefits to scientists. Computer people refer to this as "synergism"; the whole becomes greater than the sum of its parts. This is the sort of use that makes the computer a valuable tool. Like any tool, it can be used properly, used ineffectually, or abused. This depends upon the person using the computer. Automobiles and firearms are not always used properly; neither are computers. Most people use most tools in a beneficial way, and this is also true of computers.

---

## The Deed is Done

*(Continued from page 1)*

Back at the Wessling Observatory, it is 22 June 2005 and both are at ready: Larson, the Ancient One, and the historic reflector which now bears his name. He looked a little older. The telescope looked much younger. He looked reasonably together. The telescope was in pieces. Surrounded by assorted instruments and components thereof, Larson sat like a Dowager Emperor (is there such a thing?), vaguely approving, mildly amused, just short of condescension.

The Wessling Observatory is an expansively floored roll-off roof facility. Two steps were required for the flagship telescope's investiture near the middle of the open part of the building: a) bolt down the massive foot of the mount on which sits the big tuning fork, b) hoist the telescope cage, a/k/a/ tube, into the fork. Try then to align the screw holes. Where was Mr. DeMille in a *tableau* which cried for his camera? In the lowering sun under the fine sky, all we needed was

"The Pines of Rome" or the Fanfare from Copland's Third coming over speaker. There was neither fork lift nor crane, so this effort, like the Larson instrument, was done "the old fashioned way."

It was good so many eager hands were present, local and imports. Finally the telescope was held as much by gravity as bolts to a place it will occupy "until the Sun don't shine, the grass don't blow, and the wind don't blow" amongst the other telescopes. No one is anxious to shift it again anytime soon. Through craftsmanship and a sense of destiny, the Grand Rapids Association has joined arms with Newaygo County -- significantly named a "Dark Sky" group -- in a place which looks around and up from one of the commanding places in these parts.

First Light was Porrima, Gamma Virginis. This event was no less significant than the other occasion on a summer night in 1968. Larson looked through the telescope for the ages, then headed home because it was getting dark.

*Note: These articles are courtesy NASA Space Place Program at the Jet Propulsion Laboratory.*

## Where No Spacecraft Has Gone Before

by Dr. Tony Phillips

In 1977, Voyager 1 left our planet. Its mission: to visit Jupiter and Saturn and to study their moons. The flybys were an enormous success. Voyager 1 discovered active volcanoes on Io, found evidence for submerged oceans on Europa, and photographed dark rings around Jupiter itself. Later, the spacecraft buzzed Saturn's moon Titan—alerting astronomers that it was a very strange place indeed! —and flew behind Saturn's rings, seeing what was hidden from Earth.

Beyond Saturn, Neptune and Uranus beckoned, but Voyager 1's planet-tour ended there. Saturn's gravity seized Voyager 1 and slingshot it into deep space. Voyager 1 was heading for the stars—just as NASA had planned.

Now, in 2005, the spacecraft is nine billion miles (96 astronomical units) from the Sun, and it has entered a strange region of space no ship has ever visited before.

"We call this region 'the heliosheath.' It's where the solar wind piles up against the interstellar medium at the outer edge of our solar system," says Ed Stone, project scientist for the Voyager mission at the Jet Propulsion Laboratory.

Out in the Milky Way, where Voyager 1 is trying to go, the "empty space" between stars is not really empty. It's filled with clouds of gas and dust. The wind from the Sun blows a gigantic bubble in this cloudy "interstellar medium." All nine planets from Mercury to Pluto fit comfortably inside. The heliosheath is, essentially, the bubble's skin.

"The heliosheath is different from any other place we've been," says Stone. Near the Sun, the solar wind moves at a million miles per hour. At the

heliosheath, the solar wind slows eventually to a dead stop. The slowing wind becomes denser, more turbulent, and its magnetic field—a remnant of the sun's own magnetism—grows stronger.

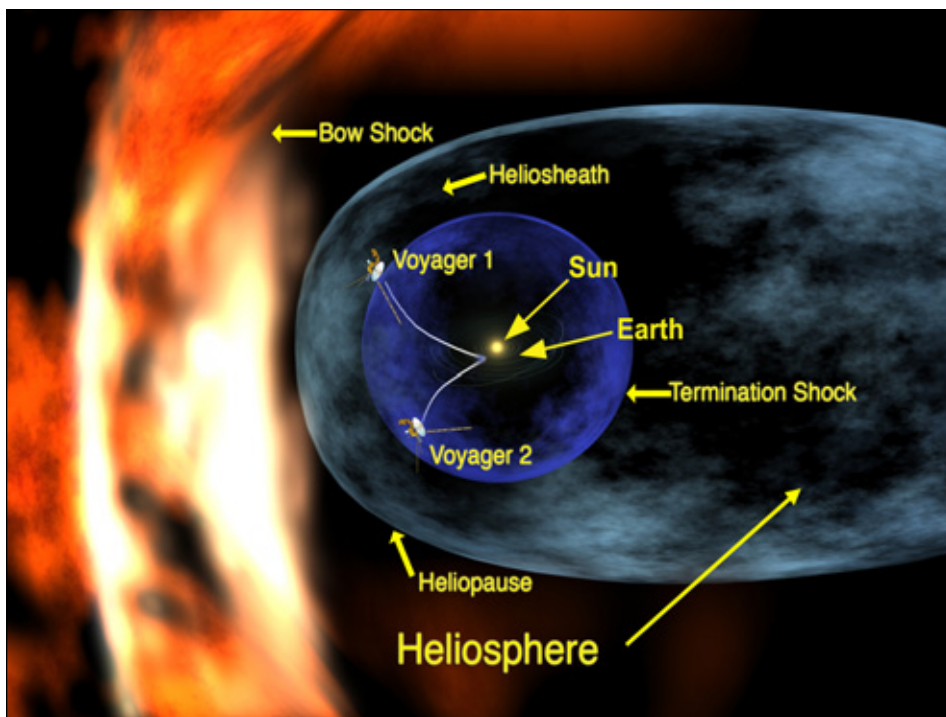
So far from Earth, this turbulent magnetic gas is curiously important to human life. "The heliosheath is a shield against galactic cosmic rays," explains Stone. Subatomic particles blasted in our direction by distant supernovas and black holes are deflected by the heliosheath, protecting the inner solar system from much deadly radiation.

Voyager 1 is exploring this shield for the first time. "We'll remain inside the heliosheath for 8 to 10 years," predicts Stone, "then we'll break through, finally reaching interstellar space."

What's out there? Stay tuned...

For more about the twin Voyager spacecraft, visit [voyager.jpl.nasa.gov](http://voyager.jpl.nasa.gov). Kids can learn about Voyager 1 and 2 and their grand tour of the outer planets at [spaceplace.nasa.gov/en/kids/vgr\\_fact3.shtml](http://spaceplace.nasa.gov/en/kids/vgr_fact3.shtml).

*Below: Voyager 1, after 28 years of travel, has reached the heliosheath of our solar system.*



## Voices from the Cacophony

By Trudy E. Bell and Dr. Tony Phillips

Around 2015, NASA and the European Space Agency plan to launch one of the biggest and most exacting space experiments ever flown: LISA, the Laser Interferometer Space Antenna.

LISA will consist of three spacecraft flying in a triangular formation behind Earth. Each spacecraft will beam a laser at the other two, continuously measuring their mutual separation. The spacecraft will be a mind-boggling 5 million kilometers apart (12 times the Earth-Moon distance) yet they will monitor their mutual separation to one *billionth* of a centimeter, smaller than an atom's diameter.

LISA's mission is to detect gravitational waves—ripples in space-time caused by the Universe's most violent events: galaxies colliding with other galaxies, supermassive black holes gobbling each other, and even echoes still ricocheting from the Big Bang that created the Universe. By studying the shape, frequency, and timing of gravitational waves, astronomers believe they can learn what's happening deep inside these acts of celestial violence.

The problem is, no one has ever directly detected gravitational waves: they're still a theoretical prediction. So no one truly knows what they "sound" like.

Furthermore, theorists expect the Universe to be booming with thousands of sources of gravitational waves. Unlike a regular telescope that can point to one part of the sky at a time, LISA receives gravitational waves from many directions at once. It's a cacophony. Astronomers must figure how to distinguish one signal from another. An outburst is detected! Was it caused by two neutron stars colliding *over here* or a pair of supermassive black holes tearing each

other apart in colliding galaxies *over there*?

"It's a profound data-analysis problem that ground-based astronomers don't encounter," says E. Sterl Phinney, professor of theoretical physics at the California Institute of Technology in Pasadena.

Profound, but not hopeless: "We have lots of good ideas and plans that work—in theory," he says. "The goal now is to prove that they actually work under real conditions, and to make sure we haven't forgotten something."

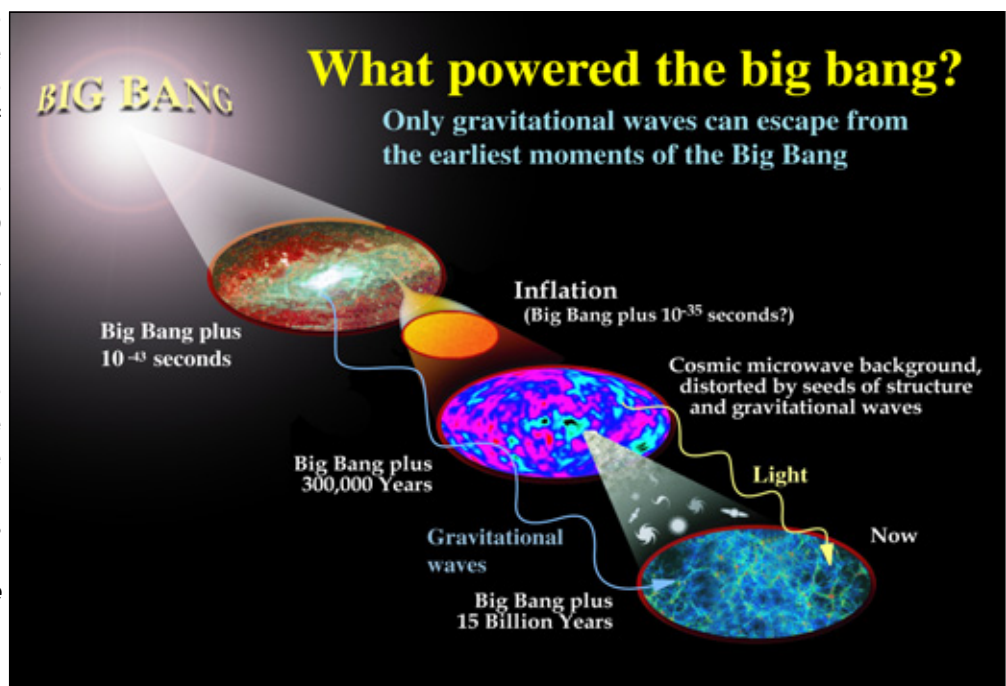
To that end, theorists and instrument-designers have been spending time together brainstorming, testing ideas, scrutinizing plans, figuring out how they'll pluck individual voices from the cacophony. And they're making progress on computer codes to do the job.

Says Bonny Schumaker, a member of the LISA team at the Jet Propulsion Laboratory: "It's a challenge more than a problem, and in fact, when overcome, a gift of information from the universe."

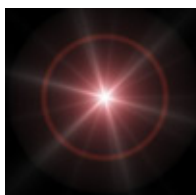
For more info about LISA, see [lisa.nasa.gov](http://lisa.nasa.gov). Kids can learn about black holes and play the new "Black Hole Rescue!" game on The Space Place Web site at

[spaceplace.nasa.gov/en/kids/blackhole/](http://spaceplace.nasa.gov/en/kids/blackhole/).

*Below: LISA will be able to detect gravitational waves from as far back as  $10^{-36}$  second after the Big Bang, far earlier than any telescope can detect.*







# The Alpha Stars

by Fritz Lowe

## Alpha Bootis

Alpha Bootis (Arcturus) is an ancient star. It is believed to be more than twice as old as our Sun. This age is determined by studying the light spectrum of the star to measure the amount of elements heavier than carbon that are present in the photosphere. In the early universe, elements heavier than carbon were rare. The metals that are abundant in the Solar System were created in the extreme heat and pressure of collapsing stars. Arcturus is classified as an "Extreme Population II" star, which basically means that it is a second generation star that formed only 3 billion years after the universe began.

Another indication of Arcturus' age is the inclination of its galactic orbit to the main disk of the Milky Way. It is currently located 69 degrees above the galactic plane and moving past us at 76 miles per second headed in toward the inner galaxy in an elongated orbit that will take it back out into the distant reaches of the galactic halo. At least 50 other stars have been identified that are traveling with Arcturus. Recent data suggests that these stars were stripped from a dwarf galaxy that entered the Milky Way eight billion years ago.

Arcturus will pass its closest to Earth within the next 5000 years and then gradually fade from view over the next half million years. Relative to the timescale of most galactic events, Arcturus is like a passing comet. It is moving across the northern sky faster than any other naked eye star. In 50,000 years it will have moved into Virgo and be within 4 degrees of first magnitude Spica. Imagine a future time when these two bright stars on the ecliptic are making conjunctions with the Moon and planets. What a sight.

Arcturus is a red giant star with a diameter that is 25 times greater than the Sun's. It has consumed most of its primordial hydrogen and is now fusing its helium into beryllium, carbon, and oxygen. As the star cools and expands, its energy output has begun to oscillate over an 8 day period causing its visible magnitude and color to

fluctuate slightly. Arcturus is the most luminous star within 60 light years. It is at least 80 times more luminous than the Sun. For a habitable planet to exist in an orbit around Arcturus, it would have to be at a distance greater than the orbit of Saturn. Yet even at this distance, Arcturus would appear larger in the sky than our Sun does from Earth.

The constellation of Bootes has many mythological roots from ancient cultures dating back to Babylonia and Akkadia (2200 bce). The only common thread among these many tales is that Bootes lived the life of a peasant even though his parents may have been gods. He is seen as a farmer, a hunter, a herdsman, and a wine maker. The rising of Arcturus in the eastern sky in late March marked the onset of Spring planting. And the setting of Arcturus at dusk in late September marked the time of harvest. Before the Big Dipper was seen as a bear, it was viewed in the shape of a plow, and Bootes was known as the plowman, even the inventor of the plow.

Later in Greek mythology when the dipper became the Big Bear, Bootes was known as "Arktophylakos" - the guardian or keeper of the Bear. In several versions of the Greek myth, his mother is Callisto who has vowed to remain a virgin in service to the goddess Artemis (Diana). However, when Zeus sees her beauty, he seduces her and she gives birth to her son Arkas (in Greek mythology Zeus seduces dozens of virgins and they all bear him children). When Zeus's wife, Hera, catches wind of this new affair, Zeus changes Callisto into a bear in order to hide her from Hera's wrath. However, the goddess Artemis is aware of this transformation and shoots Callisto for breaking her vow of chastity. Zeus, regretting the tragedy that he has caused, places Callisto in the sky as the constellation Arktos (Ursa Major).

In my favorite Greek myth of Bootes, he is seen as the Athenian, Icarus, who is taught the secret of making wine by Dionysius. When his

*(Continued on page 17)*



## A Brief History of the Time

Thanksgiving Day, 1988. The sun shown brightly on the snow all the way from Grand Rapids to Mt. Clemens. Aunt Jane had cooked a goose and a turkey with stuffings. Aunt Liz made the traditional green bean casserole with cream of mushroom soup and onion rings. Uncle Tony's liquor cabinet was well stocked and Uncle Dale had the Havana cigars. We showed up with the mashed rutabaga and tremendous appetites.

Up to that moment my observations consisted of wobbly views of the moon through a 3 inch refractor when I was twelve, a glimpse of Halley's Comet through binoculars from the Kentwood Municipal Complex on a very cold February morning in 1986 and the ability to differentiate between the Big Dipper and Orion. Sister Jane set up the scope, focused it on Jupiter and said, "Look!" I did and was astounded to see the Galilean satellites and cloud bands. In that instant I was hooked on astronomy. "Jane, there's an observatory near Grand Rapids and an astronomy club and I'm going to join it as soon as I get back to town tomorrow."

I called the Chaffee Planetarium that Friday and joined the Grand Rapids Amateur Astronomical Association the next week. I began visiting the James C. Veen Observatory on clear evenings and pestered Bruce Sidell, Terry Hunefeld and Gary Ross to explain the mysteries of "Telluride" sights (named, I presumed, after the

The following spring Dave DeBruyn showed me how the setting circles worked on the Borr and I wrote my letter requesting the keys to the kingdom to the Board of Directors:

"Dear Sirs and Madam, I have become an assiduous observer and want to increase my knowledge of the heavens by using the Borr Telescope and Veen Library. Please, may I have a key? Please, please, please, please, please, PU-LEEZE? Otherwise I will be calling you at home in the middle of the night and continue begging." In a brief but touching ceremony I received my key and have been an officially recognized amateur astronomer ever since.

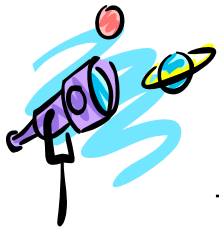
*Note: Jim Foerch joined the GRAAA in January of 1989, and never looked back. He is currently one of the Group Visit Coordinators, and also one of the trainers who teach observatory techniques to the members.*

*In real life Jim is a teacher by trade and musician by volition. He is employed by the Grand Rapids Public Schools; and his band - the Blue Water Ramblers - perform all over the Midwest. His website is [www.bluewaterramblers.com](http://www.bluewaterramblers.com).*

*If you would like to share with the members who you got started in astronomy, please take the opportunity to be included in future editions of the Orbit.*

It does at first appear that an astronomer rapt in abstraction, while he gazes on a star, must feel more exquisite than a farmer who in conducting his team.

- Isaac D'Israeli,



# The Solar System: Winter, 2005-2006

By Jeff Kozarski

**Mercury** will be in the morning sky this December reaching greatest elongation from the Sun on December 12. Look to the ESE about a half-hour before sunrise. Mercury appears yellowish in color and will be about  $11^\circ$  above the horizon on that morning a half-hour before sunrise.



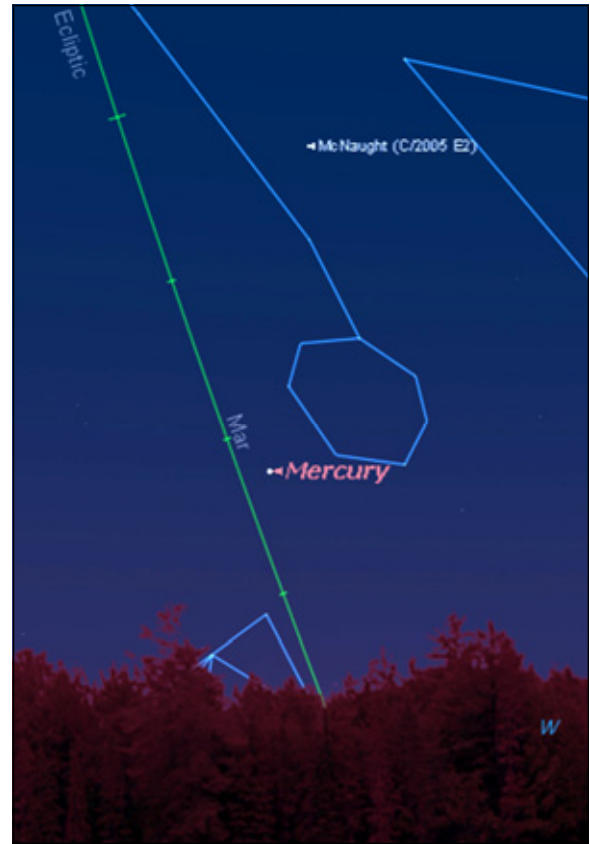
Above: Zero magnitude Mercury a half-hour before sunrise on December 12., Note a brighter Jupiter above it.

By the end of the month, Mercury sinks closer to the horizon disappearing into the Sun's glare.

Superior conjunction is on January 26 and Mercury will remerge into the western sky for the year's best evening apparition. Greatest elongation (evening) is on February 23.

The peak viewing for Mercury will be from the evenings of February 19 to March 1.

**Venus** is winding down its evening sky apparition in December reaching greatest brilliancy (-4.6 magnitude) on December 9. Venus will



Above: Mercury in the western sky a half-hour after sunset on February 23 shining at a bright  $-0.4$  magnitude.

slowly sink closer to the Sun disappearing by early January.

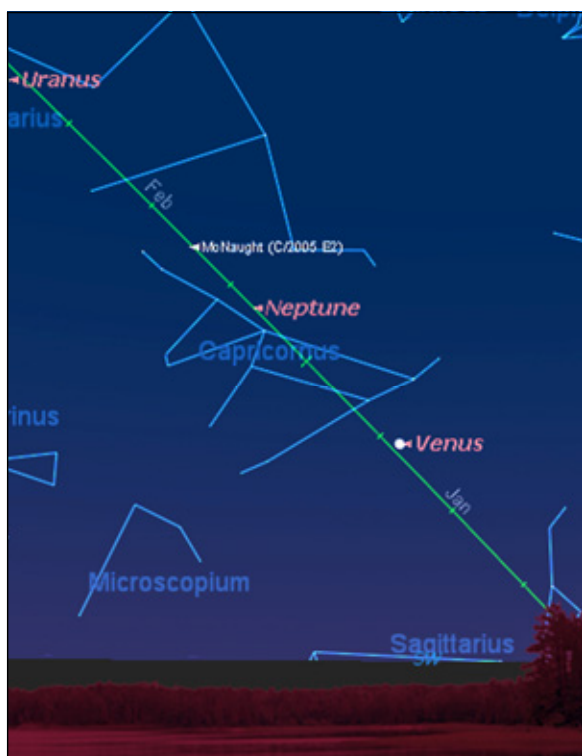
Inferior conjunction is January 13 and Venus rapidly moves from evening to morning sky. Venus and Earth are a mere 25 million miles apart from each other on January 13.

Suppose it were possible to part the Venusian clouds to view our blue home Earth at opposition on that date. We would see Earth appearing 1.1 arc minutes across and blazing at  $-6.7$  magnitude.

Well that's enough fantasizing for now, back to the solar system!

Venus' greatest brilliancy occurs February 17 ( $-4.6$  magnitude) in morning sky.

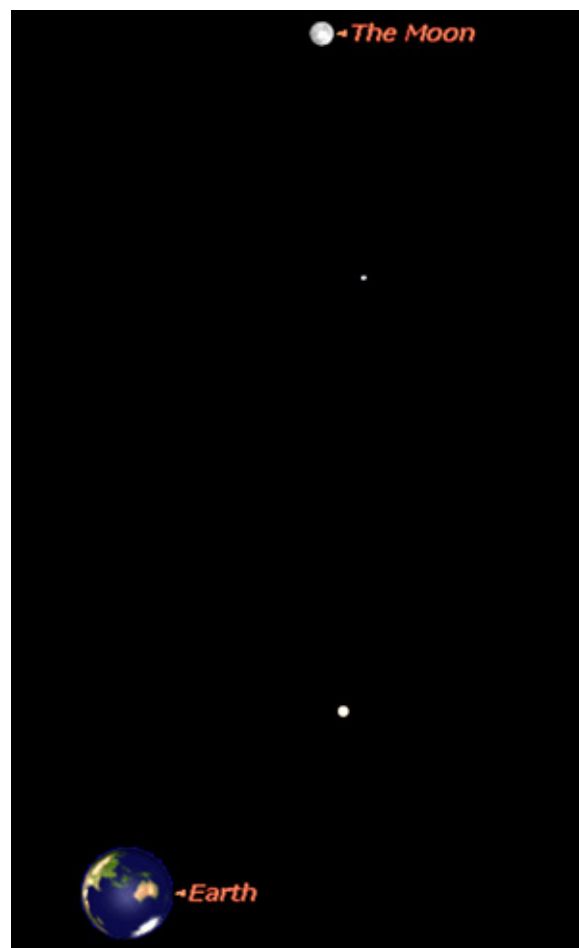




Look for Venus low in the SW after sunset during December evenings.



Here is what would **never** be seen on Venus from 43° N and 85° W at 5:00 UT on January 13. Earth is 16° up in Gemini.



A telescope would show Earth and moon like this. The Moon is a bright  $-2.6$  magnitude,  $18''$  across in size and a scant  $10'$  of arc apart from Earth. Note Australia visible.

Be sure to watch Venus through a telescope during the weeks before & after inferior conjunction. This is the most exciting time to view Venus as its phases narrow to a thin crescent a few weeks before inferior conjunction. At the same time the disk of Venus swells as it approaches Earth. On New Years Day Venus is  $59''$  of arc across and is 5% illuminated. By the beginning of February, Venus is already rising 2 hours before the Sun. A telescope will show the planet a thin crescent 11% lit and  $53''$  across. A month later Venus shrinks to 34% lit and  $35''$  across, rising just over 2 hours before the Sun on March 1.

Venus will remain in the morning sky well into the summer.



*Venus appears 16° up in the SE a half-hour before sunrise on February 17.*

- ☆ Full Moon occurs December 15, January 14, and February 12.
- ☆ New Moon occurs December 1 and 30, January 29, and February 27.
- ☆ Winter Solstice occurs December 21 at 1:35 EST.
- ☆ Earth is at Perihelion January 4.

**Mars** remains a bright object this winter in the evening sky halting its retrograde motion in Aries around December 11. It then resumes its “normal” forward motion against the background stars crossing back into Taurus in early February passing south of the Pleiades at mid-month. Though opposition was this past November, Mars still offers a little detail to the patient observer. Don’t wait too long to view it. The Martian disk slips below the 12” of arc threshold considered to be the minimum for useful observations on New Years Day.

Visually, Mars is a bright object this winter. It begins December at  $-1.5$  magnitude dimming to  $-0.6$  by New Years Eve. January finds Mars fading still to  $+0.2$  by the end of that month and

down to  $+0.7$  by the end of February. By March 17, Mars becomes a first magnitude object 139 million miles from Earth. The Red Planet will not invade our skies brighter than  $+1.0$  magnitude until April 29, 2007.

Mars will remain in the evening sky until summer.

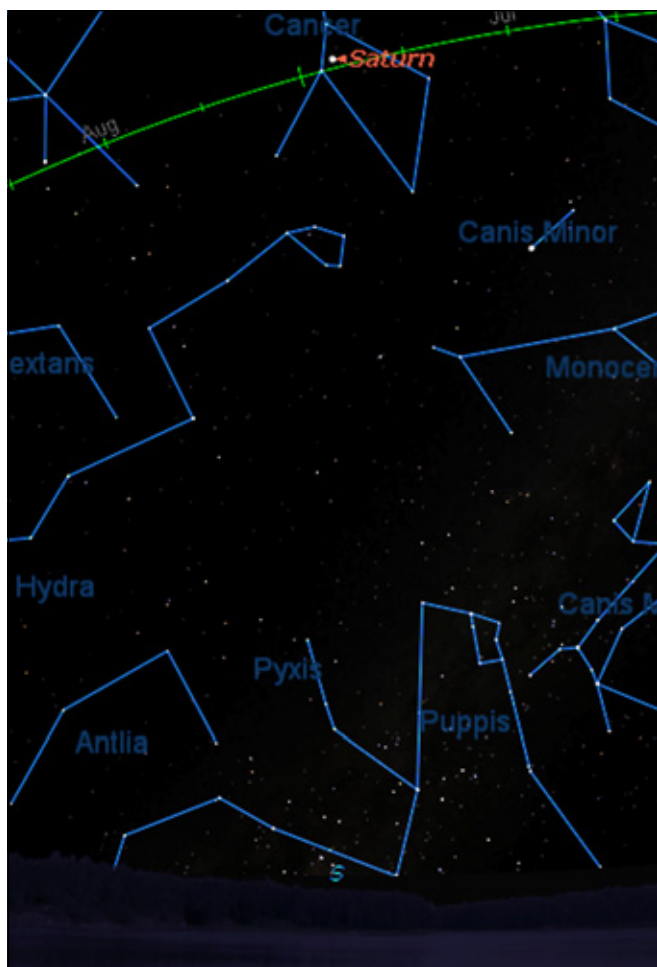
**Jupiter** is in the morning sky this winter having past solar conjunction in October. It is currently in Libra. It is a bright object around  $-2.0$  magnitude in January. The disk is still small for Jupiter standards, only 35” across in mid January.



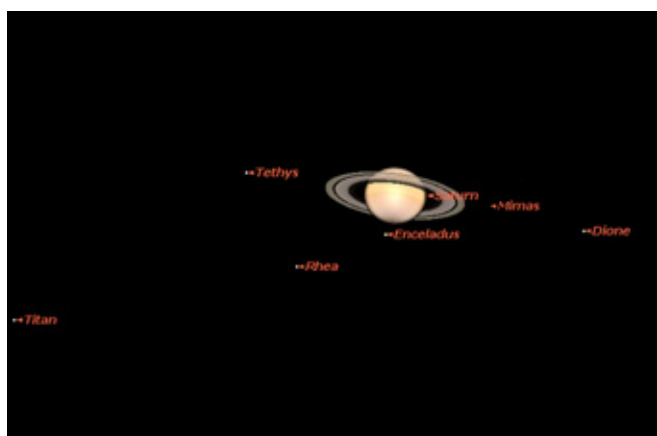
*Above: Jupiter and the moon on the meridian just before sunrise on January 23 rising over 4 hours before the Sun.*

By mid February mornings, Jupiter is well past the meridian just before sunrise. Jupiter will continue to dominate the “spring” constellations of the predawn winter sky reaching opposition in early May.

**Saturn** will be highly prominent this winter reaching opposition January 27 in Cancer.



Above: Saturn transiting at  $64^\circ$  up at opposition, 1:00 a.m. EDT.



Currently the rings of Saturn appear like this at opposition and the disk will be  $20''$  across and  $-0.2$  magnitude.

Saturn will remain high in the evening sky for telescopic observations well into the spring.

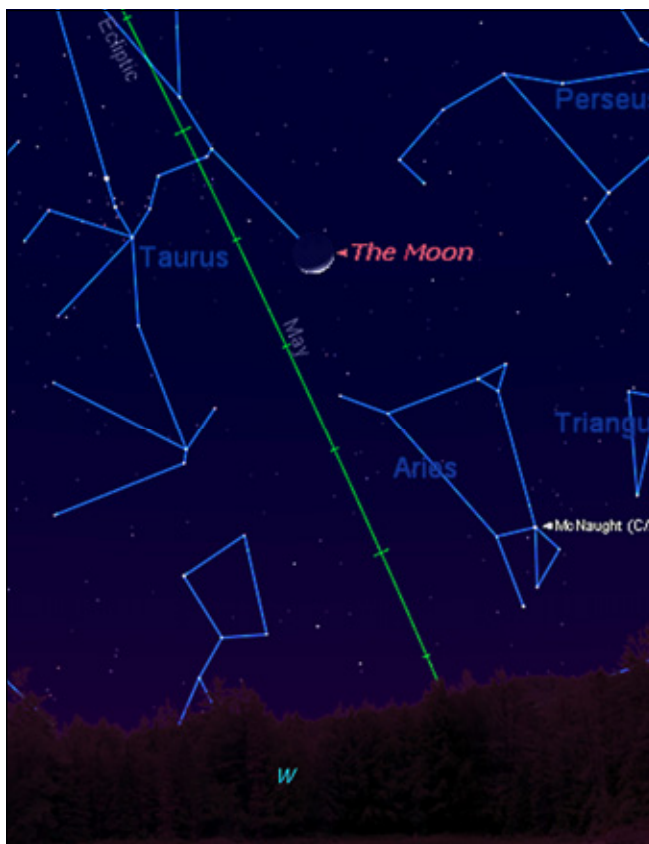
By February 23 it transits the meridian at 11:00 p.m. EDT.

**Uranus** is in conjunction with the Sun March 1 and **Neptune** is in conjunction with the Sun February 6. Both planets will be too close to the Sun this winter for easy viewing.

**Pluto** is in conjunction with the Sun on December 15 and will not be easily visible with a telescope until early 2006.

### Highlights for 2006:

- ☆ Quadrantid meteors peak January 3, moon will not interfere.
- ☆ Saturn at opposition January 27 in Cancer.
- ☆ Neptune in conjunction with Sun February 6.
- ☆ Mercury best in evening sky late February.
- ☆ Venus in morning sky from January through August, greatest elongation March 25.
- ☆ Uranus in conjunction with Sun March 1.
- ☆ Total solar eclipse March 29 Africa/Mediterranean.
- ☆ Crescent Moon passes in front of Pleiades April 1, evening sky (not April fooling either!)



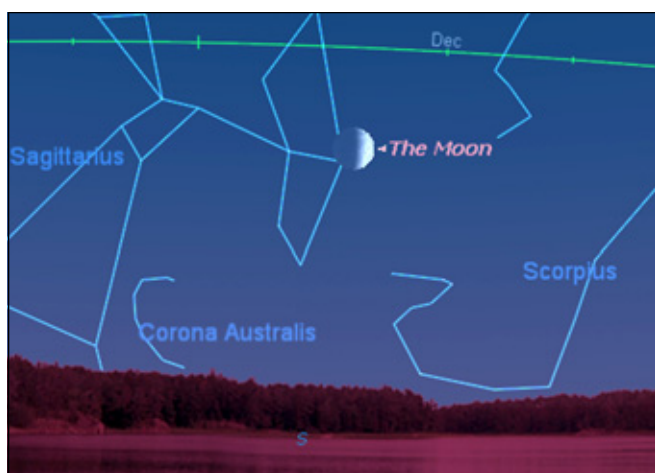
Above: The Pleiades disappear behind the moon in the evening sky.



- ☆ Moon at major northern standstill April 4, highest declination in 18 years.



Above: the near first quarter moon at sunset on April 4.



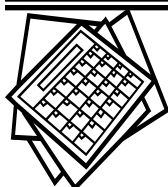
Above: the moon at sunset on September 29 just past the meridian only 17° high.

- ☆ Lyrid Meteor Shower peaks April 22, some interference by the moon in the pre-dawn hours.
- ☆ Jupiter at opposition May 4 in Libra.
- ☆ Eta Aquarid Meteor Shower peaks May 5, first quarter moon should not interfere.

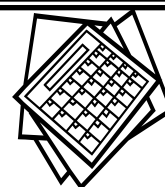
- ☆ Kuiper Belt Object 50000 Quaoar Closest Approach To Earth (42.300 AU) on June 7.
- ☆ Pluto at opposition June 16 in Serpens Cauda. (Discoverer Clyde Tombaugh's 100th Birthday was February 4)
- ☆ Saturn in conjunction with Sun August 7.
- ☆ Neptune at opposition August 11 in Capricornus.
- ☆ Perseid Meteor Shower peaks August 12, poor prospects/waning gibbous moon.
- ☆ Uranus at opposition September 5 in Aquarius.
- ☆ Moon at major southern standstill September 29, lowest declination in 18 years.
- ☆ Kuiper Belt Object 2003 UB313 (*not yet named*) Closest Approach To Earth (95.883 AU) on October 13.
- ☆ Orionid Meteor Shower peaks October 21, moon will not interfere.
- ☆ Mars in conjunction with Sun October 23, next opposition December 24, 2007 in Gemini.
- ☆ Venus at superior conjunction October 27 emerging in evening sky by years' end.
- ☆ Mercury transits the Sun November 8.
- ☆ Kuiper Belt Object 90377 Sedna Closest Approach To Earth (87.647 AU) November 14.
- ☆ Leonid Meteor Shower peaks November 17, good prospects/waning crescent moon.
- ☆ Jupiter in conjunction with the Sun November 21.
- ☆ Mercury best in morning sky late November-early December.
- ☆ The Geminid Meteor Shower peaks on December 13th. A last quarter moon will interfere.

## Space Missions

- ☆ January 15 - Stardust mission returns to Earth with samples from Comet Wild 2.
- ☆ March 10 - Mars Reconnaissance Orbiter arrives at its destination.
- ☆ April 11 - Venus Express arrives at its destination.
- ☆ May 5 - 45th Anniversary (1961), Freedom 7 Launch (Alan Shepard, 1st US Man in Space).
- ☆ Jul 20 - 30th Anniversary (1976), Viking 1, Mars Landing.
- ☆ Sep 03 - 30th Anniversary (1976), Viking 2, Mars Landing.



# Calendar of Events



## December

**December 17** - General meeting of the GRAAA. This is the annual **"You'll Burn"** and is being held at the **James C. Veen Observatory**, beginning at 6.30pm. *(Please note that it is not at Kissing Rock Farm as in years before)*. If you have never been to one, it features a bonfire, a potluck "dish-to-pass", and general astronomical merriment. It's called a "You'll Burn" because with the fire, "you'll burn" anything.

The fire will be lit at 7:00pm, and if you have some wood that you would like to bring to put on the pile, feel free to do so. However, no junk (building materials, couches, bookcases, etc.). Wood only. If you have any questions on whether your burnable items are acceptable, you can contact Ron Vander Werff. His email address is [observatory.committee@gmail.com](mailto:observatory.committee@gmail.com).

If you bring something to burn before the meeting, there is a **small post stuck in the ground** in the parking lot where you can place your burnables. Just put them around the post.

Also, as there is not a stove (just a microwave) at the observatory, there will be no any way to prepare food in the kitchen. All dishes brought to pass should be made beforehand, please. There is sufficient outlets to plug things in to keep them warm.

Otherwise come prepared for good food and fun, and be sure to dress warmly Think of is as the winter version of the "Star-B-Que." Of course, all members are welcome to attend.

## January

The January meeting will be a special viewing of the IMAX film **"Magnificent Desolation."** Details of the date and time are still being worked out, and will be put up on the club's website when available. The one thing that is certain is

that it will be on a weeknight.

## February

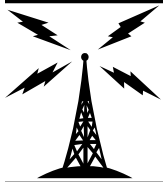
**February 18** - General meeting of the GRAAA at the James C. Veen Observatory, beginning at 7.30pm. The program, starting at 8:00pm, will feature a good old-fashioned "Star Bowl" quiz. We'll group up into teams and try to answer astronomical questions and trivia supplied by the quizmaster (whose identity is a secret as to not tarnish his (or her) reputation. All members and guest are welcome to attend, and take part in the fun.

### The Alpha Stars...

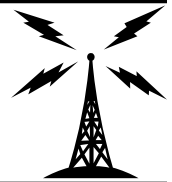
*(Continued from page 10)*

neighbors inquire about the concoction that he is brewing, Icarus offers to share some of his wine. When the men become drunk, however, they think that they have been poisoned. They fall on Icarus and kill him. In order to cover up the crime, they drag his body into the woods and bury it. When Icarus is found to be missing, his daughter Erigone goes looking for him with his hunting dog Maera. When they find the body, Erigone is overcome with grief and hangs herself. Touched by her death, Zeus transforms Erigone into the constellation Virgo. He places Icarus in the heavens as Bootes, and the dog Maera becomes one of the hunting dogs in the constellation Canes Venatici.

★★  
 ★ These earthly godfathers of heaven's light, That ★  
 ★ give a name to every fixed star, Have no more ★  
 ★ profit of their shining nights Than those that walk ★  
 ★ and wot not what they are. ★  
 ★  
 ★ -- William Shakespeare ★  
 ★  
 ★★★



## News Notes From the GRAAA



**Congratulations to the** following members who have been elected/re-elected to the Board of Directors for another two years: Caroline Dellenbusch, Kevin Jung, Jeff Kozarski, Will Millar, Jim Marron, Evie Marron.

**A reminder** to use caution when driving up to the observatory during the winter. Even though the road is being cleared (thanks to Ron Vander Werff) it still might be slippery, and it's easy to slide off the road into the trees.

**Thanks to those members** who came out and helped with the annual fall clean up/prepare for winter at the observatory. Many hands do make light work, as it only took a couple of hours. Thank you again Gail Carlson, Dave DeBruyn, Jim Foerch, Kevin Jung, Fritz Lowe, Paul Mann, and Ron Vander Werff. Let's hope it stays nice and tidy all the way through the winter months.

**The "You'll Burn" will be held** at the Observatory this year, instead of Kissing Rock Farm. All information is in the Calendar of Events page.

**After the first of the year** the small committee will meet to plan a members' survey. If you would like to help out, please contact Kevin Jung via the website. We are hopeful that the survey will assist the board in determining the future path of the association.

**The standing committees are** always looking for members interested in helping. These committees are Finance, Membership, Observatory, Program, Public & Visitors' Services, Publications, and Research & Technology. A list of these committees – and their members – is located on the club website in the **Members Section**.

**For the January meeting**, we will be having it on a weeknight, instead of a weekend. The day and date is not set yet, but it is planned that the club will get a special screening of the IMAX film "**Magnificent Desolation.**" We will need (a

minimum of) 30 people in order to have the screening. The January newsletter will have full information, and how to get tickets.

**The Stardust Mission** is nearing its end, with the samples of Comet Wild 2 returning to Earth on January 15, 2006. The capsule is scheduled to be caught in midair over the Utah desert in the early morning. In January 2004 the mission was successful in capturing cometary material from Wild 2, and also sent back incredible images of the comet.

**Launched ten years ago** on December 2nd, SOHO (the Solar and Heliospheric Observatory) is still watching the sun all the time. It's explored the solar wind and the atmosphere, discovered over 1000 comets, all from an orbit 1.5 million kilometers directly sunward of planet Earth itself. At that location, known as a Lagrange point, the gravitational influence of the Earth and Sun are equal.

**Scientists using a combination** of ground-based and orbiting telescopes have discovered a failed star, less than one-hundredth the mass of the sun, possibly in the process of forming a solar system. It is the smallest known star-like object to harbor what appears to be a planet-forming disk of rocky and gaseous debris, which one day could evolve into tiny planets and create a solar system in miniature.

**Astronomers have combined** two powerful astronomical assets, the Sloan Digital Sky Survey (SDSS) and NASA's Hubble Space Telescope, to identify 19 new "gravitationally lensed" galaxies. Among these 19, they have found eight new so-called "Einstein rings", which are perhaps the most elegant manifestation of the lensing phenomenon. Only three such rings had previously been seen in visible light.

**Remember** you can always get the latest club and astronomy news on the GRAAA website.





# ROGER B. CHAFFEE PLANETARIUM

Public Museum of Grand Rapids

## Winter-Spring 2006 Show Schedule Showing January 2 -27

Showing January 28 - May 7

### For children and family audiences

**MAGICAL SKY** - In this delightful planetarium show especially for young children, a talking telephone pole, fire hydrant, and other "characters" engage in dialogue with the planetarium operator to convey basic concepts about the sky in a way that is both meaningful and fun. Highlights include an imaginary trip to the moon and a brief but realistic thunderstorm created through special effects.

**30 minutes**

SHOWTIMES: **Saturday & Sunday at 1:30p.m.**

### For general audiences

**STAR TREK - ORION RENDEZVOUS** - While enveloped in multiple wide angle visual effects spread across the planetarium dome, Lt. Commander Geordi La Forge (LeVar Burton) conducts audience members on an exciting science fiction adventure through the Milky Way galaxy. Approach a sun 800 times larger than our own, peer into a stellar birthplace, and visit a cosmic graveyard, among other cosmic adventures. Actors Jonathan Frakes and Majel Barret Roddenberry add their talents to this multimedia experience based on the wildly successful television series.

**40 minutes**

SHOWTIMES: Daily at 2.30pm.

**UNDER WINTER SKIES** - This is a continuation of the regular series of sky shows in which prominent stars and constellations of the season as well as celestial special events are illustrated. Saturn, prominent in the winter skies of 2006, is the featured planet. **40 minutes**

SHOWTIMES: Saturday & Sunday at 3:30pm.

**Added Value:** This show is free with paid Museum admission; or arrive after 3:00pm. for the planetarium show only and pay only \$3.00/ person.

### For general audiences

**STARS OF THE PHARAOHS** - Explore the skies of the ancient Egyptians, and learn how their amazing contributions to science continue to influence us today. Participate in the unraveling of the mysteries of the stars and pyramids within the unique audio and visual environment of the planetarium theater. This show accompanies the Public Museum of Grand Rapids' spectacular exhibition: *Treasures of Ancient Egypt, The Quest for Immortality*. It is FREE with Museum admission. **30 min.**

SHOWTIMES:

Tuesday, Wednesday, Friday: 1:30 & 3:30 pm.

Monday & Thursday: 1:30, 3:30, & 7:30 pm.

Saturday: 11:30am., 12:30, 1:30, 2:30 & 4:30 pm.

**Also Apr. 3-7** - Sunday: 1:30, 2:30 & 4:30pm.

**UNDER STARLIT SKIES** - This is a continuation of the regular series of sky shows in which prominent stars and constellations of the season as well as celestial special events are illustrated.

**40 minutes**

SHOWTIMES: Saturday and Sunday at 3:30pm. **Also daily at 3:30 p.m. Apr. 3-7**

**Added Value:** This show is free with paid Museum admission; or arrive after 3:00 p.m. for the planetarium show only and pay only \$3.00/ person.

## SPECTACULAR LASER LIGHT SHOWS

January 2 - May 7

The most popular music of famous rock bands is drawn from their legendary albums. High power sound is accompanied by stunning visual effects on the planetarium's giant projection dome. Some shows also include multicolored laser light. Separate \$6.50 admission each show.

**45 minutes**

SHOWTIMES: Fridays and Saturdays:

Pink Floyd - *Dark Side of the Moon* at 8:30pm.

Radiohead - *OK Computer* at 9:30pm.

Pink Floyd - *The Wall* at 10:00pm

# The Amateur Astronomer's Introduction to the Celestial Sphere

*Announcing a new book by GRAAA member Will Millar*

In March 2006, Cambridge University Press will publish the first book of a series authored by GRAAA member and Grand Rapids Community College Professor Will Millar. This first book, "**The Amateur Astronomer's Introduction to the Celestial Sphere**," is a basic introduction to the night sky. Here is the synopsis from Cambridge's website...

This introduction to the night sky is for amateur astronomers who desire a deeper understanding of the principles and observations of naked-eye astronomy. It covers topics such as terrestrial and astronomical coordinate systems, stars and constellations, the relative motions of the sky, sun, moon and earth leading to an understanding of the seasons, phases of the moon, and eclipses. Topics are discussed and compared for observers located in both the northern and southern hemispheres. Written in a conversational style, only addition and subtraction are needed to understand the basic principles and a more advanced mathematical treatment is available in the appendices. Each chapter contains a set of review questions and simple exercises to reinforce the reader's understanding of the material. The last chapter is a set of self-contained observation projects to get readers started with making observations about the concepts they have learned. William Charles Millar, currently Professor of Astronomy at Grand Rapids Community College in Michigan, has been teaching the subject for almost twenty years and is very involved with local amateur astronomy groups. Millar also belongs to The Planetary Society and the Astronomical Society of the Pacific and has traveled to Europe and South America to observe solar eclipses. Millar holds a Masters degree in Physics from Western Michigan University.

## Contents

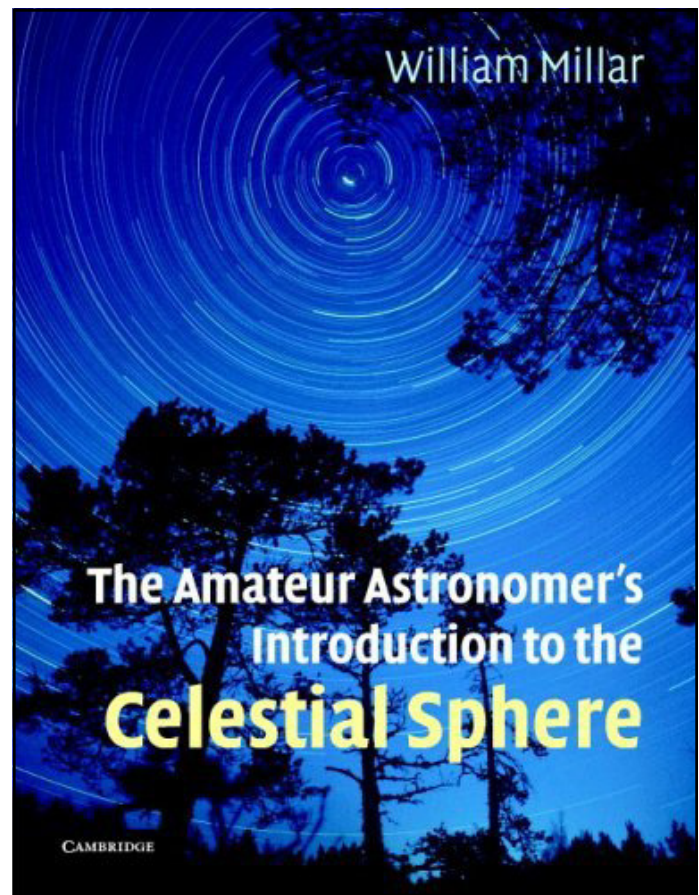
1. The lure of the sky
2. Location and coordinates
3. Stars and constellations
4. Motions of the Earth
5. The seasons
6. The phases of the Moon
7. Eclipses
8. Observation projects
9. Appendices

Paperback (ISBN-10: 052167123X | ISBN-13: 9780521671231)

This title available for pre-order at most bookstores and online.

Pre-order from Amazon.com

Pre-order from Barnes & Noble.com



**Grand Rapids Amateur Astronomical Association  
Membership Application or Renewal Form**

DATE: \_\_\_\_\_

☐ **New Membership**      ☐ **Renewal**

Please fill out the information below as completely as possible.  
For Family memberships, please include all persons for whom membership is desired.

**Please Print**

Name: \_\_\_\_\_ Birthdate: \_\_\_\_\_

Name: \_\_\_\_\_ Birthdate: \_\_\_\_\_

Name: \_\_\_\_\_ Birthdate: \_\_\_\_\_

Name: \_\_\_\_\_ Birthdate: \_\_\_\_\_

Name: \_\_\_\_\_ Birthdate: \_\_\_\_\_

Name: \_\_\_\_\_ Birthdate: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Home Phone: \_\_\_\_\_ Cell Phone: \_\_\_\_\_

E-Mail: \_\_\_\_\_

(Note: For Family members, if more than one e-mail address, please list others on back of application)

☐ **Adult** (18 or older, a Minimum of \$35.00) . . . . . \$ \_\_\_\_\_

☐ **Student** (through 17 yrs old, a Minimum of \$20.00) . . . . . \$ \_\_\_\_\_

☐ **Family** (all members of one family, a Minimum of \$45.00) . . . . . \$ \_\_\_\_\_

*(Note: Contributions greater than the minimum dues are considered a donation and are tax-deductible)*

☐ **Observatory Endowment Fund** . . . . . \$ \_\_\_\_\_

☐ **Miscellaneous Donations** . . . . . \$ \_\_\_\_\_

*(Note: Contributions to these funds are tax-deductible. Indicate amount of donation)*

☐ **OBSERVATORY USER FEE:** (a Minimum of \$20.00 per user) . . . . . \$ \_\_\_\_\_

*(Contributions of more than \$20 will help meet repairs and upgrade of equipment costs.)*

If you are a qualified user of the Veen Observatory, and wish to remain so, check  
the box for **"User Fee."**

**TOTAL ENCLOSED** (From all categories above) . . . . . \$ \_\_\_\_\_

Make Check or Money Order to:

**GRAND RAPIDS AMATEUR ASTRONOMICAL ASSOCIATION (or GRAAA)**

Mail to: Jerry Persha, GRAAA Treasurer  
199 Smith St.  
Lowell, MI 49331

**Grand Rapids Amateur Astronomical Association**  
**3308 Kissing Rock Ave. SE**  
**Lowell, MI 49331-8918**