

Inside Orbit

A Publication of the
Grand Rapids Amateur
Astronomical Association

In This Issue:

Calendar of Events & News Notes

Happenings in the GRAAA and the astronomical community

The Solar System - August 2006by Jeff Kozarski

*Will the Perseids be any good? Want to know where the moon is on a certain day?
This is the article for you*

Double Teaming to Make a Dobsonian Goto Scope.....by Ron Wright

*Blending the best of new technology with the old, to make searching
for deep sky objects easier*

Venus Transit 2004 Expedition and Adventure.....by Kevin Vaught.

A travelogue about the trip to see the Venus Transit

NASA's Space Place

*The wonders of the world of science and technology, brought to you by
the Jet Propulsion Laboratory*

Planetarium Show Listings

Current programs at the Roger B. Chaffee Planetarium

"The Amateur Astronomer's Introduction to the Celestial Sphere"

Will Millar's first book is now in your local bookstores!!!

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

Inside Orbit Staff

Editor-In-Chief	Kevin Jung
Editing, Layout & Graphics	Kevin Jung
Contributing Authors	Jeff Kozarski
Contributing Authors (this edition)	Ron Wright, Kevin Vaught
Production Staff	Kevin Jung, Will Millar

GRAAA Website

www.graaa.org

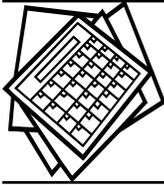
Mailing Address:

Inside Orbit
3308 Kissing Rock Rd SE
Lowell, MI 49331

Cover Photos:

"Laser-Scope" courtesy Ron Wright

"Transit Trip" courtesy Kevin Vaught



News and Events

(Latest News and Events always online
at www.graaa.org)



THE GENERAL MEETING OF THE GRAAA will be held on **Saturday, August 19th** at the James C. Veen Observatory, beginning at 8.30pm. (**Note the special start time**). The featured activity for the night is a all-club Star Party. Members - both new and not-so-new - are encouraged to bring out their telescopes and equipment and enjoy a wonderful evening under the stars with their fellow GRAAA members. A good time will be had by all.

BOOK UPDATE: Will Millar's first book - "*The Amateur Astronomer's Introduction to the Celestial Sphere*" - is (finally!) now available at local bookstores or online. If you can't find it locally, just ask them to get a few copies in. If you want it autographed, bring your book to a meeting, and he might just sign it. Now all we have to do is wait for the next ones.



Will Millar's book on the shelf at Barnes & Noble in Grand Rapids

VISITORS' NIGHTS IN AUGUST are the 12th and 26th of the month. We will be sending out reminders the week of open nights. Please assist us if you can. Thanks to all of those members who have helped previously.

OBSERVATORY STATUS UPDATES. With some recent situations at the observatory (the road being resealed, no power, etc.) we are trying to implement a notification service to let members know if there is something going on up on the hill that might make your trip out there a waste of time. Really, driving all the way out there to find out that the West Dome isn't working can be a drag.

So here what will be done: If there is something going on that will hamper your use of the facilities, there will be a notice put on the main page of the Members' Section of the website, and will remain there until the situation is resolved. That way, just by logging into the Members' Section, you will be able to see if there are any problems before journeying out to the hill. If you don't see anything listed, then everything is shiny. This will take effect immediately. Thanks to Ron Wright for the suggestion (and making the webmaster's job harder).<g>

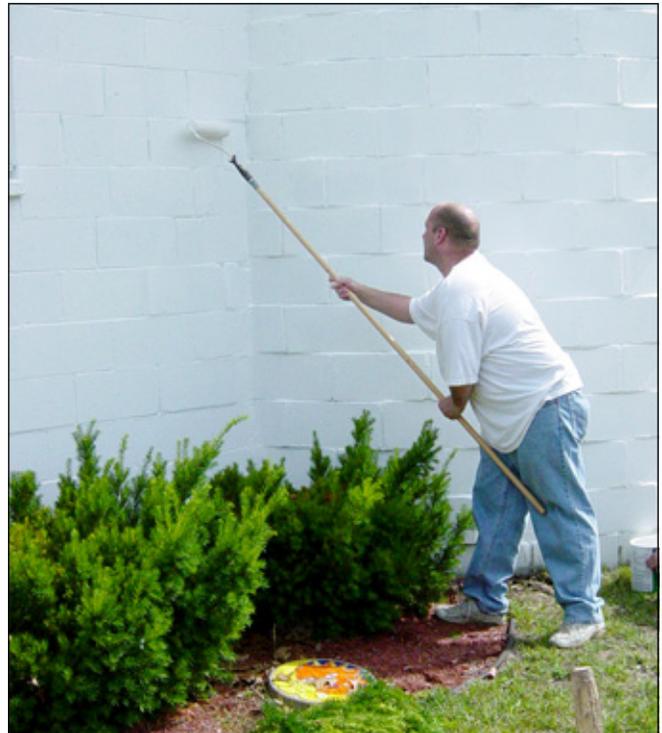
LAST MONTH THE DOMES TO the observatory were painted, and this month it was the building proper. A big thank you to all members who gave their time to undertake this project: Larry Campbell, Gail Carlson, Jim Foerch (and son Jon), Dell Paielli, Roger Smith (and kids Andy and Sara), Lou Welke.



L-R: Dell Paielli, Jim Foerch, Larry Campbell, and Lou Welke finish touching up the portable signs



Above: Dell Paielli laboriously applies the new paint job to the west dome

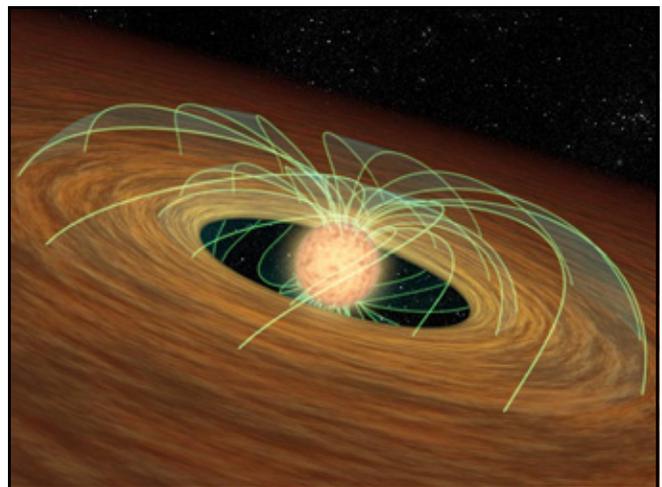


Roger Smith keeps rolling along near the East Dome

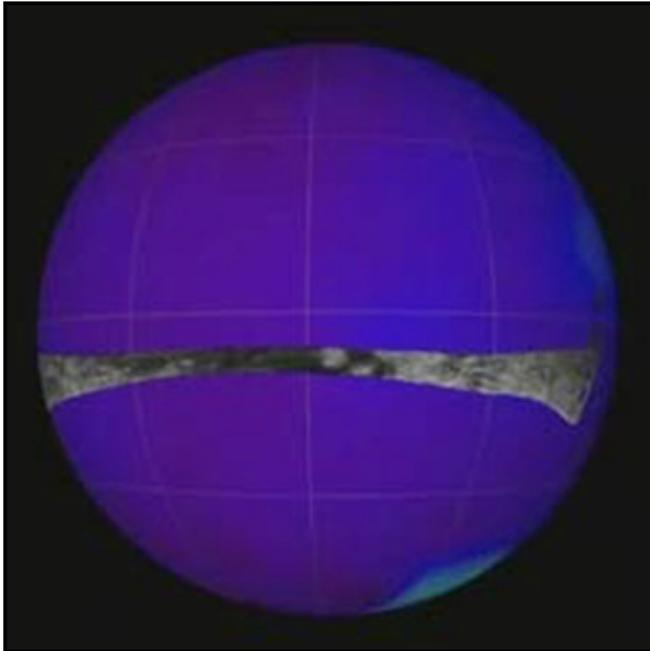


Gail Carlson works on the West Dome, while Lou Welke and Dell Paielli take care of the building proper.

PLANET-FORMING DISKS MIGHT PUT THE BRAKES ON STARS: Astronomers using NASA's *Spitzer Space Telescope* have found evidence that dusty disks of planet-forming material tug on and slow down the young, whirling stars they surround. Young stars are full of energy, spinning around like tops in half a day or less. They would spin even faster, but something puts on the brakes. While scientists had theorized that planet-forming disks might be at least part of the answer, demonstrating this had been hard to do until now.

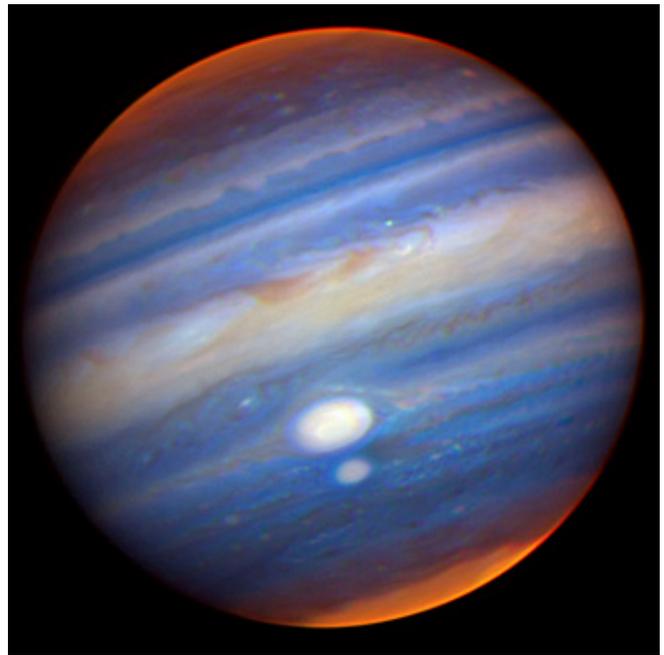


CASSINI REVEALS TITAN'S XANADU REGION TO BE AN EARTH-LIKE LAND: New radar images from NASA's *Cassini* spacecraft revealed geological features similar to Earth on Xanadu, an Australia-sized, bright region on Saturn's moon Titan. These radar images, from a strip more than 4,500 kilometers (2,796 miles) long, show Xanadu is surrounded by darker terrain, reminiscent of a free-standing landmass.

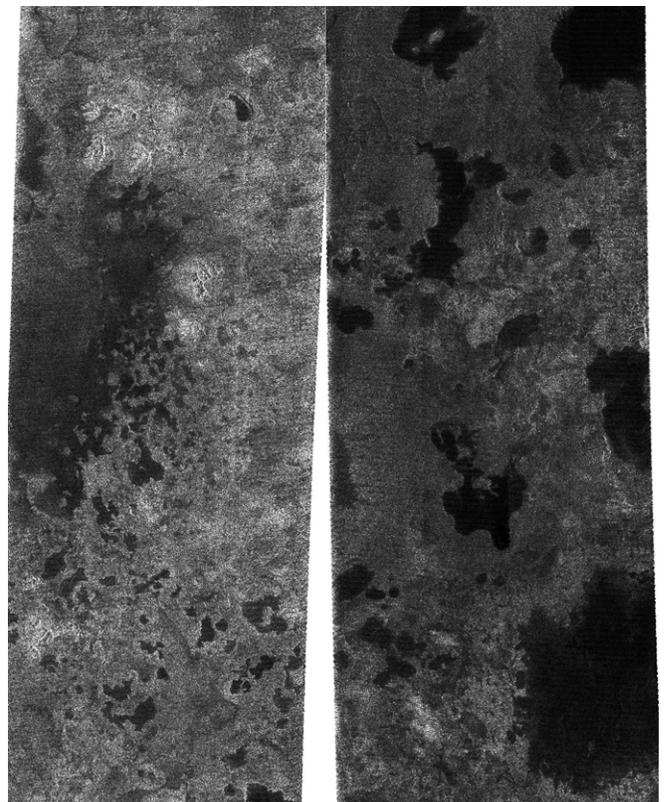


At the region's western edge, dark sand dunes give way to land cut by river networks, hills and valleys. These narrow river networks flow onto darker areas, which may be lakes. A crater formed by the impact of an asteroid or by water volcanism is also visible. More channels snake through the eastern part of Xanadu, ending on a dark plain where dunes, abundant elsewhere, seem absent. Appalachian-sized mountains crisscross the region.

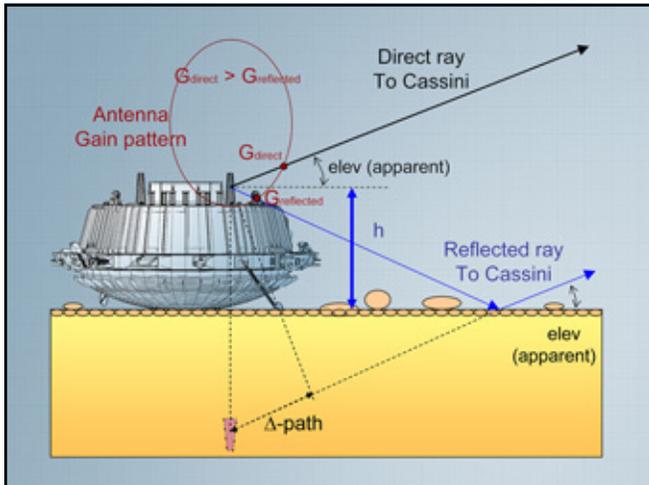
GEMINI CAPTURES CLOSE ENCOUNTER OF JUPITER'S RED SPOTS: A high-resolution image released by the Gemini Observatory shows Jupiter's two giant red spots brushing past one another in the planet's southern hemisphere. The image was obtained in near-infrared light using adaptive optics which corrects, in real-time, for most of the distortions caused by turbulence in Earth's atmosphere. The result is a view from the ground that rivals images from space.



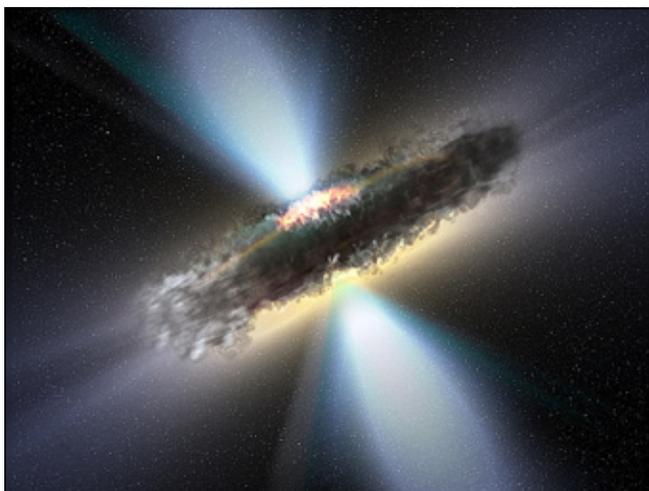
LAKES ON TITAN: The *Cassini* spacecraft, using its radar system, has discovered very strong evidence for hydrocarbon lakes on Titan. Dark patches, which resemble terrestrial lakes, seem to be sprinkled all over the high latitudes surrounding Titan's north pole.



TITAN'S PEBBLES 'SEEN' BY HUYGENS RADIO: An unexpected radio reflection from the surface of Titan has allowed ESA scientists to deduce the average size of stones and pebbles close to the Huygens' landing site. The technique could be used on other lander missions to analyze planetary surfaces for free.



NASA SCIENTISTS CONDUCT CENSUS OF NEARBY HIDDEN BLACK HOLES: Scientists on a quest to find hidden black holes in the local universe have found surprisingly few. The observation implies that if these hidden black holes exist---and most scientists are convinced they do---they must be from the more distant, earlier universe, a concept that has interesting implications for galaxy evolution.



This illustration shows the thick dust torus that astronomers believe surrounds supermassive black holes and their accretion discs. When the torus is seen edge-on' as in this case, much of the light emitted by the accretion disc is blocked.

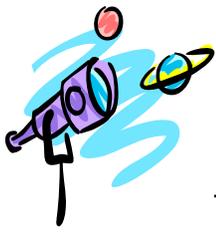
This work constitutes the first census of the highest-energy part of the X-ray sky, where the most dust-enshrouded black holes are thought to shine. A team from NASA's Goddard Space Flight Center in Greenbelt, Md., conducted the census, comprised of nearly two years of continuous data from the European Space Agency's International Gamma Ray Astrophysics Laboratory, or INTEGRAL, satellite.

PODCASTS: SPACE PLACE TO GO! No time to think about the wonders of the universe, much less how to explain them in a simple way to your students? Sign up for the new Space Place Podcast. Listen when you have time. In each Podcast, a NASA scientist answers fascinating questions about space and Earth science, with a little technology thrown in for good measure. Go to <http://spaceplace.jpl.nasa.gov/en/educators/podcast/> to subscribe. Or you can listen now on your computer or read the transcripts. Best of all, you can listen while you go for a walk, looking up at the beautiful night sky and thinking about all that is out there, known and unknown.

OPINIONS NEEDED: Very soon we will be publishing a survey about a wide array of subjects of interest to the members. It will be available on the website, and by taking the time to fill it out you will be helping the Board of Directors chart the future course of club events and activities. When you receive the email that it is ready, please take the time to fill it out.

DEADLINE FOR THE SEPTEMBER ISSUE of the *Inside Orbit* is Saturday, August 19th. If you are interested in writing an article, review, etc., please contact the editor via the website. Submissions would be more than appreciated. In fact, there's nearly a 100% probability you will get published.

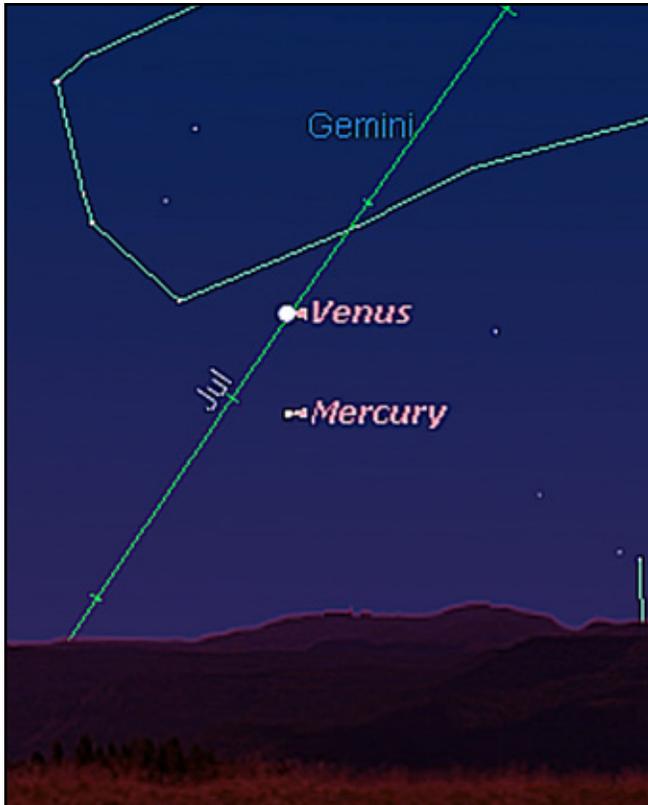
INFORMATION SPOT: The **Carbon Cycle** is the nuclear fusion reaction cycle that occurs in the cores of stars with masses greater than that of our Sun, with temperatures exceeding 16 million degrees. The reaction cycle involves carbon (C), nitrogen (N), oxygen (O), hydrogen (H) and helium (He). Hydrogen is fused into helium with the help of carbon, which acts as a catalyst to the reaction.



The Solar System: August 2006

By Jeff Kozarski

Mercury is at greatest elongation in the morning sky on August 6th. It will be about 8° up in the ENE a half-hour before sunrise, glowing yellowish in color at around zero magnitude.



Mercury and Venus on the morning of August 6th

Mercury will be nearby the much brighter Venus for many days. The two will not be in conjunction during this apparition because Mercury drops lower each day into the solar glare starting by mid August.

By the end of the month it will be lost in the bright twilight. Superior conjunction with the Sun is on September 1st.

Venus is located in the predawn sky this month. For the first half of the month it will be nearby Mercury in the ENE before sunrise. Venus is slowly losing altitude this month. On August 1st it is 18° high at sunrise. That slips to 13°



On the morning of August 22nd, Venus, the Moon, Saturn and Mercury adorn the predawn sky around 6:30 a.m. EDT

by August 31st. Nonetheless, Venus is still very bright at -3.9 magnitude. A telescope reveals a nearly full phased disc about $10''$ of arc across.

Venus is slowly winding down this morning apparition. Superior conjunction is in late October.

August 2006 Lunar Data:

- ☆First Quarter – August 2 at 4:46 am. EDT.
- ☆Full Moon – August 9 at 6:54 am. EDT.
- ☆Last Quarter – August 15 at 9:51 pm. EDT.
- ☆New Moon – August 23 at 3:10 pm. EDT.
- ☆First Quarter – August 31 at 6:56 pm. EDT.

Mars is hopelessly lost in the solar glare this month. It is setting in the west about 45 minutes after sunset early in the month dropping lower each evening. Therefore this season of Mars observing is over. Conjunction with the Sun is in October.

Jupiter remains in the evening sky this month in Libra. It will be in the SW after sunset.

Jupiter is setting just before midnight by mid-month. It won't reach conjunction with the Sun until October.



August 29th, the moon and Jupiter again a half-hour after sunset.

Saturn is in conjunction with the Sun on August 7th. It returns to the morning sky late this

month joining the planets Mercury and Venus. It is nearby Mercury on the mornings of August 20th and 21st and also Venus on the 26th.

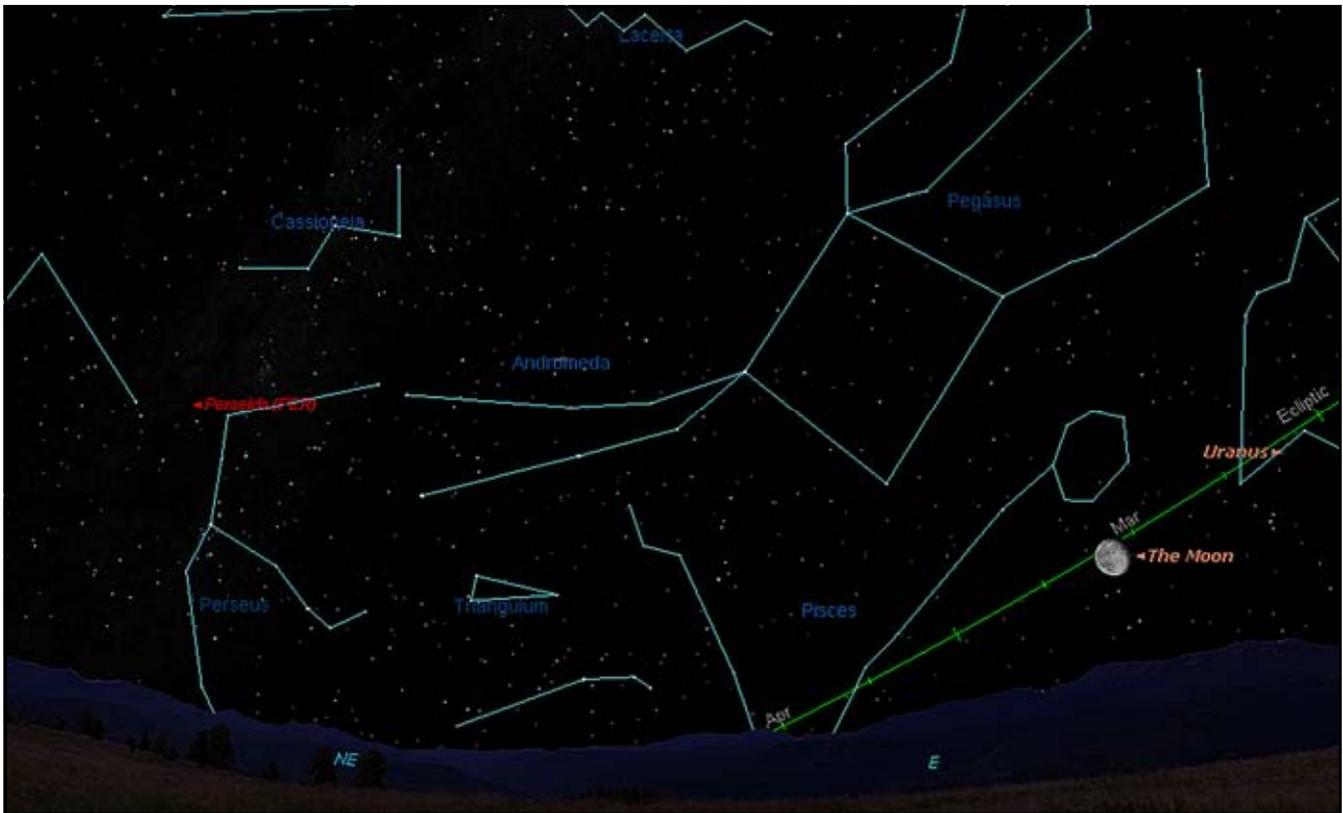
Uranus is rising around 9:30 p.m. EDT on August 15th. It can be viewed with a telescope in Aquarius glowing at +5.7 magnitude. Wait until after midnight for the planet to be highest in the south. Opposition is early next month.

Neptune is located in Capricornus. Opposition occurs on the night of August 10-11. Neptune transits around 1:45 a.m. EDT on the 11th. It is a +7.8 magnitude object with a 2.4" of arc disc.

Pluto is located in the SW sky well after sunset. Currently in Serpens Cauda the +13.9 magnitude dot of light is visible through large telescopes. By the end of the month, Pluto is setting just before 2 a.m. EDT.

The Perseid Meteor Shower peaks on the morning of August 12th. A nearly full moon (90%) will be rising after 10:00 p.m. EDT on August 11th washing out most of the meteors unfortunately.

Below: Looking to the ENE around 11:30 p.m. EDT on the evening of August 11th



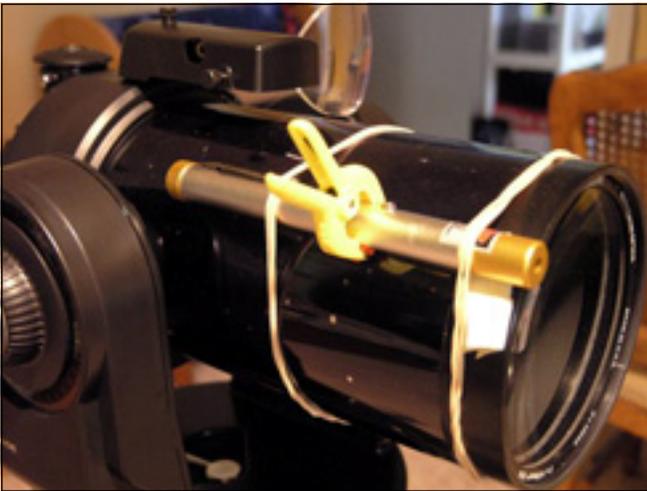


Double Teaming to Make a Dobsonian a Goto Scope

by Ron Wright

First of all I want to start out by saying this was not my idea. It came from a conversation with Eric at *Oceanside Photo and Telescope (OPT)*. I am not sure where he got the idea from, but I thought it was worth a try.

The idea is to mount a green laser on to a goto scope and use it to guide a Dobsonian. It sounded like it might work. I have a friend, Keith, who has a 10 inch dob. I have an ETX 105 PE with an Autostar Goto computer. I told him about the idea and he was game. We set up a day to it a try.



I took 2 very large rubber bands and put them around the tube of my ETX. Then I put my green laser under the bands. I got a mini clamp and clamped it to the green laser to hold the switch in place so it would stay turned on. I fired up the scope and gave it a shot. I pointed my scope to Jupiter. The laser beam was really off. So with my scope trained on Jupiter in the eye piece, I moved the laser around in the rubber bands to get the beam of the laser lined up on Jupiter in the sky. Just like setting up a finder scope. I had to put a piece of paper wadded up between the laser and the tube to get it to point right.

Keith tried to see the laser with the dob. He was about 20 ft away and could not find the laser in the scope. We moved the 2 scopes to about 5

ft of each other. Boom! It worked. He could then see the laser in his scope. We were off and running. The sweet smell of success!

I left the laser turned on and hit the first object on my goto computer. The scope started slew and I have to tell you it was pretty cool seeing that laser slew across the sky. When my scope stopped I looked in the eyepiece to confirm that we had the object. There was a faint fuzzy.

Keith moved his dob to the area of sky the laser was pointing. He sighted in the point of the laser in the sky and I turned off the laser. There it was, the fuzzy was in his field of view and turned out to be a nice nebula in his 10 inch.

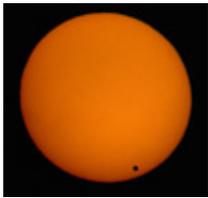
Speed was the major issue here. We would hit the object, look at it for a minute and then type in another object into the computer. We were at the next object within mere seconds. We were able to pop off about 15 messier objects in about an hour and a half.

We had a great time working together and we got to see a lot of objects in one night. This was a great way to spend time with a friend and see a lot of objects in one shot.

This Idea is also good for finding some of the more distant planets. These are hard to star hop to because the position is always changing. The computer keeps track of them, just touch a few keys and boom, there is the laser pointing to Neptune.

I have come up with another adaptation for this idea. I have never really made friends with a Telrad. I think that the idea is great but I never can seem to see the stars through the lens, even with the bull's-eye turned way down. And if you get into a dew situation...well the thing is just short of worthless. So, I have also strapped the laser on to the finder scope of the Dob. I use the same technique as above but with the laser actually attached to the finder scope. I find a bright object in the scope and then align the laser with that object and voila. Just turn the laser on, move the scope with laser attached to the area

(Continued on page 11)



Venus Transit 2004 Expedition and Adventure

by Kevin Vaught

Monday morning rolled around just like any other Monday I had encountered. However, this one had a kind of electricity in the air that was almost palpable. I knew right away what it was. The Venus Transit less than 24 hours away and I had NO idea where I was going to go to observe this event that no one alive had seen in 122 years.

The weather forecast for Va. Beach did not look good according to the Clear Sky Clock for most of the day but it looked really promising for the northern and northwestern part of the state (Virginia). At around 1600 the emails were flying and the sweat was dripping as I began to realize that a road trip was the only sure way to see this transit. Now I was not sweating because it was hot or I was afraid of a late night drive or anything like that. Oh no. I was afraid to tell my wife that I was going to go off in the middle of the night, drive to goodness knows where with a bunch of guys, wait for the sun to come up, and then take pictures of a black spot moving across the face of the sun. I was finally able to squelch my fears long enough to make plans with Glen Howell of the Norfolk Astronomical Society, of which I am a member and he is the president, to head up the Eastern Shore of Virginia to an island called Chincoteague. This would be an ideal spot if the weather would hold for us as it was further north and east of our current location so as to give us a few more minutes of transit viewing time. The plan was that I was to bring a tent and camp while Glen and Dan Rodgers (also a member of NAS) were going to split a room in a local motel on Chincoteague Island. THE WIFE WENT FOR IT.

I arrived at Glen's at around 2115 and we loaded his gear in my 2003 Dodge Durango with a 17 cubic foot swing out cargo box on the back, attached to the trailer hitch. From there we proceeded to Dan's house and picked him up. Now the deal was I would drive and pay for gas; they would pay for tolls and let me sleep on a roll away bed in the motel room. A very fair deal in my book with the price of gas. We were on the

road from Dan's at 2200 on the way to Chincoteague Island and the Venus Transit of 2004.

The drive up was mostly uneventful with light traffic as it was late on a Monday night. The only interesting thing to report was watching a speeder get pulled over on the Chesapeake Bay Bridge Tunnel. The cop pulled out and passed us and had to be going at least 100mph as he gained on the speeder. Very cool. Makes you sometimes wish you had been a cop (only sometimes though). Conversation on the way up was mostly astronomy related as you can imagine, but we did gravitate a bit toward music and art and some other off topic areas that are not fit for this forum. <BIG GRIN>

As we neared Chincoteague we started to scout out gas stations for the return trip. It was interesting to note the huge gap in pricing from one side of the street to the other. We finally decided on a station on the south bound side that had prices comparable to those at home.

We arrived on Chincoteague Island at 0030 and found our key to the room waiting for us. I was really much to wound up to sleep but knew I would need some rest for the transit so we all sacked in at 0100 setting 3 alarms for 0430 to make sure that at least 1 of them worked and we would be awakened on time to get to the wildlife refuge by 0500 when the gates opened.

0430 did not come quick enough for me but when it did we were up and dressed and out the door headed for the refuge. Glen had brought a fantastic thermos with him the previous day that I was doubtful would still contain hot coffee, but by golly it was hot and steamy and oh so delicious!!!

After a short drive to the beach parking area where we were to set up, morning twilight was in full swing. The sky was a beautiful grayish blue and clear as a bell. It was magnificent. We parked at the north end of the lot just up from some other astronomers who were setting up on the sand. With my ASGT mount this was not going to be possible (*see photo*)

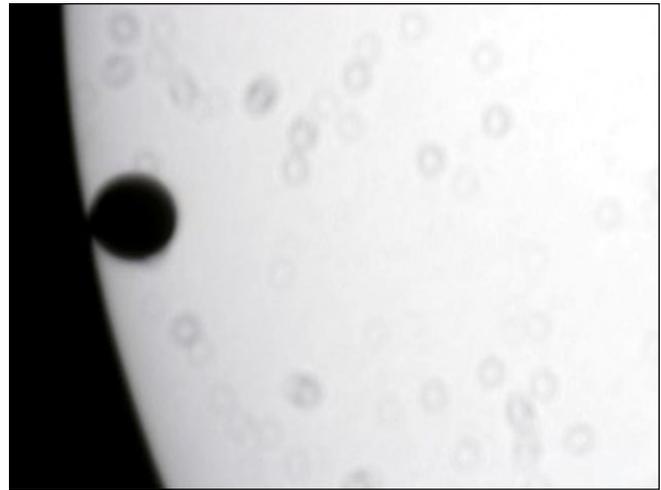
I found a place close to some picnic tables and we setup shop and waited for sunrise. It was

0528. We had about 14 minutes to wait. During that time final equipment checks were made and nervous chatter could be heard (or was that all in



my head).

Finally, as if on queue, the sun popped up and it was a glorious orange reddish color. Glen got the first picture from our group and it was a dandy. The first 15 or 20 minutes or so we did not need or filters on the scopes. But we did have some clouds to fight. Right after the sun reached 10 degrees in altitude a line of cloud



cover obscured our view for about 5 or 10 minutes. Then it cleared for another 10. Then at around 15 degrees altitude it was again obscured for another 5 but after that it was clear sailing for the rest of the transit which was over at 0725.

All in all it was a spectacular event. One that I am glad that I did not miss and glad that I was able to witness this event with two wonderful people like Glen Howell and Dan Rodgers, who are great teachers and traveling companions. Thanks guys, and maybe we won't have to go so

The Top 10 Classic SF Lines As Written by Shakespeare

10> "When thou art nine hundred years aged, thou wilt not look as dashing."

9> "Would not an Atrides by any other name still be Muad'Dib?"

8> "Therefore shalt a robot not harmeth a human being; this being the first and most felicitous law...."

7> "Hie thee hither, anon -- most alluringly doth the Dark Side beckon!"

6> "In the farthest aether, beyond the stars, no one canst hear thee scream."

5> "Father, do not thou spurnest thy truest daughter, Maureen, nor sendeth her hence unfulfilled...."

4> "Prithee, faithful HAL, fling wide the portals of the conveyance!" "Alack, good Sir Dave; I fear I cannot!"

3> "Space... the frontier that remaineth. Listen thee to the epic of the Starship Enterprise. Her blessed five year endeavor: to explore odd new Earths. To seeketh out new life and unknown societies. To bravely venture where no man hath ventured anon."

2> "These be NOT the metal vassals ye seek!"

and the Number 1 Classic SF Line As Written by Shakespeare...

1> "Look upon yon fellow, with shirt of blazing red! I testify in truth, Jim, the poor wretch be quite dead!"

[Copyright 2006 by Chris White]
[<http://www.topfive.com>]

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

Celebrating 40 Years of Intent Listening

by Diane K. Fisher

In nature, adjacent animals on the food chain tend to evolve together. As coyotes get sneakier, rabbits get bigger ears. Hearing impaired rabbits die young. Clumsy coyotes starve. So each species pushes the other to “improve.”

The technologies pushing robotic space exploration have been like that. Improvements in the supporting communications and data processing infrastructure on the ground (the “ears” of the scientists) have allowed spacecraft to go farther, be smaller and smarter, and send increasingly faint signals back to Earth—and with a fire hose instead of a squirt gun.

Since 1960, improvements in NASA’s Deep Space Network (DSN) of radio wave antennas have made possible the improvements and advances in the robotic spacecraft they support.

“In 1964, when Mariner IV flew past Mars and took a few photographs, the limitation of the communication link meant that it took eight hours to return to Earth a single photograph from the Red Planet. By 1989, when Voyager observed Neptune, the DSN capability had increased so much that almost real-time video could be received from the much more distant Planet, Neptune,” writes William H. Pickering, Director of JPL from 1954 to 1976, in his Foreword to the book, *Uplink-Downlink: A History of the Deep Space Network, 1957-1997*, by Douglas J. Mudgway.

Mudgway, an engineer from Australia, was involved in the planning and construction of the first 64-m DSN antenna, which began operating in the Mojave Desert in Goldstone, California, in 1966. This antenna, dubbed “Mars,” was so successful from the start, that identical 64-m antennas were constructed at the other two DSN complexes in Canberra, Australia, and Madrid, Spain.

As Mudgway noted in remarks made during the recent observance of the Mars antenna’s 40

years of service, “In no time at all, the flight projects were competing with radio astronomy, radio science, radar astronomy, SETI [Search for Extra-terrestrial Intelligence], geodynamics, and VLBI [Very Long Baseline Interferometry] for time on the antenna... It was like a scientific gold rush.”

In 1986 began an ambitious upgrade program to improve the antenna’s performance even further. Engineering studies had shown that if the antenna’s diameter were increased to 70 m and other improvements were made, the antenna’s performance could be improved by a factor of 1.6. Thus it was that all three 64-m DSN antennas around the world became 70-m antennas. Improvements have continued throughout the years.

“This antenna has played a key role in almost every United States planetary mission since 1966 and quite a few international space missions as well. Together with its twins in Spain and Australia, it has been a key element in asserting America’s pre-eminence in the scientific exploration of the solar system,” remarks Mudgway.



(Continued on page 11)



ROGER B. CHAFFEE PLANETARIUM

Public Museum of Grand Rapids

Summer 2006 Show Schedule August through September 4

For general audiences

VOYAGE TO INFINITY - Participate in an imaginary space voyage. Drift among star clusters, nebulas and galaxies, probing deep into space and far back in cosmic time. The stirring soundtrack is accompanied by full dome Digistar images, wide angle video and multiple special effects. **40 minutes.**

SHOWTIMES: Daily at 2:30 pm.

UNDER SUMMER SKIES - An informal look at highlights of the night sky, including the brightest stars, planets and constellations currently visible. Includes a dramatic simulation of a flight out of the Milky Way galaxy. **45 minutes**

SHOWTIMES: Daily at 3:30 pm.

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 children and family audiences

THE GREAT SPACE CHASE

Education/Entertainment Feature with Laser Light

In this amusing tale, illustrated with colorful laser graphics and other planetarium visuals, a detective chases a crafty fugitive across the universe. Included are several interludes of delightful music set to a variety of special effects. **35 minutes**

SHOWTIMES: at 1:30 pm.

Note: Planetarium sky theater closed for maintenance Sept. 5-22, 2006

Goto scope

(Continued from page 7)

you area you want to see, and there it is in your finder scope. No need to sight down the tube.

This technique also works well when trying to show someone what you are looking at in the sky. Sometimes I will have people with me while I am viewing, and they will ask "now where are we looking?" I just turn the laser on and it points straight to where the object is.

A note about lasers: This will only work with a green laser. You will not be able to see a red laser in the sky. I own two green lasers and

found out that not all lasers are created equal. One of mine is about twice as bright as the other and they are rated at the same wattage. I encourage you to purchase a laser where you can try it out before you buy it. They can be readily found on the internet, eBay, and in ads in astronomy magazines.

Now, I do not need to warn you about looking in the scope with a laser pointed in the scope do I? The laser is always pointed away from the scopes.

So grab a friend and green laser and go on a Messier Marathon. Have a blast! We did.

NASA Space Place

(Continued from page 10)

Find out more about the DSN and the history of the Mars antenna at <http://deepspace.jpl.nasa.gov/dsn/features/40years.html>.

Kids (and grownups) can learn how pictures are sent through space at http://spaceplace.nasa.gov/en/kids/phonedrmarc/2003_august.shtml.

The Amateur Astronomer's Introduction to the Celestial Sphere

Announcing a new book by GRAAA member Will Millar

In July 2006, Cambridge University Press published 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

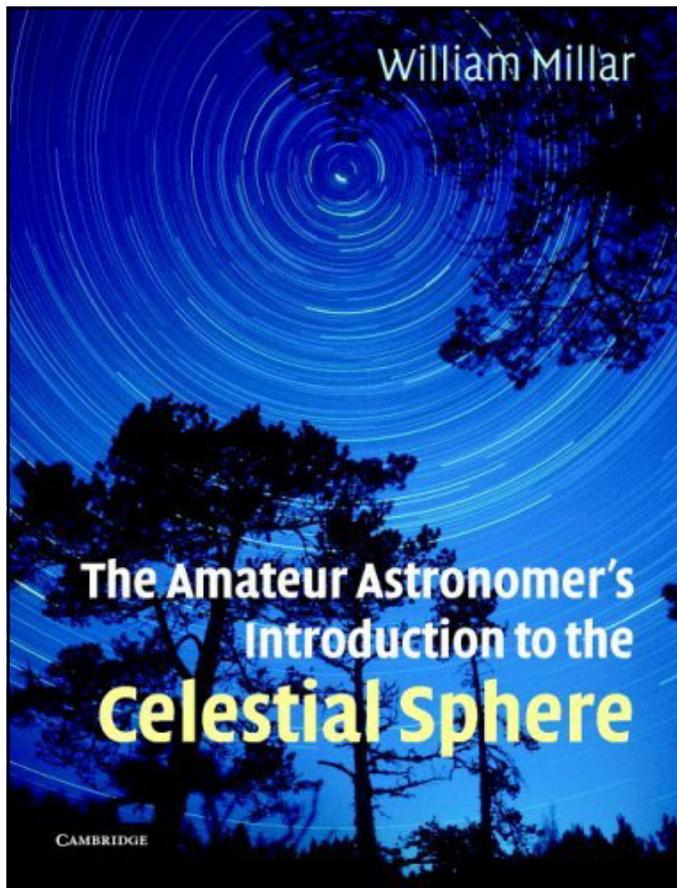
1. The lure of the sky
2. Location and coordinates
3. Stars and constellations
4. Motions of the Earth
5. The seasons
6. The phases of the Moon
7. Eclipses
8. Observation projects
9. Appendices

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

This title available 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: _____

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**