

Highlights of the May Sky...

--- 1st ---

Dusk: Mercury passes less than 3° from the Pleiades (continues until the 3rd).

--- 5th ---

New Moon
8:18 am EDT

AM: Eta Aquarid meteor shower (10 per hour).

--- 6th ---

Dusk: The Moon passes 2° above Mercury.

--- 8th ---

PM: Asteroid 5 Astraea less than 5' south of 6th-magnitude 37 Virginis.

--- 10th ---

PM: The Moon skims the southern edge of M44, the Beehive Cluster.

PM: The Moon near Mars.

--- 11th ---

First Quarter Moon
11:47 pm EDT

--- 12th ---

PM: Saturn and Regulus a few degrees north of the Moon.

--- 19th ---

PM: Mars passes a few arcminutes north of 5.3 magnitude Eta Cancri.

Full Moon
10:11 pm EDT

--- 22nd ---

PM: Mars passes through M44, the Beehive Cluster.

--- 24th ---

Dawn: The Moon is a few degrees below Jupiter - look south.

--- 27th ---

Last Quarter Moon
10:57 pm EDT

Prime Focus

A Publication of the Kalamazoo Astronomical Society

★ ★ ★ May 2008 ★ ★ ★

This Month's KAS Events

General Meeting: Friday, May 2 @ 7:00 pm

Kalamazoo Math & Science Center - See Page 10 for Details

Observing Session: Saturday, May 3 @ 8:30 pm

Galaxies of Virgo Cluster - Kalamazoo Nature Center

Astrophoto Workshop: Saturday, May 10 @ 8:00 pm

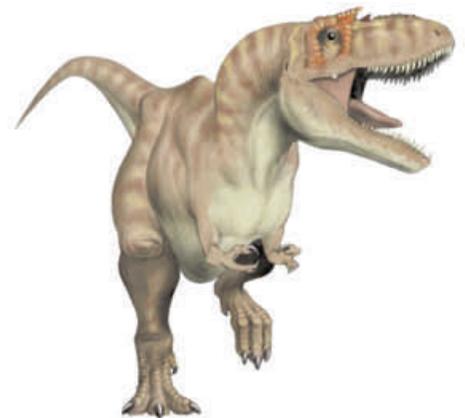
Kalamazoo Nature Center - See Page 3 for Details

Observing Session: Saturday, May 24 @ 8:30 pm

Moon, Jupiter, & Saturn - Kalamazoo Nature Center

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April Meeting Minutes



The general meeting of the Kalamazoo Astronomical Society was brought to order by President Jack Price on Friday, April 4, 2008 at 7:15 pm EDT. Approximately 40 members and guests were in attendance at the Kalamazoo Area Math & Science Center (KAMSC).

The featured speaker of the evening was KAS Board Member Dan Morgan. Dan's very first presentation to the KAS was called *What it Takes to Build a Large Telescope*. Before jumping into the details of his project, Dan covered the basic types of telescopes used by amateur astronomers. He went into the advantages and disadvantages of each type. Dan then mentioned the advantages of building your own telescope. Some telescopes, such as large aperture Dobsonians, are cheaper to build than buy. Plus, you're more free to make any desired modifications.

Dan then went into the details of building an 18" truss-tube Dobsonian telescope. He decided on an 18" mirror, because he felt it was the largest size he could afford. The 18", f/4 primary mirror was made by [Pegasus Optics](#). The focal length is approximately 70-inches and has a 1/11.5 wavefront. As Dan later explained, the mirror was obtained used off of [Astromart](#). What Dan didn't know at the time was that he purchased the mirror from Tom Taylor, a KAS member in the mid-1990's and now living near Flagstaff, Arizona. The 3.5" secondary mirror was made by [AstroSystems](#).

Much of the research for the project was done on the Internet. The primary materials used in constructing the telescope was Baltic Birch, with some Walnut and Oak. Construction began in his Junior year of High School and was his big project in wood shop. He was unable to finish the telescope before the end of the school year. The rest was built in his Grandfather's work shop.

The telescope made its debut at the Perseid Potluck Picnic in 2007. It was there that Dan realized the truss-tubes were too long, but this was a quick fix. Other minor setbacks and mistakes were also mentioned, but the telescope is now fully functional. (Editor's Note: Dan also brought his Dobsonian to the first Public Observing Session of the year on April 5th and amazed people with the view of the Orion Nebula and much more.)

The business/open forum portion of the meeting was held after the snack break. Several members reported seeing the first decent groupings of sunspots in what seemed like years. Jack mentioned an odd project to release Origami space planes from the International Space Station. Richard Bell encouraged everyone to check out the new Hubble Space Telescope image of [Omega Centauri](#). The meeting concluded at 9:04 pm after discussing upcoming events.

Board Meeting Minutes



The officers and at-large board members assembled for a meeting on Sunday, April 6, 2008 at Sunnyside Church. President Jack Price brought the meeting to order at 5:16 pm. Other officers and board members in attendance included Richard Bell, Dick Gillespie, Rich Mather, Dan Morgan, and Mike Sinclair.

Rich Mather gave his treasurer's report. The overall total in the account balances report was \$14,079.64. This includes \$5,000 in a general funds CD and \$5,810.97 in the land acquisition fund CD. Another \$1,100 from Jean DeMott's Perpetual Plant Sale cannot be added to the CD. A matching grant from Pfizer is expected soon, but not included in the overall total. Expenses reported include postage and refreshments for general meetings and the recent Full Moon Theater. Inflows for the past two months include \$1,150 in donations (including the aforementioned \$1,100) and \$315 in member dues. This does not include a large stack of new memberships given to Rich at the board meeting.

Events for April and May were covered. Everything was set for our display on the Grand Tier during the Kalamazoo Symphony's performance of Gustav Holst's *The Planets* on April 18th. Richard then gave a detailed status report of our plans for Astronomy Day on April 19th (*please read the report on page 4*). The KAS will also setup displays and pass out materials at Kellogg Elementary's *Science Night* on April 22nd. The Public Observing Sessions on May 3rd and 24th were also mentioned.

Old business started with high praise for the brand new KAS Table Cloth. Jack then went over the duties of the new "Observing Session Host". Mike Sinclair has signed up for May, but volunteers are needed for the rest of the season. These duties are usually performed by Richard Bell, but he said he wouldn't mind one bit if other members wanted to lend a helping hand. No guest speakers for September and November have been found and Richard mentioned he hasn't bothered looking yet.

New business included upcoming dues in the International Dark-Sky Association. Another Owl Observatory work session is desperately needed. No date was set, but will be soon. Richard plans to hold an astrophotography workshop on May 10th (*see page 3 for details*). Dick Gillespie asked if the KAS would like to host an observing session at a scout camp in Augusta on August 2nd. The response was positive. Richard wondered if members would prefer to hold the next picnic at Van Buren State Park instead of the Nature Center. Jack promised to ask the membership for their thoughts at the next general meeting. The meeting concluded at 6:06 pm. The next board meeting will be held on **May 4th** at Sunnyside. Start time is **5:30 pm**, a half-hour later than usual.



Worthwhile Web Sites

by Roger Williams

Some of the great adventure stories of our time are associated with the space program (think Apollo 13), but unfortunately few in the general public ever hear them. One reason may be that scientists and engineers are not necessarily the best writers and communicators. In my view, one of the exceptions is Steve Squyres, whose press conferences and whose book *Roving Mars* show something of the problems that real science encounters. But one of the best-communicating scientists must be Dr. Marc Rayman, who was deputy mission manager and chief mission engineer for the *Deep Space 1* mission.

Deep Space 1 was designed primarily as a test of new technologies, chief among which was the ion propulsion engine. In this engine, xenon atoms are ionized and then accelerated to a velocity of about 77,000 miles per hour. The recoil from shooting the atoms away at this velocity gives a very gentle but remarkably fuel-efficient acceleration to the spacecraft, and the engine proved to be a resounding success. To give the mission a plausible goal in testing all of this technology, DS1 was to rendezvous with asteroid 1992 KD, now named Braille. Dr. Rayman told the whole story in a remarkably detailed mission log, which is still accessible in the DS1 archives at this address:

<http://nmp.jpl.nasa.gov/ds1/archives.html>.

Due to problems like unexpected darkness of the asteroid and a computer reboot hours before the encounter, the hoped-for close-up photographs were not obtained, although other instruments obtained good data during the flyby. Since the spacecraft was still in good working order, an extended mission was then proposed, which would take it to a flyby of Comet Borrelly. This was when the fun really began, since the wide-field star tracker camera (ironically an old, tested technology) failed shortly into the extended mission. Completely new routines had to be developed to enable the spacecraft to point the high-gain antenna towards Earth for communication and then to reorient for engine thrusting. The cited archive gives all of the details, but the saga had a happy ending, with DS1 obtaining images of the nucleus of Comet Borrelly better than any comet pictures obtained up to that time.

The Dawn mission currently underway uses the ion propulsion engine as an essential element of the mission, not just a test technology. Dawn was launched on Sept. 27, 2007, and mission plans call for it to go into orbit around asteroid Vesta on Oct. 1, 2011. It is planned to leave Vesta on May 1, 2012 and to enter orbit around Ceres on Aug. 1, 2015. Since the mission cannot be accomplished without good performance from the ion propulsion unit, it seemed logical that Dr. Rayman might be involved again, but the Dawn web site shows

that the principal investigator is Chris Russell, and the JPS project manager is Keyur Patel. I only recently discovered that not only is Marc Rayman project system engineer, but he is also once again keeping a mission log. There are as this is written already 24 entries in the log, so it appears that we will as before get a detailed narrative. Since the mission officially lasts until Jan. 1, 2016, the story should continue for a good many years. Dr. Rayman has a very entertaining writing style, and he makes good use of humor. I encourage everyone to check out his log at:

<http://dawn.jpl.nasa.gov/mission/journal.asp>



Astrophotography Work Shop

Have you ever wanted to learn how to take photographs of the night sky? Well now is your chance! The KAS will hold another astrophotography workshop at the Nature Center on **May 10th beginning at 8:00 pm**. We'll take full advantage of the 12" Schmidt-Cassegrain in Owl Observatory, but you're welcome to bring your own telescopes, mounts, etc.

Our subject will be the Moon, which is perhaps the easiest celestial object to photograph. Techniques such as prime focus photography and eyepiece projection will be covered. Feel free to bring a webcam if you've got one!



What YOU need to bring...

- SLR Camera (35mm and/or digital)
- Film and/or Compact Flash Drive
- Cable release and/or Remote Switch
- T-mount



All members are encouraged to participate in the workshop, but please register ahead of time. Please contact **Richard Bell** either by [e-mail](mailto:richard@kalamazooastronomy.org) or telephone (373-8942). Members interested in just doing a little observing are also welcome to attend. Here's hoping for some clear skies on **May 10th**!

— — — IN MEMORIUM — — —

Richard Hoffman, former member from years past, recently passed away. His wife Emily has donated his collection of *Astronomy*, *Sky & Telescope*, and telescope making magazines to the KAS in his memory. Condolences may be sent to 9394 West M Ave, Kalamazoo, MI 49009.

Astronomy Day 2008

Report

by **Richard Bell**

This year's "Astronomy Day" can be considered a two-day special event. The first half was held at Miller Auditorium on April 18th. The Kalamazoo Symphony Orchestra performed Gustav Holst's classic series *The Planets* and the KAS set up displays on the Grand Tier Lobby. One might think the KAS and KSO worked together so their performance was held the night before Astronomy Day (or vice versa), but it's really just an amazing coincidence.

Miller Auditorium was filled to near capacity and hundreds of those people came over to visit with us and enjoy our displays, which consisted mainly of my astrophotography. Thanks go to **Jean DeMott** and **Mike Sinclair** for help with setting up and taking down the displays and interacting with the patrons. Special thanks go out to **Molly Williams** for organizing our participation in the performance. We'd also like to thank Thom Andrews, KSO Director of Marketing & Public Relations, for allowing us to participate in the performance and for lending a hand unloading our display materials.

Our main activities were held on Saturday, April 19th at the Kalamazoo Nature Center. Approximately 650 people attended Free Admission Day, which consisted of the KNC's Earth Day activities and our own Astronomy Day program. This was the year that our luck with the weather finally ran out. Every Astronomy Day I can remember (going back to 1997) was blessed with mostly sunny skies. This year the skies were mostly cloudy with temperatures in the mid-70's. The Sun did peak out at times, but it was never clear enough for solar observing.

Therefore, our solar observers were able to take the day off. Thanks to **Jim Kurtz**, **Tim Kurtz**, **Bill Nigg** and **Bill Van Dien** for at least volunteering! On the positive side, the cloudy weather allowed me to float around the entire day so I



Mike Sinclair listens intently as another question is posed at the "Ask the Astronomer" booth.

could take plenty of pictures and fill in where needed. Plus, there wasn't a single sunspot visible for the third year-in-a-row (thank you, solar minimum).

Another unfortunate thing about this year's Astronomy Day was that the Glen Vista Gallery was unavailable because of the opening of a new photography exhibit. This was the home of the past two Astronomy Days and I had really grown fond of holding our event there. Therefore, we held this year's event in the "Expedition Station" (a fancy name for the kid's play room). Fortunately, Jean and I were able to make use of every single corner of the room and were able to save all of our indoor activities from cancellation.

The theme for Astronomy Day 2008 was Mercury and the Sun. One display covered the features of the Sun, while the other showed off the brand new images of Mercury from the MESSENGER spacecraft. Our other display was Member Astrophotography. Sadly, only my photos were on display since the other pictures were to be provided by some of our solar observers. This is another example of the need for the astrophotographers of the KAS to donate copies of their work so a permanent display can be created.

Like last year, three hands-on tables were available for our target demographic - kids! The first was the Sundial Table. I searched up and down the Internet for a variety of sundials. Some were really interesting, but a bit complicated. Another was too simple. Finally, I settled on an equatorial sundial that is available for download on the *Sky & Telescope* [web site](#). It was complex enough so the kids could put enough work into and get a sense of satisfaction. Not to mention they work really well! The morning crew at the sundial table was **Dick & Jackie Gillespie**. They also donated the pencils, which



Richard Bell's nieces, Alexis & Merina, keep a watchful eye on the young patrons at the KAS Coloring Table.

served as the sundial's gnomon, and provided the base for the sundials. Jackie Gillespie continued at the sundial table in the afternoon (filling in for a sick member). **Amy Ohrstrom**, a brand new member attending her first KAS event of any kind, worked along side Jackie and did an excellent job.

Coming up with a hands-on activity to go along with Mercury was a challenge. Finally, I asked myself: "What do most people associate with Mercury?" Naturally, the first answer that came to mind is craters. Ten years ago, for the Crossroads Theater premiere of the movie *Deep Impact*, Jean and I came up with an activity for people to make craters by dropping a marble in a container filled with flour and a thin layer of temper paint on top.

This time we wanted to do something grander, so we filled a 34-inch diameter pool with two 25-pound bags of flour and layered it with cocoa. With the assistance of the step ladder from Owl Observatory, kids were able to make some very realistic looking craters. However, one of the side effects was the ever-present smell of cocoa in one-half of the room! **John Miller** did an excellent job at the crater area in the morning and Dick Gillespie did equally well in the afternoon.

The third hands-on activity was the coloring table. My two nieces, **Alexis Bell** and **Merina Allegretti**, did a great job in the morning. Let's hope their Uncle can talk them into volunteering for many years to come. Perhaps it'll become a family



John Miller points out a newly formed crater made by this meteor-flinging youth



Brand new KAS Member, Amy Ohrstrom, assists patrons both young and younger at the Sundial Table.

dynasty! **Susan Bond** then helped the kids color during the afternoon. Thanks again to all our hands-on volunteers. You really are the core of Astronomy Day!

Other activities include the "Ask the Astronomer" booth, which made its debut last year. **Mike Sinclair** started off from 10am - 12pm. Mike again claimed victory for making the most money; about \$2.50. Someone needs to tell Mike this competition exists only in his head! The 5¢ fee is optional! **Kirk Korista** and **Mark Miller** also volunteered another couple of hours each at the *Peanuts*-inspired booth. The last of the main programming was Astronomy Day Theater. In a way, this worked out better in the Expedition Station than Glen Vista, since we were able to use the comfortable couches and chairs that are kept in that room.

Finally, we can't forget the crew at the greeting table. Jean DeMott and **Dennis Stuart** welcomed visitors in the morning. **Joe Borrello** relieved Dennis in the afternoon. The greeting table looked better than ever this year thanks to our brand new KAS table cover. Many of the free items on our hand-out table were provided by NASA, JPL, the Chandra X-ray Center, and *Astronomy* magazine.

Main activities ended shortly after 4:00 pm. Thanks to several of our afternoon crew for staying after, packing and hauling everything away. This includes KAS President **Jack Price**, who came to check things out in the afternoon.

The clouds persisted throughout the evening and night hours, so this forced us to cancel the Public Observing Session. Although, it may have been clear enough to view Saturn at times. However, the hazy conditions and the Full Moon would have made any other observing impossible.

Astronomy Day 2009 is already being planned. We may make next year's event bigger than ever, since 2009 has been declared the International Year of Astronomy. The big question is will we hold it at the Nature Center or look for a new location. Either way, we hope to see *you* there!

Mars Moon in Color and in 3D

A new stereo view of Phobos (*seen below*), the larger and inner of Mars' two tiny moons, has been captured by a NASA spacecraft.

The High Resolution Imaging Science Experiment (HiRISE) on Mars Reconnaissance Orbiter took two images of Phobos 10 minutes apart on March 23rd. Because the two were taken at slightly different angles, this provides a three-dimensional effect when combined and seen through red-blue glasses.

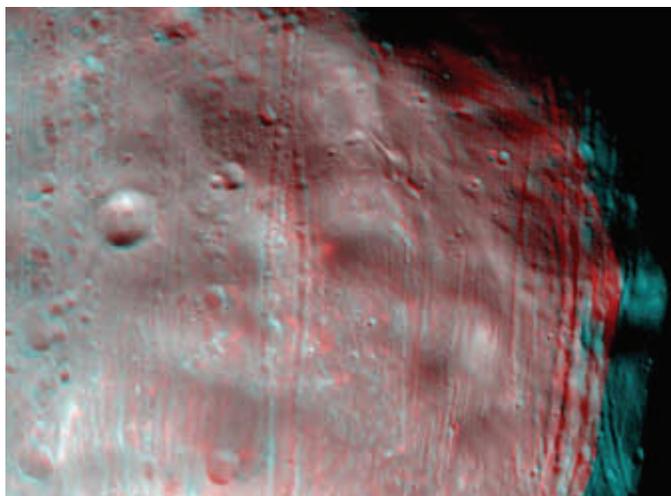
"Phobos is of great interest because it may be rich in water ice and carbon-rich materials," said Alfred McEwen, HiRISE principal investigator at the Lunar and Planetary Laboratory at the University of Arizona, Tucson.

Previous spacecraft, notably Mars Global Surveyor, have taken higher-resolution pictures of Phobos because they flew closer to the moon, said Nathan Bridges, HiRISE team member at the Jet Propulsion Laboratory in Pasadena, Calif.

"But the HiRISE images are higher quality, making the new data some of the best ever for Phobos," said Bridges. "The new images will help constrain the origin and evolution of this moon."

By combining information from the camera's blue-green, red and near-infrared color filters, scientists confirmed that material around the rim of Phobos' largest surface feature, Stickney crater, appears bluer than the rest of Phobos. The impact that excavated the 5.5 mile diameter Stickney crater is thought to have almost shattered the moon.

"Based on analogy with material on our own moon, the bluer color could mean that the material is fresher, or hasn't been exposed to space as long as the rest of Phobos' surface has," Bridges said.



The new view shows landslides along the walls of Stickney and other large craters; Phobos' striking surface grooves and crater chains; and craters hidden on the moon's dark side illuminated by "Marsshine."

"Marsshine" is sunlight reflected by Mars onto the moon. The phenomenon is similar to "Earthshine," where Earth reflects sunlight that illuminates the dark side of our moon. Like Earth's moon, Mars' moons Phobos and Deimos are "tidally locked" on their planet, that is, they always present the same side to the planet they orbit.

Phobos was 4,200 miles away when the HiRISE camera took the first photograph (*seen above*). At that distance, the camera was able to resolve the surface at a scale of 22 feet per pixel, and see features as small as 65 feet across.

Phobos was 3,600 miles away when the HiRISE camera took the second picture minutes later. At that distance, the camera was able to resolve features about 50 feet across.

Phobos, only about 13.5 miles in diameter, has less than one-thousandth the gravity of Earth. That's not enough gravity to pull the moon into a sphere, so it's oblong. Mars' second moon, Deimos, is even smaller, at about 7.5 miles across. The very dark, diminutive moons may be captured asteroids from the outer, carbon-rich, Mars-Jupiter asteroid belt.

More images and information about the Mars Reconnaissance Orbiter spacecraft is online at:

<http://www.nasa.gov/mro>



Stellar Compass for Space Explorers

by Patrick L. Barry

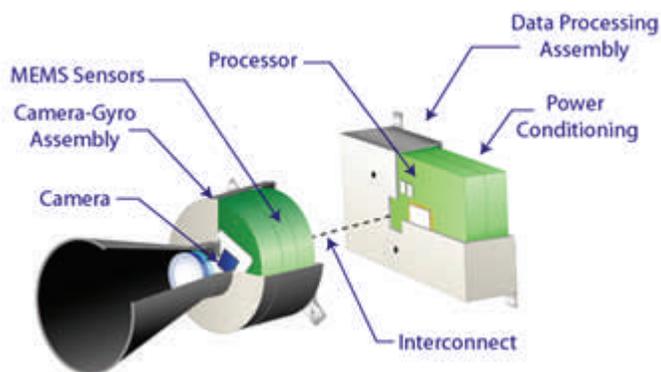
In space, there's no up or down, north or south, east or west. So how can robotic spacecraft know which way they're facing when they fire their thrusters, or when they try to beam scientific data back to Earth?

Without the familiar compass points of Earth's magnetic poles, spacecraft use stars and gyros to know their orientation. Thanks to a recently completed test flight, future spacecraft will be able to do so using only an ultra-low-power camera and three silicon wafers as small as your pinky fingernail.

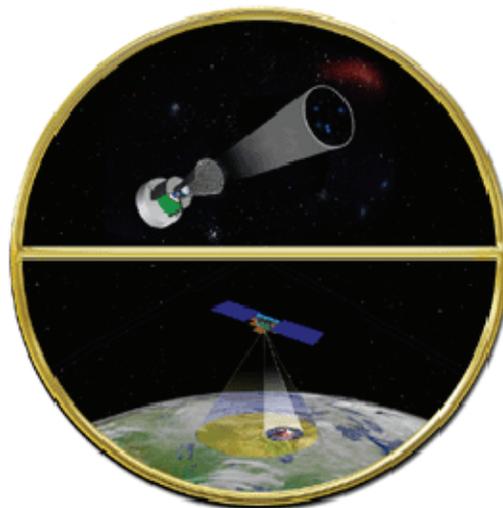
"The wafers are actually very tiny gyros," explains Artur Chmielewski, project manager at JPL for Space Technology 6 (ST6), a part of NASA's New Millennium Program.

Traditional gyros use spinning wheels to detect changes in pitch, yaw, and roll — the three axes of rotation. For ST6's Inertial Stellar Compass, the three gyros instead consist of silicon wafers that resemble microchips. Rotating the wafers distorts microscopic structures on the surfaces of these wafers in a way that generates electric signals. The compass uses these signals — along with images of star positions taken by the camera — to measure rotation.

Because the Inertial Stellar Compass (ISC) is based on this new, radically different technology, NASA needed to flight-test it before using it in important missions. That test flight reached completion in December 2007 after about a year in orbit aboard the Air Force's TacSat-2 satellite.



Compass is built as two separate assemblies, the camera-gyro assembly and the data processor assembly, connected by a wiring harness. The technology uses an active pixel sensor in a wide-field-of-view miniature star camera and micro-electromechanical system (MEMS) gyros. Together, they provide extremely accurate information for navigation and control.



"It just performed beautifully," Chmielewski says. "The data checked out really well." The engineers had hoped that ISC would measure the spacecraft's rotation with an accuracy of 0.1 degrees. In the flight tests, ISC surpassed this goal, measuring rotation to within about 0.05 degrees.

That success paves the way for using ISC to reduce the cost of future science missions. When launching probes into space, weight equals money. "If you're paying a million dollars per kilogram to send your spacecraft to Mars, you care a lot about weight," Chmielewski says. At less than 3 kilograms, ISC weighs about one-fifth as much as traditional stellar compasses. It also uses about one-tenth as much power, so a spacecraft would be able to use smaller, lighter solar panels.

Engineers at Draper Laboratory, the Cambridge, Massachusetts, company that built the ISC, are already at work on a next-generation design that will improve the compass's accuracy ten-fold, Chmielewski says. So ISC and its successors could soon help costs — and spacecraft — stay on target.

Find out more about the ISC at:

<http://nmp.nasa.gov/st6/>

Kids can do a fun project and get an introduction to navigating by the stars at:

spaceplace.nasa.gov/en/kids/st6starfinder/st6starfinder.shtml

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

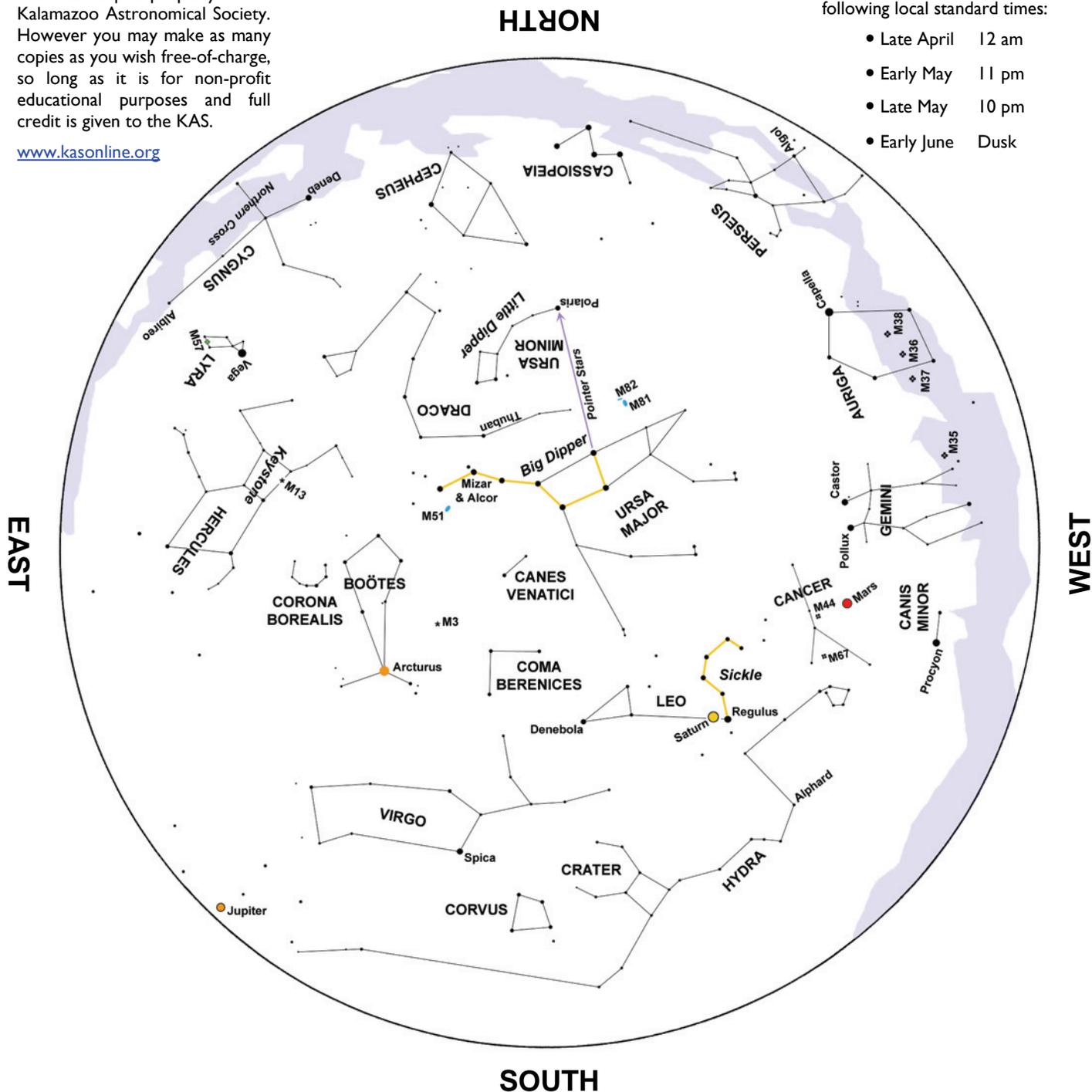
May Night Sky.....

This star map is property of the Kalamazoo Astronomical Society. However you may make as many copies as you wish free-of-charge, so long as it is for non-profit educational purposes and full credit is given to the KAS.

www.kasonline.org

This map represents the sky at the following local standard times:

- Late April 12 am
- Early May 11 pm
- Late May 10 pm
- Early June Dusk



Mercury steals the spotlight during the first week of May. For the first three days of the month, the speedy little planet passes less than 3° of the Pleiades (M45). Using binoculars, look low in the west-northwest about 45 minutes after sunset.

On May 6th, a thin crescent Moon passes 2° above Mercury. The Moon then has a close encounter with the Beehive Cluster (M44) on May 10th.

The asteroid 5 Astraea passes less than 5 arcminutes south of the star 37 Virginis

on the night of May 8th and 9th. A good star map and telescope are a must.

Mars passes a few arcminutes north of 5.3 magnitude Eta Cancri on May 19th and then *through* M44, the Beehive Cluster on May 22nd and 23rd.

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May 2008

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GET OUT & OBSERVE!



MAY STARGAZING DATES

Kalamazoo Nature Center • 7000 N. Westnedge Ave.

Saturday, May 2 @ 8:30 pm
Galaxies of Virgo Cluster

Saturday, May 24 @ 8:30 pm
Moon, Jupiter, & Saturn

with the **Kalamazoo Astronomical Society**

Kalamazoo Valley Museum Planetarium Show Schedule

Bear Tales

Saturdays, 11:00 am; Sundays, 1:30 pm

ASI: Cosmos

Wednesdays & Saturdays, 2:00 pm

Polar Astronomers

Saturdays & Sundays, 3:00 pm



Planetarium admission is \$3.00 per person. The Kalamazoo Valley Museum is located at 230 North Rose Street in downtown Kalamazoo. For more information please call (269) 373-7990 or visit us on the web at www.kalamazoomuseum.org



The Miller PLANISPHERE

The Miller Planisphere is made with heavy duty plastic and includes a durable plastic case. All planispheres sold by the KAS are 10.5" in diameter and set at 40° latitude. Just dial the date and time and you'll see what's in the sky for that moment. All proceeds go toward the programs of the Kalamazoo Astronomical Society. To order yours please send an e-mail message to kas@kasonline.org.

Only \$13.00

General Meeting Preview



Visitors from Space

Meteorites & Comets

Presented by **Dr. John Grace**

*Professor Emeritus of Geology
Western Michigan University*

Since ancient times humankind has been intrigued with not only the constant stars but to other visitors to the night sky such as meteors and comets. While stars could be put into some standard ritual context, meteorites and comets were more puzzling; strange and unpredictable.

Dr. Grace's talk will focus on the age, classification and assumed origin of meteorites and comets and also their significance as to the origin of the solar system. We will also discuss the possibility of meteorite impacts on the earth as they might influence evolution.

Friday, May 2 @ 7:00 pm

*Kalamazoo Area Math & Science Center
600 West Vine, Suite 400 • Use Dutton St. Entrance*

Kalamazoo Astronomical Society
c/o KAMSC
600 West Vine, Suite 400
Kalamazoo, MI 49008

STAMP

