Highlights of the January Sky. . .

- - - 2nd - - -
PM: Mars is about 7° left of the Moon.

- - - 3rd - - -
AM: Quadrantid Meteor Shower peaks.

- - - 7th - - -
Last Quarter Moon

- - - 8th - - -
AM: Saturn's rings are titled 4.9° with respect to Earth; widest they appear until August 2010.

- - - 11th - - -
Dawn: Moon less than 1° above Antares.

- - - 13th - - -
Dawn: A thin Waning Crescent Moon about 5.5° to lower right of Mercury low in SE.

- - - 15th - - -
New Moon

- - - 17th - - -
PM: Thin Waxing Crescent Moon about 5° to lower right of Jupiter low in SE.

- - - 23rd - - -
First Quarter Moon

- - - 25th - - -
AM: Waxing Gibbous Moon near the Pleiades.

- - - 27th - - -
AM: Mercury at greatest western elongation (25°) . Look above SE horizon before sunrise.

Mars is closest to Earth (61.7 million miles)

- - - 29th - - -
Mars at opposition

- - - 30th - - -
Full Moon

Prime Focus

A Publication of the Kalamazoo Astronomical Society

☆ ☆ ☆ January 2010 ☆ ☆ ☆

This Months KAS Events

General Meeting: Friday, January 8 @ 7:00 pm
Kalamazoo Area Math & Science Center - See Page 14 for Details

Board Meeting: Sunday, January 10 @ 5:00 pm
Sunnyside Church - 2800 Gull Road - All Members Welcome

Full Moon Theater: Saturday, January 30 @ 7:00 pm
WMU Main Campus, Rood Hall, Room 1110 - See Page 4 for Details

Inside the Newsletter. . .

December Meeting Minutes

The KAS Annual Meeting, featuring our 11th Holiday Party, began at 6:30 pm EST on Friday, December 4, 2009. Approximately 55 members and guests were in attendance at the Kalamazoo Area Math & Science Center (KAMSC).

Dinner was served at 6:40 pm. Our potluck hors d'oeuvre and dessert extravaganza was as good as always. These include the traditional tasty meatballs and more desserts than one could possibly enjoy in a single evening. Jean DeMott, was not able to attend this year's party, but still did another terrific job with the decorations. Special thanks to Richard Bell, Susan Bond, Dick & Jackie Gillespie, and Don Stilwell for setting everything up. Substituting for the wassail this year was some home-made red cherry and cream soda from Greg Sirna. Could this be a new Holiday Party tradition?

Once dinner was complete and everyone had a chance to relax and chit chat we played five rounds of BINGO. Here are the lucky winners:

- **Cathy Otterson** - 22mm Epic ED-2 Eyepiece
  - *Donated by Orion Telescopes & Binoculars*
- **Al Hanchar** - Starry Night Galaxy Explorer CD
  - *Donated by Orion Telescopes & Binoculars*
- **Stephanie Stratton** - Firefly Planisphere
  - *Donated by the KAS*
- **Al Hanchar** - *Bad Astronomy* by Phil Plait (signed)
  - *Donated by the KAS SkyShop*
- **Bob White** - Galileoscope
  - *Donated by the KAS*

Al Hanchar was this year's big winner in the "cut throat" BINGO competition. He won two out of five rounds. Here he is selecting his second prize, *Bad Astronomy* by Phil Plait, which was signed by the author on Astronomy Day. KAS President Jack Price looks on in amazement.

And yes, for the second year-in-a-row we had a double BINGO winner. Congrats, Al!

Final nominations and elections for 2010 KAS Officers and At-Large Board Members were then held once everyone reconvened in the presentation center. Thanks to Grace Cox and Greg Sirna for counting the ballots. The election results appear on page 13. Jack Price then gave a brief president's report. He gave a thumbs up to the 2010 edition of *SkyWatch*, published by the makers of *Sky & Telescope*. Jack also plugged the ultra-cheap green laser pointers that can be found on eBay.

Joe Borrello then gave a brief, but excellent slide show on his recent trip to Palomar Observatory in California. Joe was attending an awards ceremony for his daughter's jewelry design and used the opportunity to pay homage to the historic 200-inch Hale Telescope.

A lengthy discussion was then held concerning the option of pursuing a robotic telescope in Mike Patton's observatory at Arizona Sky Village or staying on course for a dark-sky site somewhere in the west Michigan area. (In the Editor's opinion, it was very refreshing to see so many members in attendance take part in this important discussion.) The final vote was 33 in favor of pursuing the robotic telescope, 4 for the dark-sky site, and 1 for none of the above.

We then held the door prize drawings and here are the lucky winners (in order): **Brandon Werner** (*Atlas of the Sky* DVD - donated by Orion); **Bill Nigg** (*NightWatch* by Terence Dickinson - donated by Richard Bell); **Jason Hanflik** (*NightWatch* by Terence Dickinson - donated by Jean DeMott); **Ruth Price** (*Voices from the Moon* by Andrew Chaikin - donated by the KAS); **Sue Sirna** (*Death from the Skies* by Phil Plait (signed) - donated by the KAS SkyShop); **Dennis Stuart** (Deep Space Mysteries 2010 calendar - donated by Ocean Photo & Telescope); **Frank Severance** (Solar System 100 piece puzzle - donated by the KAS); **Melody Woolf** (*Starry Night Screen Saver* - donated by Orion); **Gary Lubbert** (Deep Space Mysteries 2010 calendar - donated by OPT); **Don Stilwell** (Moon Phase calendar - donated by Molly Williams); **Joe Borrello** (Moon Phase calendar - donated by Molly Williams).

The following members choose the astronomical photographs used as the table centerpiece decorations: **Beverly Byle, Phyllis Lubbert**, **Mark Woolf**, **John Grace**, **Greg Sirna**, **Stephanie Stratton**, **Rich Mather**, **Bob Havira**, **Mike Patton**, **Cathy Otterson**, **Susan Bond**, **Molly Williams**, **Susan White**, and **Mike Sinclair**.

The meeting concluded at 9:34 pm. Thanks to the volunteers that helped with clean-up and putting everything away.

Board Meeting Minutes

The KAS officers and at-large board members assembled for another meeting on Sunday, December 6th. KAS President Jack Price brought the meeting to order at 5:08 pm at Sunnyside Church. Other board members in attendance included Richard Bell, Jean DeMott, Dick Gillespie, and Mike Sinclair. Newly elected 2010 board members, Jason Hanflik and Don Stilwell, were also in attendance.

Under his treasurer's report, Rich Mather reported that the inevitable happened - the Galileoscope bill finally showed up. Rich had to pay the bill with his own credit card, since the KAS currently had insufficient funds in petty cash. Rich will reimburse himself once one of our two CD's expire. It was also decided to roll the CD's over for another year. Rich also reported that our account information needs to be updated with the credit union; specifically who can write and cash checks in Rich's absence. Jack Price and Roger Williams were suggested as the most logical choices. An official resolution will be published in these minutes once we can obtain the necessary information from Roger.

We received a total of 67 entries in the Galileo Writing Contest; just under the maximum of 70. It was decided to hold an awards ceremony for the entrants before the general meeting on February 5th with a special start time of 6:30 pm. Students not able to attend on February 5th can pick-up their Galileoscopes at a future general meeting or presented to them at their school. Mike Sinclair volunteered to be the emcee for the ceremony. Jean DeMott suggested that Michael Francis could give a special video introduction as Galileo. Readers might recall Mr. Francis' portrayal as Galileo at Astronomy Day 2009. Richard will try to have Orion donate planispheres for the winners as well. We might even try to obtain special prizes for exceptionally written essays.

Now that we've received the go ahead from the membership to pursue a robotic telescope, Richard suggested that a special "task force" be assembled to develop the project. (Editor's Note: several members have already volunteered for the task force and more are always welcome. Regular updates on the project will appear as needed in *Prime Focus*.)

Upcoming events were then covered. Bill Nigg will talk about observing Mars at the January 8th meeting. The next Full Moon Theater will be held on January 30th (details on page 4). Richard Bell will give a presentation called *Orion Always Comes Up Sideways* on February 5th. The February Freeze Out will be held on February 13th at the Nature Center. The 2010 Messier Marathon will be held on March 13th at the Kiwanis Area. Richard suggested we take Full Moon Theater on the road this spring and attend a showing of the new Hubble IMAX movie. The meeting concluded at 6:50 pm.

KAS People are the Greatest

I would like to thank the KAS members who responded on very short notice to help out with the Holiday Party in my absence this year. My 100 year old great aunt passed away in Ohio and her memorial service occurred on the same day as the party. I would like to extend special thanks to Richard Bell who put in a lot of hours selecting and printing the wonderful astrophotos and then helped me incorporate them into the decorations. He also helped the day before the party, transporting everything to KAMSC and working with me on preliminary set up. Many thanks also to Dick & Jackie Gillespie, Susan Bond, and Don Stillwell, who responded to a request, on short notice, for help with set up before the party and to all those who helped with clean up. I would also like to thank the members who have sent me messages of appreciation and condolence and Greg Sirna for sending me a bottle of his great soda from the party. What a great group!

- Jean De Mott

Update

ROBOTIC TELESCOPE

A sizable majority of KAS members voted to pursue the Robotic Telescope Project at the Annual Meeting on December 4th. Therefore, we'll do our best to publish news on the progress of this exciting opportunity as it becomes available here in *Prime Focus*.

As reported in the minutes to your left, the Board approved my request to form a Robotic Telescope Task Force. A call for volunteers was sent out to all KAS members (via e-mail) on December 7th. Several members have already expressed an interest in serving on the task force. These include Joe Borrello, Jean DeMott, Kevin Jung, Rich Mather, Bill Nigg, Don Stilwell, Dennis Stuart, and Carol Van Dien. More members are always welcome.

The first objective of the task force will be to outline the steps of this project. The first step will likely be writing an agreement or contract with Mike Patton. We're just beginning, so there's much more to come!

- Richard Bell

Kalamazoo Astronomical Society

presents

Full Moon Theater

Saturday, January 30 @ 7:00 pm

WMU Main Campus - Rood Hall - Room 1110

2010: The Year We Make Contact

A new time, a new odyssey, a new chance to confront the enigmas arising from the daring Jupiter mission of the year 2001. Crew members aboard the *Leonov* are on course to rendezvous with the still-orbiting *Discovery*. What they don't know is that they are equally on course for an uncharted realm of human destiny. And that their fate will rest on the silicon shoulders of the computer they reawaken, HAL-9000.

In this awesome film based on Arthur C. Clarke's sequel novel to *2001: A Space Odyssey*, filmmaker Peter Hyams (*Capricorn One, Outland*) crafts an absorbing spellbinder that builds on its landmark movie predecessor yet is captivating in its own right. The year is 2010. Time to discover we are not alone.

Directions to Rood Hall

Head north up the Howard Street hill from the intersection of Howard and Stadium Drive. Turn right onto W. Michigan Ave. and then go left at the round-a-bout. Turn right into the parking lot. Parking is perfectly safe and free all day on Saturday. Rood Hall is located just past Everett Tower.

Admission is FREE! The KAS will provide the popcorn and soft drinks. You just need to show up and have a great time! For more information and directions to Rood Hall, please visit our web site: www.kasonline.org

2009: The Year of Astronomy

by Richard Bell

On December 20, 2007 the 62nd assembly of the United Nations made the proclamation that 2009 would be the International Year of Astronomy (IYA2009). The purpose of IYA2009 was to commemorate the 400th anniversary of Galileo Galilei's first observations with the telescope. If you didn't know that by now then you must have been in either a very deep cave or coma this year! This event was sorely needed, in my opinion, because things were becoming a little stagnant. After all, we (in the northern hemisphere) haven't had a bright comet to spice things up in 12 years and the last major event was the 2003 Mars opposition. Even the amazing missions to the planets have become somewhat routine. So, the IYA2009 was a welcome change of pace and the Kalamazoo Astronomical Society enjoyed a tremendous year as a result.

One of our big success stories in 2009 were the general meetings. We always have fantastic guest speakers, but we'll have a very tough time beating the past year. In fact, I challenge you to find another astronomy club or even a museum/planetarium that had better lecturers than we did in 2009. Late in 2008, I made a list of speakers I thought we could realistically have (i.e. afford), but I was sure at least one of them would turn us down. Not one of them did.

Our first guest speaker was Dr. Fred Adams from the University of Michigan. Dr. Adams spoke on April 10th and discussed *Extrasolar Planets: Formation, Migration, and Long Term Evolution.* Dr. Jack Baldwin, from Michigan State University, is another renowned astrophysicist and

Jackie Gillespie helps this young astronomer build a model of the Hubble Space Telescope at the Great Observatories Image Unveiling on February 21st.

Our special guest speaker at the general meeting on June 5th was co-editor of the Astronomy Picture of the Day web site, Dr. Robert Nemiroff. Approximately 125 members and guests were in attendance.

spoke on May 1st. His presentation was entitled *Telescopes of the Future*. May seemed an appropriate time for that talk, since Galileo first heard about the telescope in May 1609. The guest speaker on June 5th was the one I was certain would turn us down. It was Dr. Robert Nemiroff from Michigan Technological University in Houghton. Dr. Nemiroff is best known for being co-editor of the *Astronomy Picture of the Day* (APoD) web site. His talk was called, predictably enough, *Best Astronomy Images of 2009*.

The rest of our guest speakers in 2009 were notable amateur astronomers. Dale Mais talked about *Amateur Spectroscopy*, which he is best known for, on September 11th. Dale was featured in the May 2003 issue of *Sky & Telescope* and has even authored a handful of articles for them. My personal favorite presentation was on October 2nd. Dr. Axel Mellinger, from Central Michigan University, was our guest that night. He's a physicist by trade, but is best known amongst amateur astronomers for his astrophotography. His talk, *Stars, Dust & Gigabytes: New Panoramic Images of the Milky Way*, dealt with his amazing mosaic image of our home galaxy as seen within. We finished up the year with a presentation by Terry Mann, President of the Astronomical League. Her talk was called *Women of Astronomy, Holding Up Half the Sky*.

KAS members to speak in 2009 included Kirk Korista, Mike Sinclair, and yours truly. I had the honor (and somewhat

misfortune) of giving the first talk in 2009. My talk, *The 99 Years That Changed Astronomy*, was schedule for January 9th, but was postponed to the 16th due to severe winter weather. The 16th wasn't much better because the temperature at 7pm was 0º F! Kirk had better luck on February 6th was his presentation *Misconceptions of the Big Bang*. Finally, Mike Sinclair talked about one of his favorite subjects on March 6th. That talk was called *An Unwanted Idea: The Short but Provocative History of Black Holes*.

Not only were our general meeting speakers excellent, but the attendance was awesome and we received a great deal of publicity. The highest attendance was for Dr. Nemiroff's talk in June. I counted 125 members and guests in attendance. This was due in-part to an article in the *Kalamazoo Gazette*, but mainly to a link on APoD the week leading up to the talk. *KAS Online* received an unprecedented number of hits that week. This all came 6 days after Astronomy Day 2009, where we had 143 people attend Phil Plait's keynote talk and also received a great deal of publicity. What a week that was! About 70 people attended Kirk's talk in February, 60 for Mike's talk in March, and 80 for Dr. Adams' talk in April! Most of the other meetings had attendance above average. The sole exception was for my talk in January – no doubt due to the weather delay and record low temperatures! I'm just glad it happened to me and none of our other speakers.

We also had excellent attendance for the three "Full Moon Theater" events we held at WMU in 2009. We played *Galileo's Battle for the Heavens* on January 24th, *The Journey to Palomar* on February 28th, and *400 Years of the Telescope* on March 14th. I thought attendance would steadily drop each month, but it held firm or even increased. We didn't do exact counts, but estimates are around 40-50 people a month. That's pretty good! Be sure to join us for more installments of Full Moon Theater in 2010. The one in January actually takes place on a Full Moon!

Jim Kurtz looks on while this lady observes through his (now sold) Tele Vue 85 refractor. This was part of our 100 Hours of Astronomy event on April 4th in downtown Kalamazoo.

Kerry Robbert tested this Galileoscope at our Public Observing Session at the Kalamazoo Nature Center on September 12th.

Another big component of our IYA celebration was outreach. The now traditional outreach events include Science Night at Vicksburg Middle School, the Kindleberger Festival in Parchment, and Education Day at WMU before a Bronco football game. One notable outreach event in 2009 was the "Great Observatories Image Unveiling" on February 21st at the Nature Center. That event was a bit hampered by winter weather, but we still had over 40 guests attend the Unveiling which also consisted of hands-on activities, displays, and a talk on galaxies. We also had a huge crowd at Spooky Science Saturday at Kingman Museum on October 24th. Rich Mather and I helped kids make something like a zillion planispheres and Big Dipper Clocks! I'm sure Dick & Jackie Gillespie were just as busy in the afternoon.

One area that didn't go as planned was our observing events, but this was beyond our control. The success rate of our Public Observing Session season was less than 50%. In fact, for the second year-in-a-row, we didn't pull off one public session in June. We did have clear skies for both nights of the *100 Hours of Astronomy* on April 3rd and 4th. Attendance was pretty good, but I think we should have held it at a place with more people around instead of KVCC'S Arcadia campus. We tried to do just that during the premiere weekend of the new *Star Trek* movie, but the weather didn't cooperate. That would have been a blast. Sidewalk Astronomy is something we don't do enough of, in my opinion. We pulled off one out of three scheduled sessions at the Kiwanis Conservation Area near Marshall. We'll keep trying, because that's a pretty dark spot (just a little damp).

The event of the year was no doubt Astronomy Day 2009 on May 30th. I've never worked so long and hard on one event in my life. In fact, I started planning for AD2K9 *before* Astronomy Day 2008. My first idea was to hold a super-event at Miller Auditorium. This had a fair chance of happening until the economy tanked and I found out that

Neil deGrasse Tyson doesn't give talks on weekends! Nevertheless, I'm more than pleased with how things turned out. If you haven't yet done so, please read my ginormous report on AD2K9 in the August 2009 issue of *Prime Focus*. It (and many images) also appear online. I would like to again thank all those that volunteered their time on May 30th. The volunteer support was unprecedented and is a testament to the health of the KAS and the dedication of its members. Again, my most sincere thanks go to my co-coordinator, Jean DeMott, and to Molly Williams for her assistance with our first-ever grant. Work is already underway on Astronomy Day 2010. If all goes as planned this event may even surpass AD2K9. That would be quite a feat, since AD2K9 won Best Event in its population category in *Sky & Telescope's* Astronomy Day Award.

The best indicator to the health of the KAS and to its success during the IYA is State of the Membership. I'm pleased to announce that our membership has never been bigger. As I write this the KAS has 131 memberships, way up from 112 at the end of 2008. This translates to over 200 individual members and easily surpasses the record of 123 memberships set in 2003. Part of this increase is no doubt due to our successful events. However, I believe much of the credit goes to the new Online Membership Form on the redesigned *KAS Online*. I was hoping this would happen and I love it when I'm right! Membership will drop at the beginning of 2010 (it *always* does), but I hope we quickly bounce back and beat 2009's record.

Perhaps one of the most significant moments in KAS history took place at the Annual Meeting on December 4th. The members in attendance overwhelmingly voted to pursue a robotic telescope in Mike Patton's observatory at Arizona Sky Village. Let me reemphasize that we are only postponing our quest for a piece of dark-sky property in Michigan. Mike has presented us with a tremendous opportunity and I can't wait to get started on it. Before Mike made his proposal several of us commented (or joked) on how we'd really rather have a robotic telescope out west first, before buying dark-sky property locally. We knew it would be impossible to pull-off a project like that from scratch, but now we have a fair chance of succeeding. Maybe we won't, but it's not going to be because we never tried. Several members have already volunteered for the Robotic Telescope Task Force and we hope to get to work early in 2010. Pulling this off might even be easier than Astronomy Day 2009. We have no set date and can therefore proceed at our own pace. However, my goal is to have a grant proposal ready in 2011. That year will mark the 75th anniversary of the KAS.

The International Year of Astronomy would not have been complete without a visit from Galileo. Mike Francis portrayed the great scientist in the Kalamazoo Valley Museum's Stryker Theater at Astronomy Day 2009

The Bad Astronomer, Phil Plait, was the keynote speaker at Astronomy Day 2009 on May 30th. He spoke in front of 143 people in the Kalamazoo Nature Center Cooper's Glen Auditorium. Photo courtesy of Kevin Jung.

I've said this before, but it's worth repeating. The best days have yet to come. Thank you all for your continued support and thank you, Galileo, for turning a telescope to the sky 400 years ago.

☽ ✷ ☾

Celebrating the 400th Anniversary of the Astronomical Telescope

Part 2 of 2 — by Brad Hoehne

Soon after Galileo had observed the Moon to be a rough, uneven world, he turned one of his telescopes to other objects in the night sky. He had, by this time, succeeded in producing a 30 power instrument. First he observed individual fixed stars. In his *Siderius Nuncius* he makes an observation that many amateurs today notice, stars do not appear bigger (or, more precisely, *much* bigger) through the telescope. He wrote:

> *In the stars, the increase [in magnification] appears much smaller so that you believe that a glass capable of multiplying other objects by, for example, a ratio of 100 [in area, not diameter, that is, 10x] hardly multiplies stars by a factor of 4 or 5.*

Galileo had noticed that the stars are much smaller than we perceive them to be in the night sky. He surmised, correctly, that his sense of the size of stars was due to imperfections in his instrument and in the eyes of the observer himself. He demonstrated this by pointing out that brilliant Venus, seemingly so large in the inky canvas of a dark night sky, *"in broad daylight, is perceived so small that she seems hardly equal to a tiny star of sixth magnitude". "Daylight,"* he said of the bright stars and planets, *"can shear them of their hair."*

More important than the appearance of the fixed stars was their number. Everywhere he looked, Galileo found far more points of light than could be perceived with the naked eye.

"Indeed, with the glass you will detect below the sixth magnitude such a crowd of others that escape natural sight that it is hardly believable," Galileo wrote. He went on to note his intention of producing a complete map of all the stars in a single constellation - Orion - but *"overwhelmed by the enormous multitude of stars... I put off this assault for another time."* In other words, there were a lot of stars. Lacking time to produce a complete sketch of the entire constellation, he presented his reader with a simple map of the belt of and sword of Orion. Today this map holds up pretty well. Compare this early sketch from Galileo's observing notebook to a modern star atlas image of the same region of sky (shown below), which shows stars down to magnitude 8.5.

Though somewhat cursory, Galileo's sketch beautifully captures the visual appearance of the central portion of Orion. Not all the stars he recorded are placed precisely. Recall, however, that he observed with a telescope that had a field of view smaller than the Great Nebula in Orion (the black blob in the bottom center of the right image.) Galileo's accomplishment is akin to drawing a picture of the Big Dipper having only seen it through a soda straw.

Galileo also turned his sights of a few of the "nebulous" patches in the sky and discovered that they were made up of stars too faint to perceive individually with the naked eye but which, collectively, appear as a small cloud. He published drawings of the Pleiades, Prasepe (the "Beehive" cluster) and "Orion's Head" (a small cluster slightly above a line drawn between Betelgeuse and Bellatrix.) Most striking was his observation that the Milky Way was made up of *"nothing else than congeries of innumerable stars distributed in clusters."*

The planets were unlike the stars. They did appear larger in his instrument.

> *"The planets present entirely smooth globes...that appear as little moons, while the fixed stars are not seen bounded by circular outlines, but rather as pulsating all around with certain bright rays."*

He began observing Jupiter on the 7th of January, 1610. To his initial puzzlement, he noticed three tiny stars alongside the planet in line with the ecliptic. At first he considered that there has been a coincidental alignment of Jupiter with three "fixed stars."

The next night he observed again:

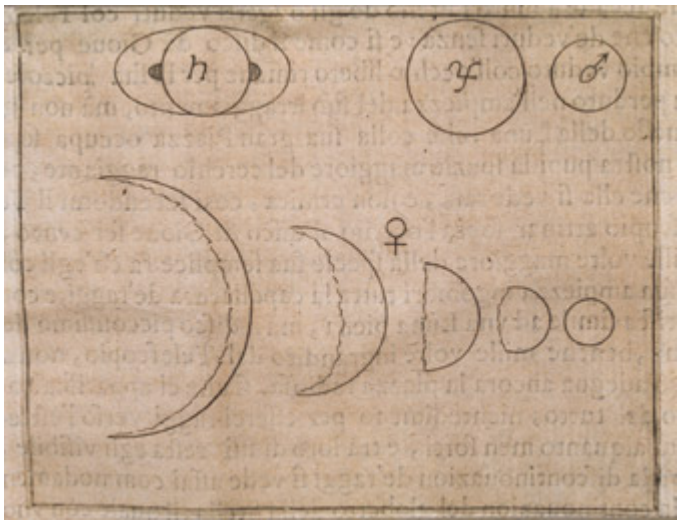
Because he did not take precise note of the distances between the three smaller points of light, he considered, with this observation that Jupiter may have simply passed across a line of three faint stars. However, he began to entertain the idea that these points might be associated with Jupiter. The next night was cloudy, so he next observed Jupiter on the 10th:

Now there were only two stars! With this observation, Galileo finally surmised that the motion of these stars was associated with Jupiter itself. The missing star, he thought, must be behind Jupiter. Since the "fixed stars" were just that, fixed, there was no way to account for the motion of these objects unless they had moved relative to one another, and to Jupiter. They were something other than fixed stars.

On the 13th of January, he was surprised to note, for the first time, a fourth point of light. By this time he had become convinced that the points of light that he was seeing were, in fact, moving about the planet Jupiter as our moon moves about the Earth. Though he was anxious to publish, and thereby establish priority, he wanted to make certain that he had an airtight and convincing case. (Budding scientists of today would do well to emulate Galileo's diligence.) Over the next fortnight, he continued to make observations and take notes in tedious, and ever more exact, detail. By now he was estimating distances (by tracking how long it took the motion of the sky to drag the objects across his field of view) and attempting to make several observations across a given night. He also noted that, whatever speed or direction Jupiter himself was moving against the background stars, the four points kept up, stayed within a maximum distance either before or aft of the planet, and seemed to possess clockwork motion.

Contrary to 1,500 years of tradition, not all motion, he realized, was centered on the Earth. Of these points of light, he wrote *"no one can doubt that they complete their revolutions about [Jupiter] while, in the meantime, all together they complete their 12 year revolution about the center of the world."* By this time "world" was growing to mean "universe" and not "Earth."

To our eyes, Galileo's observations and interpretations of what he saw seem as obvious and trivial as the fact the Earth is spherical. It takes only a moment with a small telescope for us to visually confirm, to a reasonable amount of satisfaction, that the Moon is not a perfect sphere, but a rough and pockmarked world. A month or two of study of the phases of Venus would convince most of us that that world goes about the Sun, and not about the Earth. A few nights of careful observation of Jupiter would make clear that those small dots



Galileo's sketches of the planets. The phases of Venus, which proved that it orbited the Sun and not the Earth, is illustrated in the center. Saturn, which Galileo never fully comprehended, is shown at the upper left. Jupiter and Mars are at the upper right, but Galileo's telescope was too crude to show any significant detail.

of light are, in fact, small worlds whirling about the great planet. In hindsight, it would seem perverse to deny these truths, but that's just what many of Galileo's time did and often for good, even non-religious, reasons.

Galileo went on to observe that Venus waxed and waned like the Moon (suggesting that it went about the Sun), sunspots (which he interpreted as being on the surface of the Sun), the strange "three lobed" shape of Saturn, and the roundness of the planet Mars. Soon after Galileo published his "Starry Message" in March 1610, the criticisms began flowing in. The strongest wave of these came from fellow mathematicians who pointed out that Galileo's instruments might not have been faithfully reproducing reality. The telescope, after all, was the first instrument in history to extend the natural capabilities of the human senses. To some, a device that extended sight by a factor of 30 seemed as preposterous as a pair of shoes that would allow an ordinary man to jump 30 feet in the air. Many critics responded out of complete ignorance of the device and knee-jerk incredulity. The telescope was not yet widespread, and few mathematicians had had a chance to look through one before passing judgment. Others doubted his claims because the instruments to which they had access were inferior and, with them, they could not reproduce his extraordinary observations. Galileo, perhaps, was hallucinating.

But even those who were lucky enough to look through one of his finer instruments (many of which he mailed to heads of state along with a copy of his *Siderius Nuncius*) were not necessarily won over to Galileo's thinking. While his telescope marked an extraordinary leap in mankind's ability to view the heavens, it was, by today's standards, a wretched instrument. Afflicted with severe chromatic aberration and

optical imperfections (glass technology was not what it is today), having a very narrow field of view, shaky and awkward to use, and giving a dim image, Galileo's instruments struck many observers his day as suspect. Were those little points of light caused by the instrument itself? (Just as our telescopes are sometimes afflicted with internal reflections.) Did the heavens have some special property that made looking at them different than looking at objects on the ground? (How could you know?) Was the view convincing enough to undermine the elaborate model of the universe that had withstood the test of 15 centuries? (For many the answer was "no.")

Some critics, however, saw the potential of the telescope, but took issue with the interpretations of its user. One such critic was Cristov Clavius then 74 and at the end of a long and illustrious career as a mathematician and astronomer. His greatest accomplishment was the assembly of the modern Gregorian calendar which we still use today. In early 1611, Clavius and a trio of other mathematicians were loaned an instrument that had been sent to the powerful Cardinal Bellarmine. They were given instructions to attempt to repeat Galileo's observations and report back their findings. Did this instrument really work as advertised?

The Father of Modern Astronomy, Galileo Galilei, as portrayed by Justus Sustermans circa 1639. Notice the telescope in Galileo's right hand.

Sometimes seeing isn't believing. Mathematicians, astronomers, and others in authority in the 17th century weren't convinced Galileo's telescope produced real images.

While they concurred with Galileo on many accounts (there were many more stars than met the eye, Saturn looks a little funny, and Venus goes through phases, points of light move about Jupiter), they differed with him in a few key ways. Most importantly, they had trouble accepting the idea that these observations necessarily implied the Earth went about the Sun, rather than vice versa. The Tychonic model, where the Sun went about the Earth, but everything else went about the Sun, was embraced by some. Furthermore, unwilling to completely discard the idea of the perfection of the heavens Clavius' quartet suggested that the Moon might not, in fact, be rough, but instead, like a crystal ball, a smooth sphere full of inclusions of different density and opacity. The roughness, they suggested, may simply have been a trick of the light across the innards of unevenly transparent orb.

Ironically, a large crater in the Moon's southern hemisphere is now named in Calvius' honor.

However, Clavius' group pronounced the telescope a "true scientific instrument" capable of showing the universe as it truly appears. So endorsed, Galileo began receiving fame, accolades and many invitations to demonstrate his telescope before heads of state and church. He had achieved the recognition and position that he desired. The infamy that was to stain his final years was still two decades in the future.

Brad Hoehne is a member of The Columbus Astronomical Society in Ohio.

Sunglasses for a Solar Observatory

by Patrick Barry

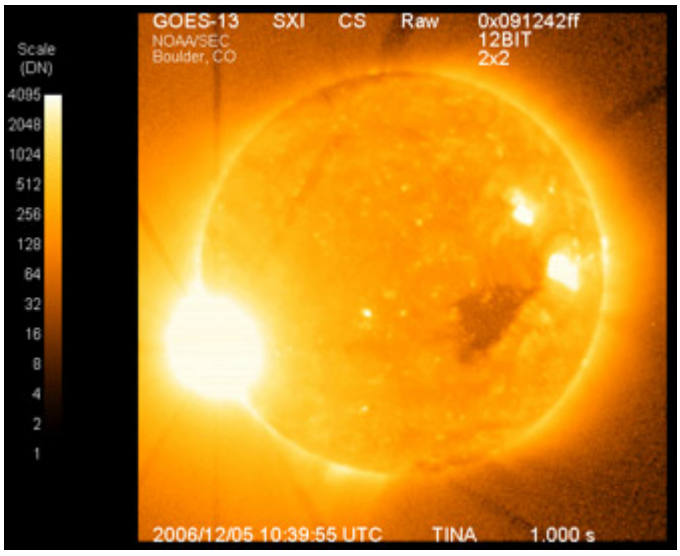
In December 2006, an enormous solar flare erupted on the Sun's surface. The blast hurled a billion-ton cloud of gas (a coronal mass ejection, or CME) toward Earth and sparked days of intense geomagnetic activity with Northern Lights appearing across much of the United States.

While sky watchers enjoyed the show from Earth's surface, something ironic was happening in Earth orbit.

At the onset of the storm, the solar flare unleashed an intense pulse of X-rays. The flash blinded the Solar X-Ray Imager (SXI) on NOAA's GOES-13 satellite, damaging several rows of pixels. SXI was designed to monitor solar flares, but it must also be able to protect itself in extreme cases.

That's why NASA engineers gave the newest Geostationary Operational Environmental Satellite a new set of sophisticated "sunglasses." The new GOES-14 launched June 27th and reached geosynchronous orbit July 8th.

Its "sunglasses" are a new flight-software package that will enable the SXI sensor to observe even intense solar flares safely. Radiation from these largest flares can endanger military and civilian communications satellites, threaten astronauts in orbit, and even knock out cities' power grids. SXI serves as an early warning system for these flares and helps scientists better understand what causes them.



X-9 class solar flare December 6, 2006, as seen by GOES-13's Solar X-ray Imager. It was one of the strongest flares in the past 30 years.

"We wanted to protect the sensor from overexposure, but we didn't want to shield it so much that it couldn't gather data when a flare is occurring," says Cynthia Tanner, SXI instrument systems manager for the GOES-NOP series at NASA's Goddard Space Flight Center in Greenbelt, Maryland. (GOES-14 was called GOES-O before achieving orbit).

Shielding the sensor from X-rays also reduces the amount of data it can gather about the flare. It's like stargazing with dark sunglasses on. So NASA engineers must strike a balance between protecting the sensor and gathering useful data.

When a dangerous flare occurs, the new SXI sensor can protect itself with five levels of gradually "darker" sunglasses. Each level is a combination of filters and exposure times carefully calibrated to control the sensor's exposure to harmful high-energy X-rays.

As the blast of X-rays from a major solar flare swells, GOES-14 can step up the protection for SXI through these five levels. The damaged sensor on GOES-13 had only two levels of protection — low and high. Rather than gradually increasing the amount of protection, the older sensor would remain at the low level of protection, switching to the high level only when the X-ray dose was very high.

"You can collect more science while you're going up through the levels of protection," Tanner says. "We've really fine-tuned it."

Forecasters anticipate a new solar maximum in 2012-2013, with plenty of sunspots and even more solar flares. "GOES-14 is ready," says Tanner.

For a great kid-level explanation of solar "indigestion" and space weather, check out:

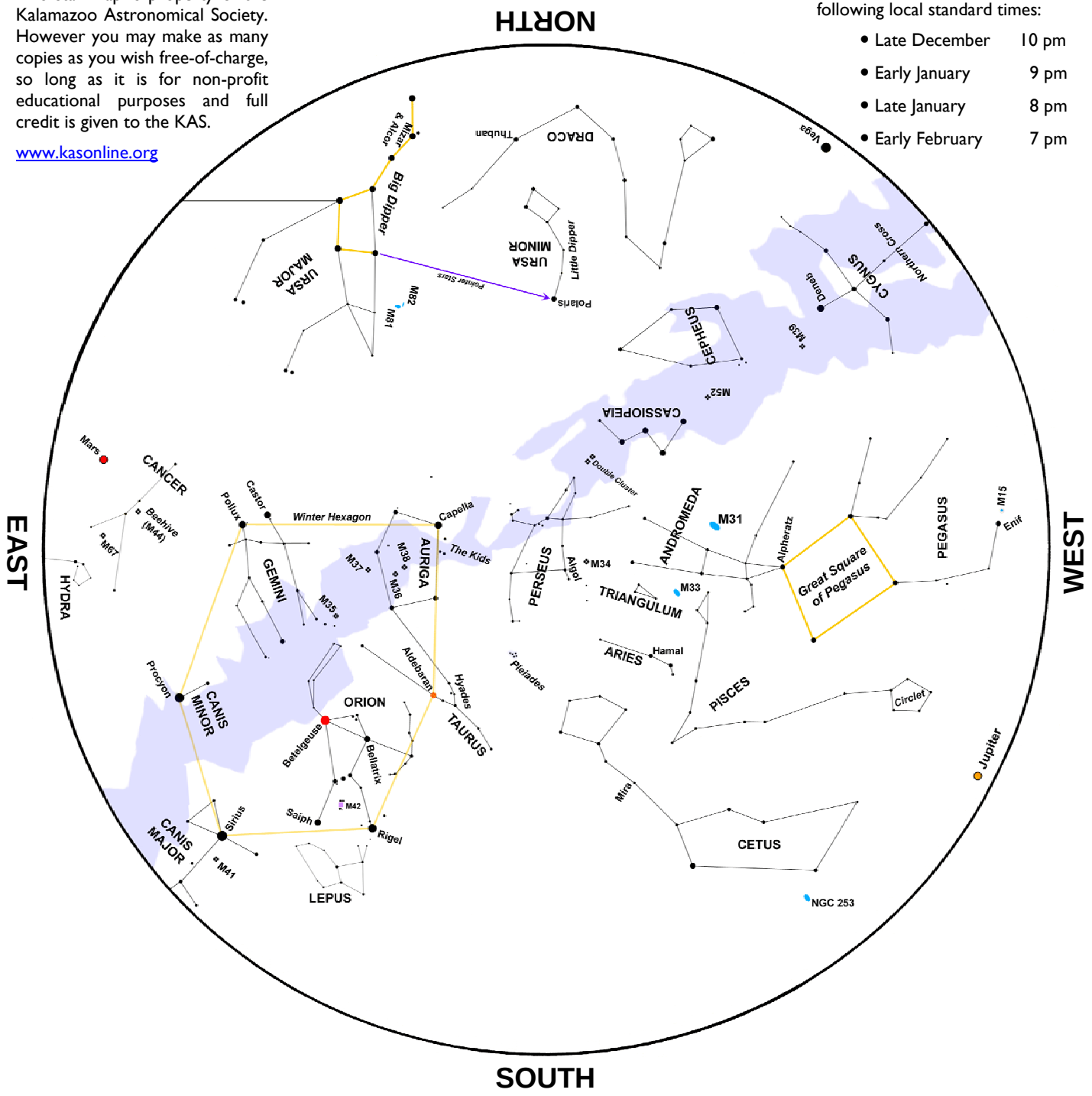
http://spaceplace.nasa.gov/en/kids/goes/spaceweather/

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

January Night Sky.....

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

- Late December 10 pm
- Early January 9 pm
- Late January 8 pm
- Early February 7 pm

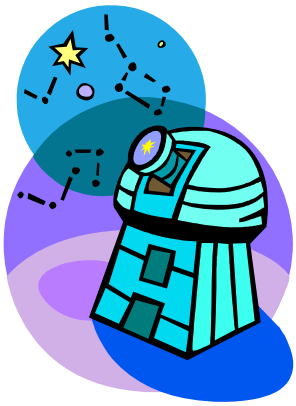


A Waning Crescent Moon can be found less than ½° above the red supergiant star Antares before sunrise on January 11th. Look in the southeast at about 7:00 am EST. Binoculars may also reveal the globular cluster M4 about 1.5° to the upper right (west) of Antares.

Mercury is at great elongation on January 27th. It'll appear 25° west of the Sun and be visible above the southeastern horizon about 45 minutes before sunrise.

Mars will also be closest to Earth on January 27th. The red and blue planet will be only be separated by 61.7 million miles. Mars will apppear as a -1.3 magnitude orange star in Cancer the Crab. The red planet is at opposition on January 29th. It'll rise at sunset and set and sunrise at that time.

Observatory Naming Contest



Mike Patton is looking for suggestions on what to call his 20' × 20' roll-off roof observatory at Arizona Sky Village.

Therefore, we've decided to hold a "Name Mike's Observatory" Contest!

Please submit your suggestion (along with a brief explanation) using the Contact Form on KAS Online. We'll submit a list of names to Mike and he'll pick his favorite suggestion.

Kalamazoo Valley Museum

Planetarium Show Schedule

Sky Legends of the Three Fires
Weekdays, 11am; Saturdays; 1pm Sundays, 2pm

Winter Nights
Saturdays, 2:00 pm

Invaders of Mars
Everyday at 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

DEADLINE
For Articles

for the

February 2010 Issue of

Prime Focus

is **January 15, 2010**

Please submit all articles to the **Editor** in text or Microsoft Word format. Thanks!

General Meeting Preview

Mars is Coming. . . Again!

Presented by **Bill Nigg**

Veteran observer and long-time KAS member Bill Nigg will describe why and how he has observed Mars during several opposition opportunities over the last 20+ years. Plenty of expert resources about this popular object will help the observers at any level. This year, we all need lots of encouragement to set up the scope in January & February and hopefully accomplish some discovery-type experiences. Astronomers are currently in the middle of several space science projects on Mars that have advanced into astro-geology, astro-chemistry and (maybe?) astro-biology yet observable planet changes are often viewed from backyard telescopes. Let us discuss how to optimize your efforts and results.

Friday, January 8 @ 7:00 pm

Kalamazoo Area Math & Science Center

600 West Vine, Suite 400 • Use Dutton St. Entrance

- Dutton Entrance Locked by 7:15 pm -

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

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