The Prairie Astronomer

December, 2012 Volume 53, Issue #12

The Official Newsletter of the Prairie Astronomy Club

December Program

Holiday Social - December 26th

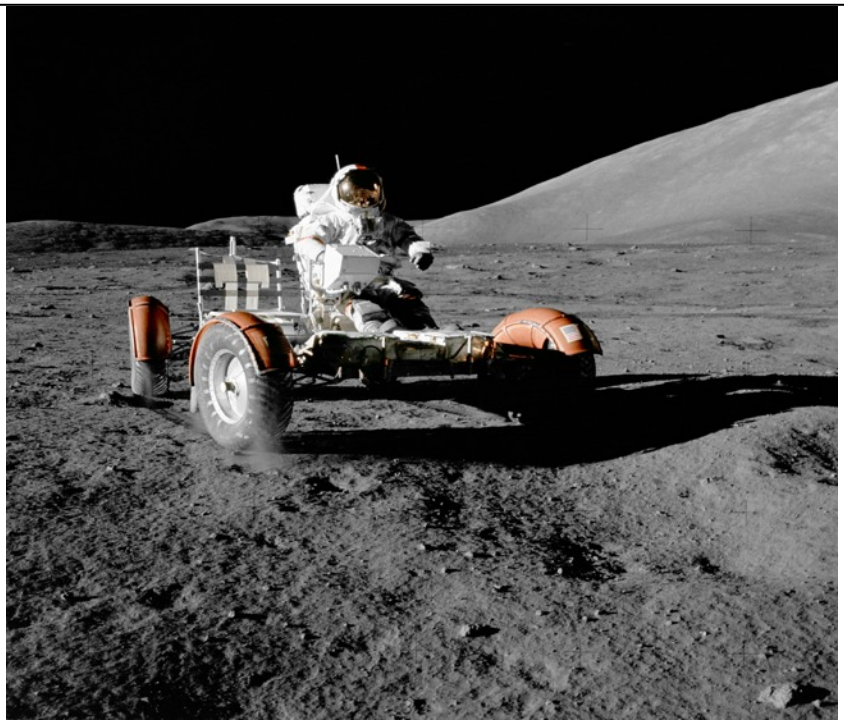
This social is our annual holiday social event at Mueller Planetarium. All club members and their families are welcome to attend. YOU MUST BE A PAC MEMBER to attend. We'll begin with a short (20 minute) fulldome show called "Dark" (a short introduction to dark matter). Immediately following "Dark" - former PAC president Larry Stepp will give an update on the Thirty Meter Telescope Project. Larry is Telescope Director for the 30 meter project. We should be all wrapped up by 9pm.

In This Issue:

Forty years ago on Dec. 11, 1972, astronaut Eugene A. Cernan, commander, makes a short checkout of the lunar rover during the early part of the first Apollo 17 extravehicular activity at the Taurus-Littrow landing site. This view of the "stripped down" rover is prior to loading up. Equipment later loaded onto the rover included the ground-controlled television assembly, the lunar communications relay unit, hi-gain antenna, low-gain antenna, aft tool pallet, lunar tools and scientific gear. This photograph was taken by scientist-astronaut Harrison H. Schmitt, lunar module pilot. The mountain in the right background is the east end of South Massif. While astronauts Cernan and Schmitt descended in the Lunar Module "Challenger" to explore the moon, astronaut Ronald E. Evans, command module pilot, remained with the Command and Service Modules "America" in lunar orbit.

Image Credit: NASA

Featured Photo



The Bad Astronomer Fact of the Month

Jupiter is so big you could fit every other planet in the solar system inside it with room to spare.

Volume is a tricky thing. Our brains are pretty good at judging relative linear sizes of things: this thing is twice as long as that thing, for example. But volume increases far more rapidly than linear size. Take a cube where each side is one centimeter. It has a volume of one cubic centimeter (cc). Now double the length of each side to 2 cm. It looks twice as big, but its volume goes up to 8 cc! The volume of a cube is a the length x width x height, so there you go.

Spheres are the same way: the volume increases with the cube of the radius. Specifically, volume = $4/3 \times \pi \times (\text{radius})^3$. So one sphere might look slightly larger than another, but in fact have a lot more volume.

Such is the way of Jupiter. I see pictures of it compared to the other planets, and honestly Saturn looks only slightly smaller – Saturn's radius is about 60,000 km compared to Jupiter's 71,000. But that turns out to make a huge difference in volume!

Here's a table I created to compare the planets. The first number column is the planet's equatorial radius in kilometers (the biggest planets aren't perfect spheres, but as you'll see this doesn't matter). The second number column is the volume in cubic km based on that radius. The third is the volume of the planet divided by the volume of Jupiter (so that ratio = 1 for Jupiter itself). The last column is the same, but rounded to two decimal places to make it easier to read.

	Radius (km)	Volume (km^3)	Vol/Vol(Jupiter)	
Mercury	2440	6.08E+10	0.00004	0.00
Venus	6052	9.28E+11	0.00061	0.00
Earth	6378	1.09E+12	0.00071	0.00
Mars	3397	1.64E+11	0.00011	0.00
Jupiter	71492	1.53E+15	1.00000	1.00
Saturn	60268	9.16E+14	0.59908	0.60
Uranus	25559	6.99E+13	0.04569	0.05
Neptune	24766	6.36E+13	0.04157	0.04
Pluto	1150	6.37E+09	0.00000	0.00

The big conclusion here is pretty obvious when you look at that last column. Even though Saturn is only a little smaller than Jupiter, it only has **60%** of the big guy's volume! Uranus and Neptune together are only another 9%. If you combine *all* the planets in our solar system, they add up to only about 70% of Jupiter's volume. That leaves a lot of room left over for all the moons and asteroids in the solar system, too!

So Jupiter really is a monster. There's a half-joke astronomers say: The solar system consists of the Sun, Jupiter, and assorted rubble. As you can see, that's really not that far off from the truth!

You can read more from the Bad Astronomer at his blog:
http://www.slate.com/blogs/bad_astronomy.html

Club Events

Newsletter submission deadline January 15, 2012

No PAC Meeting
December - Holiday Social

PAC Meeting
Tuesday January 29, 2013 @Hyde Observatory
How to use a Telescope

2013 PAC Star Party Dates - Dates in bold are closest to the new moon

January	Jan 4th	**Jan 11th**
February	Feb 1st	**Feb 8th**
March	Mar 1st	**Mar 8th**
April	Apr 5th	**Apr 12th**
May	May 3rd	**May 10th**
June	May 31st	**Jun 7th**
July	Jun 28th	**Jul 5th**
NSP	**Aug 4-9**	
August	Aug 2nd	**Aug 9th**
September	Aug 30th	**Sep 6th**
October	Sep 27th	**Oct 4th**
November	Oct 25th	**Nov 1st**
December	Nov 29th	**Dec 6** and 27th

Lunar Party Dates:

Apr 19th
May 17th

Aug 16th
Sep 13th
Oct 11th

Internet Links of Interest

http://www.universetoday.com/

http://www.thespacereview.com

http://www.thespacereview.com/article/1945/1

http://space.flatoday.net/

http://www.spaceportamerica.com/

http://www.planetary.org/home/

http://www.nasaspaceflight.com/

http://www.spacex.com

ON THE NET

PAC:
www.prairieastronomyclub.org

PAC E-Mail:
info@prairieastronomyclub.org

NSP:
www.nebraskastarparty.org

NSP E-Mail:
info@nebraskastarparty.org

OAS
www.OmahaAstro.com

Hyde Observatory
www.hydeobservatory.info

Panhandle Astronomy Club
Panhandleastronomyclub.com

PAC-LIST: You may subscribe to the PAC listserv by sending an e-mail message to: imailsrv@prairieastronomyclub.org. In the body of the message, write "Subscribe PAC-List your-email-address@your-domain.com"

For example:
Subscribe pac-list me@myISP.com

To post messages to the list, send to the address

pac-list@prairieastronomyclub.org

PAC can also be found on Twitter and Facebook.

Buy club apparel through the club website. Shirts, hats, mugs, mouse pads and more.

December/January Observing: What to View--Jim Kvasnicka

Planets

Jupiter: Dims a little from -2.7 to -2.5 and its disk is 43" wide. On January 21st Jupiter will be less than 1º from the waxing gibbous Moon.

Mars: Sets two hours after the Sun to start the month.

Uranus and Neptune: In Pisces and Aquarius.

Saturn: Rises between 2 and 3 am to start January and two hours earlier to end the month. Saturn's rings are tilted 19º from edge on, the best view of the rings since 2006.

Venus: Nearing the end of its morning apparition.

Mercury: Invisible to the naked eye at dawn.

Messier List

M33: The Pinwheel Galaxy in Triangulum.
M34: Open cluster in Perseus.
M52: Open cluster in Cassiopeia.
M74: Galaxy in Pisces.
M76: The Little Dumbbell, planetary nebula in Perseus.
M77: Galaxy in Cetus.
M103: Open cluster in Cassiopeia.
Last Month: M2, M15, M29, M31, M32, M39, M110
Next Month: M1, M35, M36, M37, M38, M42, M43, M45, M78, M79

NGC and Other Deep Sky Objects

Cr50: The Hyades in Taurus; use binoculars.
NGC 1746: Large and loose open cluster in Taurus.
NGC 1980: Emission Nebula in Orion south of M42.
NGC 2169: The 37 Cluster in Orion. The stars form the number 37.

Double Star Club List

Beta Orionis: Rigel, Bright white and dim blue stars.

Delta Orionis: Mintaka, Bright white and pale blue pair.

Struve 747: Equal pair of white stars in Orion.

Lambda Orionis: Pair of white stars.

Theta 1 Orionis: The Trapezium in M42.

Iota Orionis: Bright white and blue stars.

Theta 2 Orionis: Three white stars.

Sigma Orionis: White primary with three pale blue stars.

Zeta Orionis: Alnitak, bright white primary with 2 white secondary stars.

Focus on Observing Clubs

Galaxy Observing Programs

The Astronomical League offers four different galaxy observing programs. These programs are for the advanced observer and require a telescope with an aperture of 15 inches to be able to see all of the objects.

Galaxy Groups & Clusters Program

- Requires the purchase of an Observing Guide from the AL Bookstore.
- Search Method – manual or device aided.
- Observing Technique – visual or imaging.
- Must observe/image 120 objects from the list of 250. 30 galaxy trios, 30 Hickson Groups, 30 Abell Galaxy Clusters, 30 additional galaxy clusters.

Arp Peculiar Galaxy Program

- Search Method – manual or device aided.
- Observing Technique – visual or imaging (preferred).
- Must observe/image 100 galaxies from the list of 338.

Flat Galaxies Program

- Search Method – manual or device aided.
- Observing Technique – visual or imaging.
- Regular Award – observe/image 50 flat galaxies from the list.
- Honorary Award – observe/image 100 flat galaxies from the list.

Local Galaxy Group & neighborhood Program

- Requires the purchase of an Observing Guide from the AL Bookstore.
- Search Method – manual or devoice aided.
- Observing Technique – visual or imaging.
- Must observe/image 88 galaxies from the list in the Observing Guide.

For more information on these galaxy observing programs go to the Astronomical League web site. Several of the programs require that you purchase an Observing Guide from the AL Bookstore. These guides are not expensive and usually run around $10 to $12. If you have any questions or need help getting started on any observing program please ask me and I will be glad to help. If you have not started an observing program I strongly recommend that you do so. You won't be disappointed and you will have a lot of fun doing the program.

ANNUAL MEMBERSHIP

REGULAR MEMBER - $30.00 per year. Includes club newsletter, and 1 vote at club meetings, plus all other standard club privileges.

FAMILY MEMBER - $35.00 per year. Same as regular member except gets 2 votes at club meetings.

If you renew your membership prior to your annual renewal date, you will receive a 10% discount.

Club members are also eligible for special subscription discounts on Sky & Telescope Magazine.

Club Telescopes

To check out one of the club telescope contact **Ben Rush.** If you keep a scope for more than a week, please check in with Jason once a week, to verify the location of the telescope and how long you plan to use it. The checkout time limit will be two weeks, but can be extended if no one else has requested use of a club scope.

100mm Orion refractor:
Available

10 inch Meade Dobsonian:
Available

13 inch Truss Dobsonian:
Available

Science News and Notes by Ben Rush

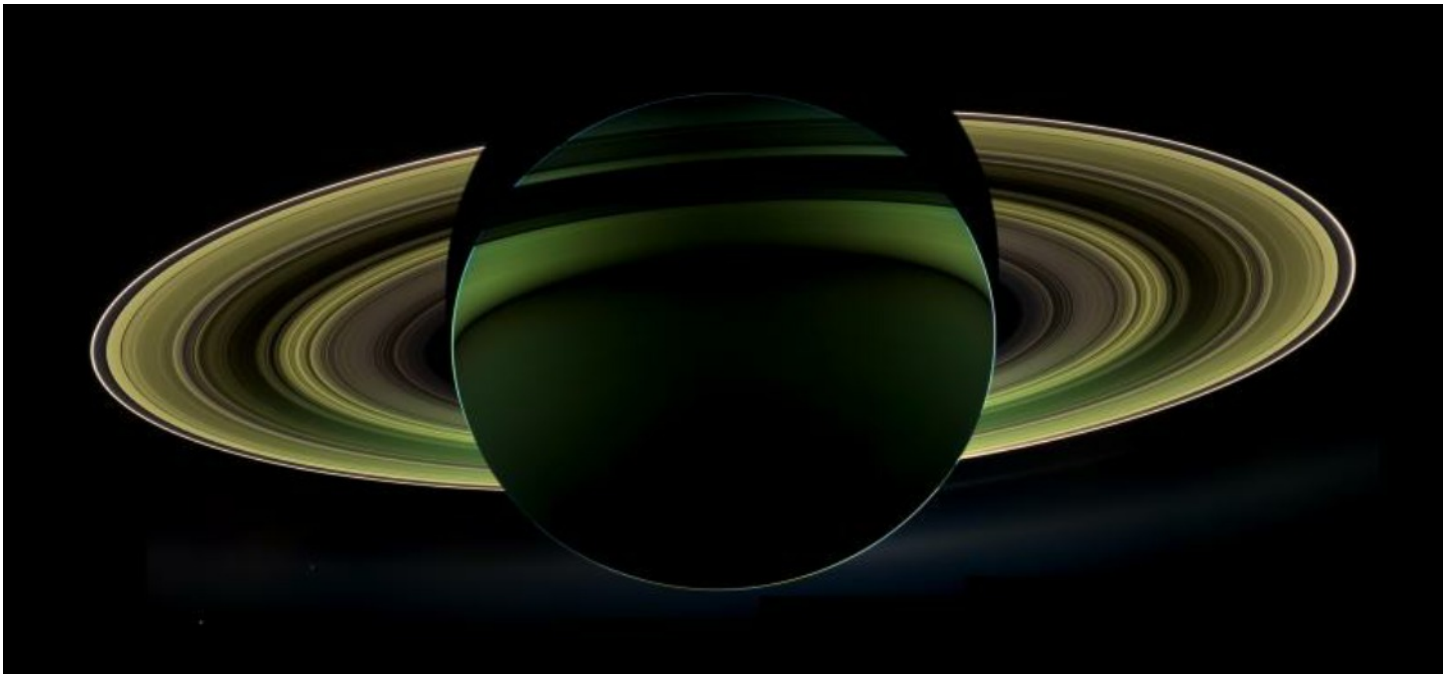
Most distant X-Ray jets discovered

X-Ray jets emanating from a black hole in Quasar GB 1428 are, to-date, the most distant discovered. This is a big discovery not only because it gives astronomers a glimpse into the interaction of black holes and their host galaxies when the universe was young, but it also gives astronomers an insight into matter surrounding the galaxy itself.

The big bang left behind a large swath of photons as part of the total background radiation. When electrons emitted from the massive black hole at the center of GB 1428 strike these photons, the photons are further excited into the X-Ray spectrum, boosting their total intensity and allowing us to see them more clearly. The interaction of the jet with the background radiation therefore gives astronomer's ample data to theorize about both; providing insights into the makeup of the universe when it was only 10% the age it is today.

The Quasar GB 1428 is 12.4 billion light years from Earth.

Merry Christmas from Cassini!



NASA's Cassini spacecraft has delivered a glorious view of Saturn, taken while the spacecraft was in Saturn's shadow. The cameras were turned toward Saturn and the sun so that the planet and rings are backlit. (Credit: NASA/JPL-Caltech/Space Science Institute)

Challenge Observing Objects for December/January

Each month I will have two objects, one for the more seasoned observer and one for the beginning observer. Each object I hope will challenge you just a little bit. I will provide you with a little bit of information about the object. It is your job to find it and if you would write a little report or draw what you see. The first person to report back on each object will have their report published in the next issue of the newsletter. Happy Hunting!

Advanced Object

B33

The Horsehead Nebula in Orion is a small dark nebula silhouetted against the very faint glow of IC 434. It is difficult to see and requires excellent seeing conditions and a Hydrogen Beta Filter.

Image Credit: Jean-Charles Cuillandre (CFHT), Hawaiian Starlight, CFHT

Beginner Object

NGC 253

This 7.6 magnitude galaxy in Sculptor is also called the Silver Coin Galaxy. This galaxy lies less than a degree from the south galactic pole. It is part of the Sculptor Galaxy Group which is the closest group to our Local Group and lies about 10 million light years. It's name comes from the high rate of stellar formation occurring and it is the closest starburst galaxy to the Milky Way.

Image Credit: David Haworth

From Super to Ultra: Just How Big Can Black Holes Get?

Sciencedaily.com

Some of the biggest black holes in the Universe may actually be even bigger than previously thought, according to a study using data from NASA's Chandra X-ray Observatory.

Astronomers have long known about the class of the largest black holes, which they call "supermassive" black holes. Typically, these black holes have masses ranging between a few million and a few billion times that of our sun.

This new analysis of the brightest galaxies in a sample of 18 galaxy clusters suggests that the masses of at least ten of the supermassive black holes in these galaxies are ultramassive, in that they weigh between 10 and 40 billion times the mass of the sun. Astronomers refer to black holes of this size as "ultramassive" black holes and only know of a few confirmed examples.

"Our results show that there may be many more ultramassive black holes in the universe than previously thought," said study leader Julie Hlavacek-Larrondo of Stanford University and formerly of Cambridge University in the UK.

The researchers estimated the masses of the black holes in the sample by using an established relationship between masses of black holes, and the amount of X-rays and radio waves they generate. This relationship, called the fundamental plane of black hole activity, fits the data on black holes with masses ranging from 10 solar masses to a billion solar masses.

The black hole masses derived by Hlavacek-Larrondo and her colleagues were about ten times larger than those derived from standard relationships between black hole mass and the properties of their host galaxy. One of these relationships involves a correlation between the black hole mass and the infrared luminosity of the central region, or bulge, of the galaxy.

"These results may mean we don't really understand how the very biggest black holes coexist with their host galaxies," said co-author Andrew Fabian of Cambridge University. "It looks like the behavior of these huge black holes has to differ from that of their less massive cousins in an important way."

All of the potential ultramassive black holes found in this study lie in galaxies at the centers of massive galaxy clusters containing huge amounts of hot gas. Outbursts powered by the central black holes are needed to prevent this hot gas from cooling and forming enormous numbers of stars. To power the outbursts, the black holes must swallow large amounts of mass in the form of hot gas. Because the largest black holes can swallow the most mass and power the biggest outbursts, ultramassive black holes had already been predicted to exist to explain some of the most powerful outbursts seen. The extreme environment experienced by these galaxies may explain why the standard relations for estimating black hole masses do not apply.

These results can only be confirmed by making detailed mass estimates of the black holes in this sample, which is by modeling the motion of stars or gas in the vicinity of the black holes. Such a study has been carried out for the black hole in the center of the galaxy M87, the central galaxy in the Virgo Cluster, the nearest galaxy cluster to Earth. The mass of M87's black hole, as estimated from the motion of the stars, is significantly higher than the estimate using infrared data, approximately matching the correction in black hole mass estimated by the authors of the Chandra

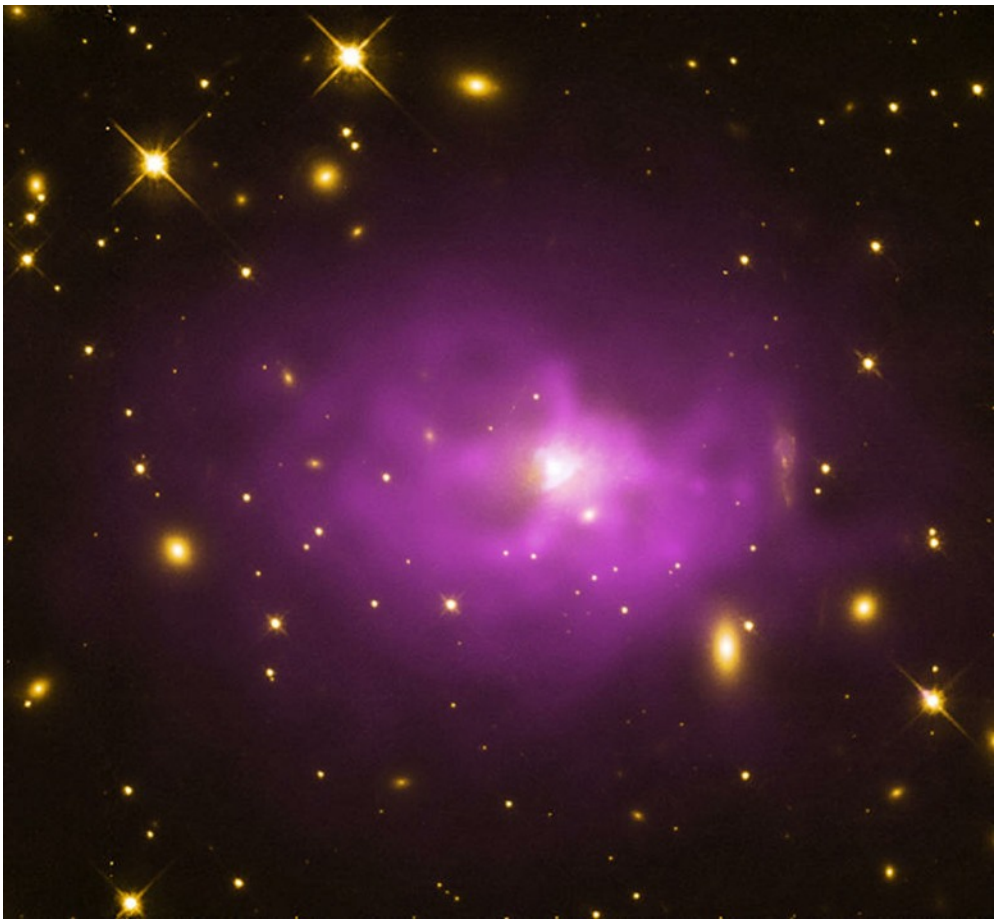
study.

"Our next step is to measure the mass of these monster black holes in a similar way to M87, and confirm their existence. I wouldn't be surprised if we end up finding the biggest black holes in the Universe," said Hlavacek-Larrondo. "If our results are confirmed, they will have important ramifications for understanding the formation and evolution of black holes across cosmic time."

In addition to the X-rays from Chandra, the new study also uses radio data from the NSF's Karl G. Jansky Very Large Array (JVLA) and the Australia Telescope Compact Array (ATCA) and infrared data from the 2 Micron All-Sky Survey (2MASS).

These results were published in the July 2012 issue of The Monthly Notices of the Royal Astronomical Society.

NASA's Marshall Space Flight Center in Huntsville, Ala., manages the Chandra program for NASA's Science Mission Directorate in Washington. The Smithsonian Astrophysical Observatory controls Chandra's science and flight operations from Cambridge, Mass.



The black hole at the center of this galaxy is part of a survey of 18 of the biggest known black holes in the universe. This large elliptical galaxy is in the center of the galaxy cluster PKS 0745-19, which is shown in this composite image containing X-rays from Chandra (purple) and optical data from Hubble (yellow). Researchers found that some of the black holes in the survey may be about ten times more massive than previously thought. This includes ten that could weigh between 10 and 40 billion times the mass of the sun, making them "ultramassive" black holes. *(Credit: X-ray: NASA/CXC/Stanford/Hlavacek-Larrondo, J. et al; Optical: NASA/STScI; Radio: NSF/NRAO/VLA)*

THE *Prairie Astronomy Club*

Amateur Astronomy --
A Hobby as Big as the Universe

The Prairie Astronomer is published monthly by the Prairie Astronomy Club, Inc. Membership expiration date is listed on the mailing label. Membership dues are: **Regular $30/yr, Family $35/yr**. Address all new memberships and renewals to: **The Prairie Astronomy Club, Inc., PO Box 5585, Lincoln, NE 68505-0585**. For other club information, please contact one of the club officers listed to the right. Newsletter comments and articles should be submitted to: **Jason Noelle at jason.noelle@gmail.com,** no less than ten days prior to the club meeting. The Prairie Astronomy Club meets the last Tuesday of each month at Hyde Memorial Observatory in Lincoln, NE.

FIRST CLASS MAIL

Next PAC Meeting
Tuesday
January 29, 2012
7:30 PM
Hyde Observatory