The Spectrogram
Newsletter for the Society of Telescopy, Astronomy, and Radio

January 2008

S*T*A*R
P.O. Box 863
Red Bank, NJ 07701
On the web at:
http://www.starastronomy.org

Edited by: Ahmad & Hanna Jrad

January's Meeting

The next meeting of S*T*A*R will be on Thursday, January 3. Our program will be *"NASA's Dawn Mission"* by Dennis O'Leary. All are welcome. The meeting will begin promptly at 8:00pm at the King of Kings Lutheran Church, 250 Harmony Road, Middletown.

Editor's Corner

Thanks to Gavin Warnes, Steve Walters, Michael Lindner, Rob Nunn, Steve Fedor, & Randy Walton for contributing to this month's Spectrogram.

Reminder to pay membership dues $25/individual, $35/family. Donations are appreciated. Make payments to Paul Nadolny at the January meeting or mail a check payable to S*T*A*R Astronomy Society Inc to:

S*T*A*R Astronomy Society
P.O. Box 863
Red Bank, NJ 07701

February Issue

Please send articles and contributions for the next *Spectrogram* by Friday, January 25. Please email to stargaze07@verizon.net.

Comet Holmes Over Hungary
Credit & Copyright: Tamas Ladanyi

Calendar

Sep 6, 2007 – *"NASA's Deep Impact Mission"* by Elizabeth Warner, University of Maryland

Oct 4, 2007 – *" Webcam Astrophotography"* by Clif Ashcraft

Nov 1, 2007 – *"The Interstellar Medium"* by Dr Hector Arce, American Museum of Natural History

Dec 6, 2007 – *"Adventures at Palomar"* by Alan Midkiff

Jan 3, 2008 - *"NASA's Dawn Mission"* by Dennis O'Leary, S*T*A*R Astronomy

Feb 7, 2008 - *"Moons of the Solar System"* by David Britz, S*T*A*R Astronomy
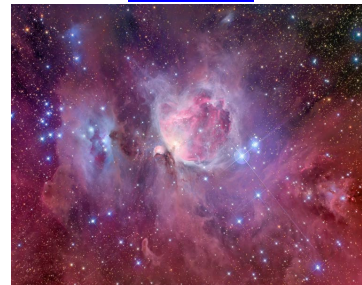
Mar 6, 2008 - *"Our Changing Sun"* by Ken Legal, S*T*A*R Astronomy

Apr 5, 2008 – *"The Near Side Lunar Megabasin"* by Charlie Byrne, S*T*A*R Astronomy

May 4, 2008 – *"TBD"*

Jun 1, 2008 – AGM

M42-Wisps of the Orion Nebula
Credit & Copyright: Jon Christensen

President's Corner

By Gavin Warnes

First, I hope that everybody had a great holiday season and happy New Year to you all. Hopefully you had a chance to see Mars at its closest during December. For me, the views have not been as good as the last two oppositions due to the decreased size and the wintertime seeing conditions, but I've still been able to take some pictures (got very chilly in the process though!). We did get a surprise comet in 2007 to make up for it though.

I'm very happy to report that our increased publicity efforts are paying off and that membership is growing nicely. Last year we finished at 52 members as I write this on Christmas Eve we are up to 63. We need to maintain this momentum, so please continue to participate in events that promote S*T*A*R and welcome our new members. Larry Campbell will be holding "his big school" star party in February and he will need all the help he can get.

The observing sessions we planned for the fall were both clouded out, but we'll keep trying. The winter brings transparent skies and many open clusters to observe. Starting in January I'll post on the discussion board when I am observing or imaging in my backyard – you are very welcome to join me (hot chocolate and cookies provided). I've also got the Stellacam working so we can play with that.

With luck, Santa brought you some new astronomy toys. If you have anything that you would like to show off for Scope and Tell at the meetings, please let me know. It need not be a telescope – anything you think would be of interest would be great.

Clear skies in 2008,

Gavin

November Meeting Minutes

By Rob Nunn on behalf of Steve Fedor

The December 2007 meeting of S*T*A*R Astronomy began at 8:07 pm on December 6. The meeting was attended by about 41 people. President Gavin Warnes chaired the meeting and began by greeting and introducing one first time attendee.

Gavin next presented the agenda for the meeting and noted the speakers for the next two meetings. In January Dennis O'Leary will speak on NASA's DAWN mission, and in February Dave Britz will speak on moons of the solar system.

Gavin then introduced the speaker for the evening. Alan Midkiff is a commercial airline pilot and amateur astronomer who has an arrangement with the Palomar Observatory to observe the operation of the 200-inch Hale telescope. Alan's wife Cindy, who also attended the meeting, made the initial proposal for the arrangement.

Alan told of his interest in astronomy, which dates back to a high-school paper and continues with current observing sessions with his 25-inch telescope and trips to observatories. He then outlined the history of the 200-inch telescope and its use today in research in astronomy. The gist of his talk, titled "Adventures at Palomar," was his experiences observing the operation of the telescope. Alan presented photographs that he took and drawings made by the telescope's designers showing the structure of the telescope and dome. He showed details such as the right-ascension bearings and drive gears, the stairs through the interior of the strut to the declination drive motor, and the observer's cage at the prime focus. He concluded his talk with several videos, which showed the slewing operation, the capture of a guide star for automatic tracking, and a time-lapse sequence of the process of removing the mirror, washing it, and applying a new aluminum coating.

Following the talk Alan answered questions from the audience. Someone mentioned that a 1/10 working model of the Palomar telescope had been built, and Alan said that he knew of the model and has tried to learn where it is now.

At 9:20 pm Nancy McGuire presented objects of the month. The beginner's object is the double cluster in Perseus, NGC869 and NGC884. The challenge object is the globular cluster NGC2419 in Lynx.

The coffee break began at 9:30 pm, and the meeting resumed at 9:50 pm.

Gavin presented the darkness intervals for the month, which will be posted on the club's web site, and spoke briefly of the star party at Holmdel's Bayonet Farm on November 16. About 100 people were treated to views through 10 telescopes as they participated in the star party. Gavin thanked those who participated, and noted that the club hopes to develop its relationship with the park, which has an excellent field for viewing. Gavin then said that he plans to hold viewing sessions at his house. Dates will be posted on the club's web site.

Several members made announcements. Larry Campbell announced a star party at the Holmdel Village School scheduled for Monday February 11, with cloud dates of February 12 and 13. Randy Walton informed the meeting of several items for sale from A.S.T.R.A., and items for sale for support of the Ocean County College planetarium. Dennis O'Leary noted that one third of the members are Qualified Operators for the club's 25-inch telescope, but that the telescope is not being used.
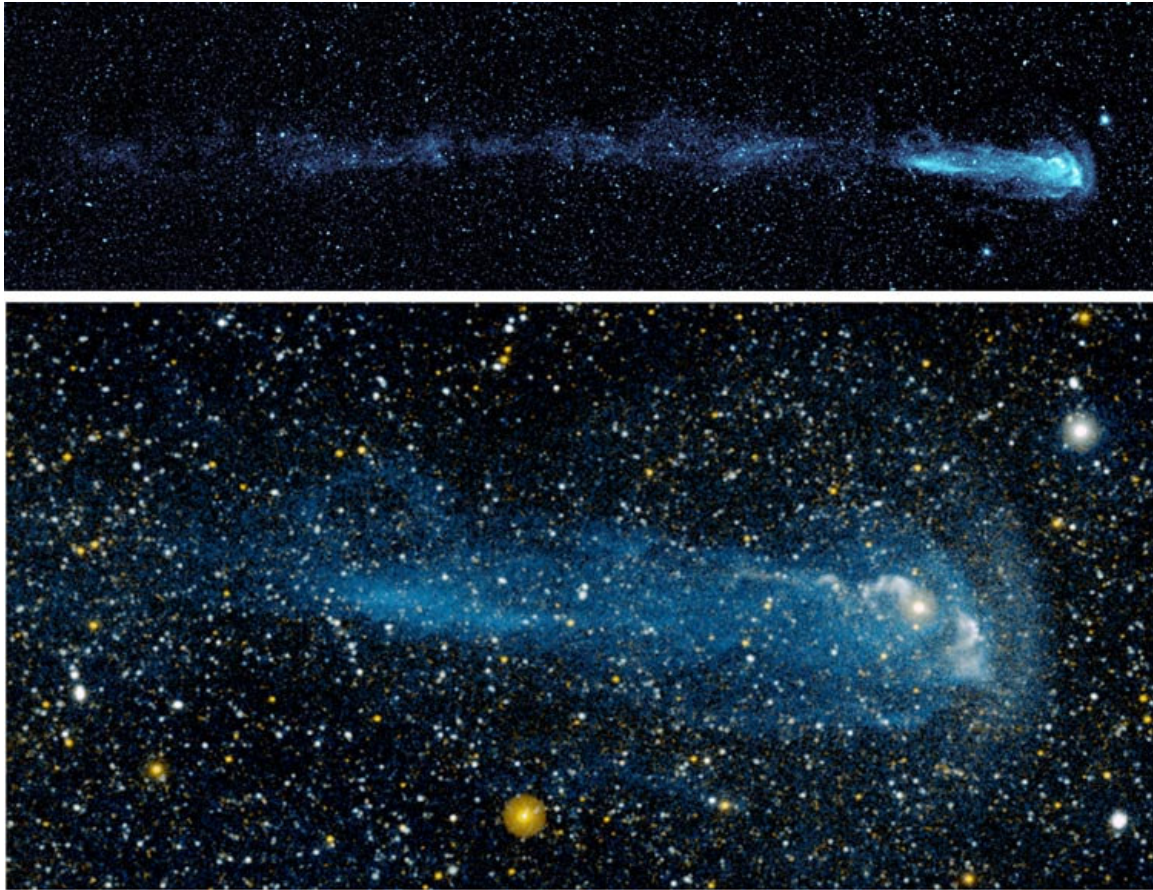
Astronomers looking at new ultraviolet images from the Galaxy Evolution Explorer spacecraft were surprised to discover a 13-light-year long tail on Mira, a star that has been extensively studied for 400 years (Article below)

The 50/50 drawing was made by our guest Cindy, who selected a ticket from a player who is not a member of the board (a first for the season). John Armata donated the prize of $7.50 to the club.

Jay Respler noted that the shuttle launch will be December 7 at 4:13 pm, and that the shuttle may be visible about 10 degrees above the southeast horizon about 6 minutes later. Gavin made a request for articles for the Spectrogram, which can be sent to Ahmad Jrad. Finally Gavin asked if the club would like to have video recordings made of the talks. There seemed to be agreement that recordings would be valuable, and a trial recording will be made next month of the talk by Dennis O'Leary.

The meeting ended at 10:04 pm. Following the meeting the sky was clear, and about a dozen people gathered behind the church to enjoy views of Mars, Comet Holmes, the Crab Nebula, and several other objects.

Ultraviolet Surprise
By Patrick L. Barry and Tony Phillips

How would you like to visit a universe full of exotic stars and weird galaxies the likes of which astronomers on Earth have never seen before?

Now you can. Just point your web browser to galex.stsci.edu and start exploring.

That's the address of the Galaxy Evolution Explorer image archive, a survey of the whole sky at ultraviolet wavelengths that can't be seen from the ground. Earth's atmosphere blocks far-ultraviolet light, so the only way to see the ultraviolet sky is by using a space telescope such as NASA's Galaxy Evolution Explorer.

About 65% of the images from the all-sky survey haven't been closely examined by astronomers yet, so there are plenty of surprises waiting to be uncovered.

"The Galaxy Evolution Explorer produces so much data that, beyond basic quality control, we just don't have time to look at it all," Mark Seibert, an astronomy postdoc at the Observatories of the Carnegie Institution of Washington in Pasadena, California, said.

This fresh view of the sky has already revealed striking and unexpected features of familiar celestial objects. Mira is a good example. Occasionally visible to the naked eye, Mira is a pulsating star monitored carefully by astronomers for more than 400 years. Yet until Galaxy Evolution Explorer recently examined Mira, no one would have guessed its secret: Mira possesses a comet-like tail 13 light-years long.

"Mira shows us that even well-observed stars can surprise us if we look at them in a different way and at different frequencies," Seibert said.

Another example: In April, scientists announced that galaxies such as NGC 1512 have giant ultraviolet spiral arms extending three times farther out into space than the arms that can be seen by visible-light telescopes. It would be like looking at your pet dog through an ultraviolet telescope and discovering his ears are really three times longer than you thought!

The images from the ultraviolet space telescope are ideal for hunting new phenomena. The telescope's small, 20-inch primary mirror (not much bigger than a typical backyard telescope) offers a wide field of view. Each image covers 1.2 degrees of sky—lots of territory for the unexpected.

If someone combing the archives does find something of interest, Seibert advises that she or he should first search astronomy journals to see whether the phenomenon has been observed before. If it hasn't, email a member of the Galaxy Evolution Explorer science team and let them know, Seibert said.

So what are you waiting for? Fire up your web browser and let the discoveries begin!

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

What Is The Difference Between A Big Telescope And A Small Telescope?

(Or All you ever wanted to know about image size, brightness, f ratio, focal length and resolution but were too afraid to ask.)

By Gavin Warnes

Recently, there was a conversation on the discussion board about the effects of increasing the aperture of a telescope and the brightness of the image. There was quite a lot of confusion, so I thought I would do a little homework and write an article to attempt to explain some of the conclusions I've drawn. Hopefully I have got my facts correct and this will prove useful and enlightening for others.

Mike Lindner wrote on excellent article on the background to this in article in the October 2003 Spectrogram (http://www.starastronomy.org/Library/Spectrogram/2003-4/spectrogram-10-2003.pdf) – I recommend that you read that too.

Prime focus photography
One important distinction to understand is the difference between doing photography and making visual observations. All telescopes have an objective (either a mirror or lens) that forms an image at a point called the prime focus. If you are doing photography, this is where you place your CCD chip or, if you are nostalgic, film. The size of the image at the prime focus is unrelated to the eyepiece you use and is solely dependent on the focal length of the objective. The image size at the prime focus is determined as follows.

$$\text{Image Size} = \frac{\text{Angular Size of Object x Telescope } f_o}{q} \quad (1)$$

q = 3438 if angular size is in minutes of arc

f_o = focal length of telescope objective

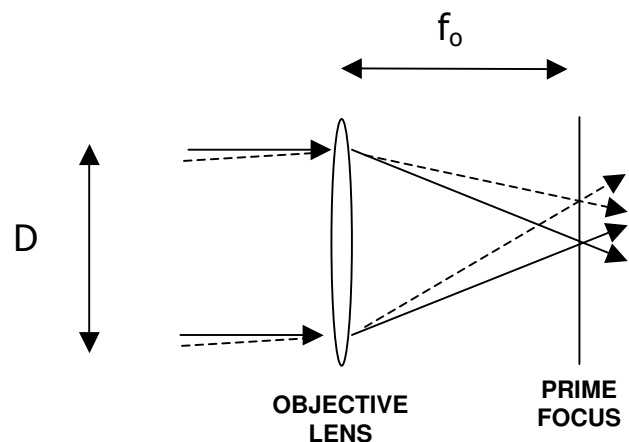The image size is in the same units as the focal length – I'll use mm for this article.

Figure 1 – Simple schematic of a telescope without an eyepiece. f_o is the focal length of the objective. Light from a star that is exactly on axis (ie, at the center of the field of view) forms a image at the center of the prime focus. Light from stars away from the axis of the telescope enters at a slight angle and forms an image, subtended by a greater

angle, displaced from the center of the prime focus. That's how telescopes produce a larger scale image than you see with your naked eye.

Imagine I want to look at M101 which is a galaxy about 22 arc minutes in diameter. I have two telescopes I can use:

6" f/5, focal length 762mm
25" f/5, focal length 3175mm

If I use formula 1, the two telescopes will produce an image of the following diameters at the prime focus.

6" f/5, image size 4.876mm
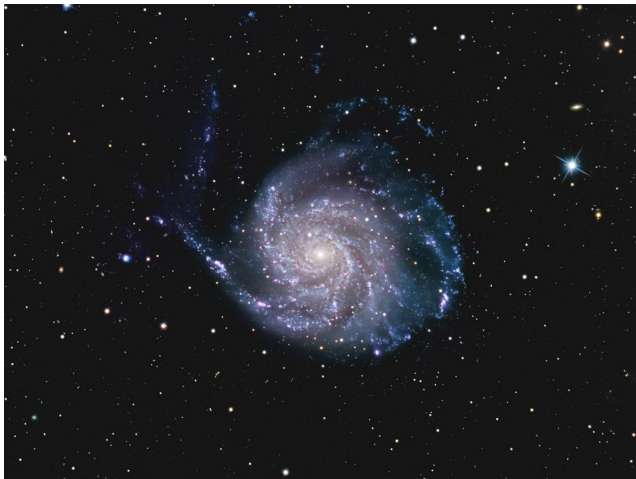25" f/5, image size 20.317mm

Figure 2 – The image size at the prime focus in a 6" f/5 scope (top) vs a 25" f/5 scope (bottom). The pictures show the central section of the prime focus, about 10mm x 8mm.

Let's assume I have a camera that has chip 22 x 22 mm in size. I can take a picture with both telescopes, but the image in the 25" will be $(25*5)/(6*5) = 4.166$ times larger. Now, I conveniently picked an object that is essentially circular to

make this easier to think about. Let's calculate the area of the two images in square mm.

6" f/5, image area = π x $(4.876/2)^2$ = 18.681 mm^2
25" f/5, image area = π x $(20.317/2)^2$ = 324.328 mm^2

So the area of the image in the 25" scope is much bigger. What is the area of the objective in both telescopes?

6" f/5, objective area = π x $(152.4/2)^2$ = 18,248 mm^2
25" f/5, objective area = π x $(635/2)^2$ = 316,819 mm^2

Ok, let's divide the area of the image by the area of the objective to get the relative image brightness (the amount of light per unit area at the prime focus) between the two telescopes.

6" f/5, 18.681/18,248 = 0.001023
25" f/5, 324.328/316,819 = 0.001023

Hold on a second, that's the same number! The effect of the two areas cancels out. There is an important point here – the image brightness *at the prime focus* only depends on the f ratio of a telescope. If I had a 25" f/2.5 telescope it would have half the focal length. The diameter of an image at the prime focus would be half as much from equation 1, so the area would be on quarter as much. The same amount of light would be entering the scope, so the image brightness would be four times as much as the 25" f/5. You may find this odd, but for those of you old enough to remember setting the aperture on manual camera the concept should be familiar. It doesn't matter if you have a camera with a lens 50mm or 25mm in diameter – f/5 is f/5. A telescope is the same as a camera lens.

Not convinced? Let's compare a 6" f/5 and a 6" f/8 telescope. The image will occupy a larger area at the prime focus in the 6" f/8 scope as it has a longer focal length and hence greater inherent magnification. The amount light entering the two telescopes is the same, so the prime focus image is dimmer per unit area in the 6" f/8 scope.

Now the analysis above works for extended objects like people, landscapes, galaxies and nebulae. Stars are different. When you magnify an object which is resolved into distinct stars, the stars do not get bigger. Instead the gaps between the stars increase. In a telescope all the light collected from a star appears in something called the Airy disk. The size of the Airy disk is dependent on f ratio alone.

Airy Disk Diameter = 2.44 x λ x f ratio $\qquad$ (2)

λ = wavelength of light

The Airy Disk diameter is in the same units as wavelength.

This is the diameter of the center of the Airy disk – there are concentric diffraction rings round it. Both of the telescopes

in my example have the same size Airy disk, so the brightness of the Airy disk is proportional to the area of the objective. So the stars in my 25" f/5 scope are $(12.5^2/3^2)$ = 17.26 times brighter than my 6" f/5 scope *at the prime focus and in the eyepiece.* If I had a 6" f/10 telescope, the Airy disk would be twice the size and one quarter the brightness of that of the 6" f/5 *at the prime focus.*

Hang on a second. Aren't galaxies made up of billions of stars? Shouldn't they act as a collection of point sources? Well, in the size of telescopes used by amateurs we cannot resolve stars in other galaxies. They all merge together and consequently galaxies behave like an extended object. Open clusters in our galaxy are generally easy to resolve in small scopes and the stars are brighter at the prime focus in the larger scope of two scopes with the same focal ratio. Globular clusters are generally partially resolved so act somewhere in between point sources and an extended object.

Although a 6" f/5 scope and 25" f/5 scope have the same brightness at the prime focus, the 6" scope produces a much smaller image. To get the same image size as the 25", you'd need to stack two 2x Barlow lenses together to expand the image of the 6" scope. The image would be 4 times wider, but the brightness would be 1/16th what it was. The scope would have effectively become a 6" f/20 scope. This is done with planetary astrophotography where there is plenty of light and you are trying to use high magnification.

One trick deployed by imagers is to use a focal reducer. These do the opposite of a Barlow lens and shrink the image scale, effectively increasing the brightness at the prime focus and increasing the true field. Focal reducers make a telescope function as if it has a faster focal ratio. Schmidt Cassegrain telescopes are typically f/10, but when used with an f/6.3 or f/3.3 focal reducer exposure times are reduced substantially at the expense of smaller image size (no free lunches I'm afraid).

Observing with an eyepiece
You may have picked up on the fact that I keep emphasizing *at the prime focus.* That's because it is different when you use an eyepiece (plus I have an irritating habit of repeating myself). I'm going to walk through the same example using an extended object (M101) but this time using an eyepiece. The focal length and apparent field of the eyepiece determines how much of the image at the prime focus you will see. This means that there is a circular area at the prime focus from which the eyepiece collects the light. Now, let's look at M101 through an eyepiece in the 6" f/5 and 25" f/5.

The true field viewed through the eyepiece is as follows:

True Field = Apparent Field / Magnification   (3)

True Field = (Apparent Field x FL Eyepiece)   (3)
                        FL of Objective
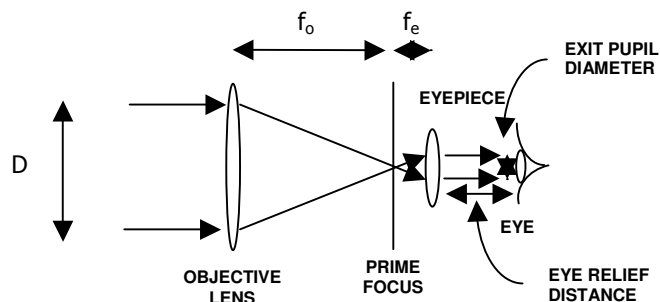
FL stands for focal length.

Figure 3 – Schematic of a telescope and eyepiece – only rays from a star on axis are shown for clarity.

Apparent field is a measure of the breadth of view given by an eyepiece design (eg. 82° for Televue Naglers). Equation 3 is over simplified but is in common use and is good enough to illustrate my next point.

Ok, so let's pretend we have a fantasy eyepiece in our eyepiece case in which M101 will fill the whole field in the 6" scope. For that we need a true field of 22 arc minutes or 0.367 of a degree. Let's assume our eyepiece has an apparent field of 65 degrees, and a 6" f/5 scope has a focal length of 762mm. To have M101 fill the field exactly we need a 4.3mm eyepiece. Using the math we used at while back we know that the 4.3mm eyepiece is collecting light from a disk at the prime focus 4.876mm across (ie. the size of M101 in the 6" f/5 scope). The image in the eyepiece is magnified 177 times.

What happens if we put the 4.3mm eyepiece in a 25" f/5 scope? Well, we all know that would be give 3175/4.3=738 times magnification which is a bit over the top. But, just imagine that there is no atmosphere and the mirror is perfect and we can do this. We can now only see the core of the galaxy. That's because the whole image is 20.317mm across but our eyepiece is only gathering light from the central 4.876mm. That's why we can only see the core of M101 in the 25" scope.

So what eyepiece would we need if we would want to have M101 fill the field of view in the 25" f/5 scope? Using formula 3 we need a 17.9mm eyepiece if it has an apparent field of 65 degrees. That will get us back to 177 times magnification. This time our 17.9mm eyepiece is collecting light from a circle at the prime focus 20.317mm across, ie. the diameter of M101 in the 25" f/5 scope.

What about the brightness of the two images? Light emerges from the eyepiece as a converging cone. The narrow point of that cone is the exit pupil where you place the lens of your eye. Further back from the exit pupil the light diverges again – that's how solar image projection works. The diameter of the exit pupil is as follows:
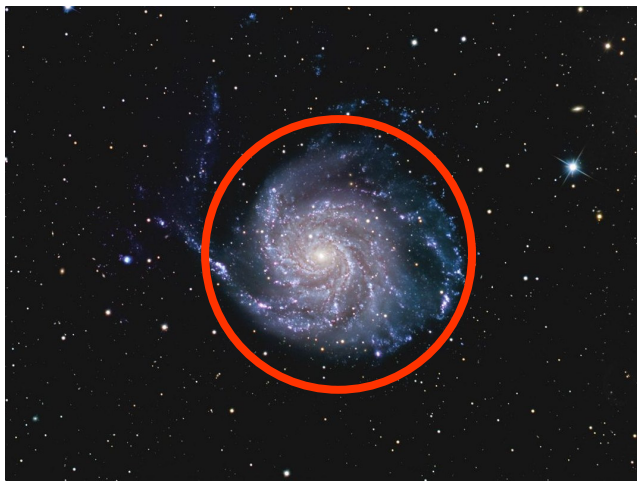
Figure 4 – The area of the prime focus seen by a 4.3mm eyepiece in a 6" f/5 scope (top) and 25" f/5 scope (bottom).

Exit Pupil = Diameter of Objective / Magnification   (4)

The magnification is the same in the two scopes, but in the 25" the exit pupil is 635/177 = 3.58mm, in the 6" it is 0.86mm. Both of these are smaller than our dilated pupil at night so all of the light is entering our eye. Because we have used different focal length eyepieces, we have removed the effect of different image size at the prime focus in both scopes. The image size in the two eyepieces is the same and contains all of the light we collected from M101. Consequently the image in the 25" scope viewed through the eyepiece is much brighter than the 6", even though the image at the prime focus is the same brightness in the two telescopes. Interestingly enough the exit pupil is the image of the objective (strictly the entrance pupil) – that's why the exit pupil is more than 4 times bigger for the 25" scope than the 6" scope for the same magnification. The brightness per unit area of the two exit pupils is the same, but the total amount of light for the 25" scope is much greater.
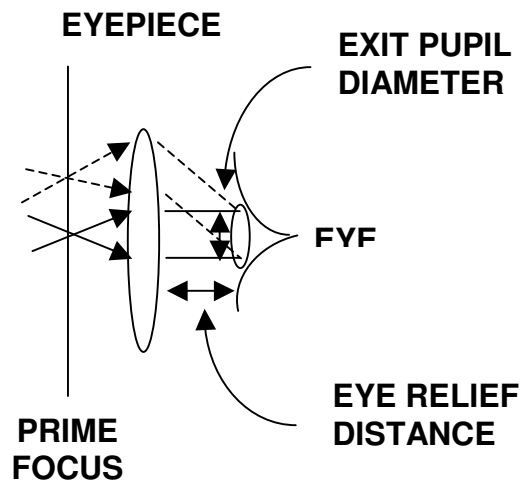

Figure 5 – Light from two stars – one on and one off axis emerging from the eyepiece.

Two telescopes with different f ratios but the same focal length

Two popular telescopes are the 6" f/8 and 8" f/6. In this example I've kept the focal length the same, unlike the 6" f/5 and 25" f/5 where the f ratio stayed the same but the focal length changed. Because these telescopes have the same focal length the image size at the prime focus is the same. The extra light in the 8" scope has to go somewhere, so this time the image at the prime focus is brighter in the 8" f/6 scope. That's because it's f/6, not because it's an 8" (the image brightness at the prime focus in a 6" f/8 and 8" f/8 would be the same for reasons described already). Because the 6" f/8 and 8" f/6 have the same focal length we get the same magnification for a given eyepiece The images in the 8" scope when viewed through an eyepiece will be brighter in the 8" scope because it's an 8", not because it's f/6.

Two completely different telescopes

Say you start amateur astronomy with a 6" f/8. One day aperture fever strikes and you buy a 15" f/4.5. Now, in this case the image of an extended object at the prime focus will be brighter because it's f/4.5, not because a 15". The image will also be larger as the focal length is greater. The images are brighter when using an eyepiece in the 15" scope because it is 15", not because it's f/4.5

So why do we use bigger telescopes?

What I hope I have been able to convince you off is that a larger scope will always yield brighter images than a smaller scope (for the same magnification) when you use an eyepiece. When observing, aperture rules. That is fairly obvious. However, when you are doing prime focus photography this is not true for extended objects (which probably came as a surprise). So why do imagers use large diameter telescopes?

The main reasons for using a larger scope for photography are increased image size, better resolution and brighter stars. Actually increased image size is actually an effect of focal length, not aperture as described by equation 1. Most of the time however, when we increase the aperture the focal length increases as it is hard to make telescopes with very fast focal ratios. An exception to this is an astrograph that typically has a very fast focal ratio and a high price tag. The Ritchey-Chretien scopes craved by imagers for their flat fields actually have relatively slow focal ratios of the order of f/8 so the exposure time is longer compared to a fast Newtonian.

The resolution of a telescope is the ability to discern two stars in close proximity as separate (the resolution of extended objects is more complex and goes beyond the scope of this article). The most well known criteria to describe the resolution of a telescope was described by Lord Rayleigh. The simplest way to state the Rayleigh criterian is that the minimum separation that can be discerned is 140/D arc seconds, where D is the diameter of the objective in mm. Strictly this is for observation with the human eye using

green light, but it is a good rule of thumb. That's fine in theory, but you'll notice that even a diameter of 100mm would have a resolution of 1.4 arc seconds. Typically you won't achieve that because the optics in your telescope aren't perfect or mis-collimated and the atmosphere is churning above you. A good test of your scope is to try to split Epsilon Lyra (the double double) as the two doubles are each around 2.35 arc seconds apart. So, a bigger telescope does have better resolution but ultimately the seeing limits what you can achieve. Long exposure photography is particularly vulnerable to seeing as the stars will jiggle around, blurring out the Airy disks in the image to create larger diameter stars.

Confused already?
Well, this turned out to be much longer than I anticipated! Hopefully by going through this step by step it makes sense, even if some of it seems a little counterintuitive to start with. If it is still unclear, ask me and I'll do my best to explain.

Thanks to Steve Walters and Mike Lindner for reviewing this article. The image of M101 was taken by Steve Walters.
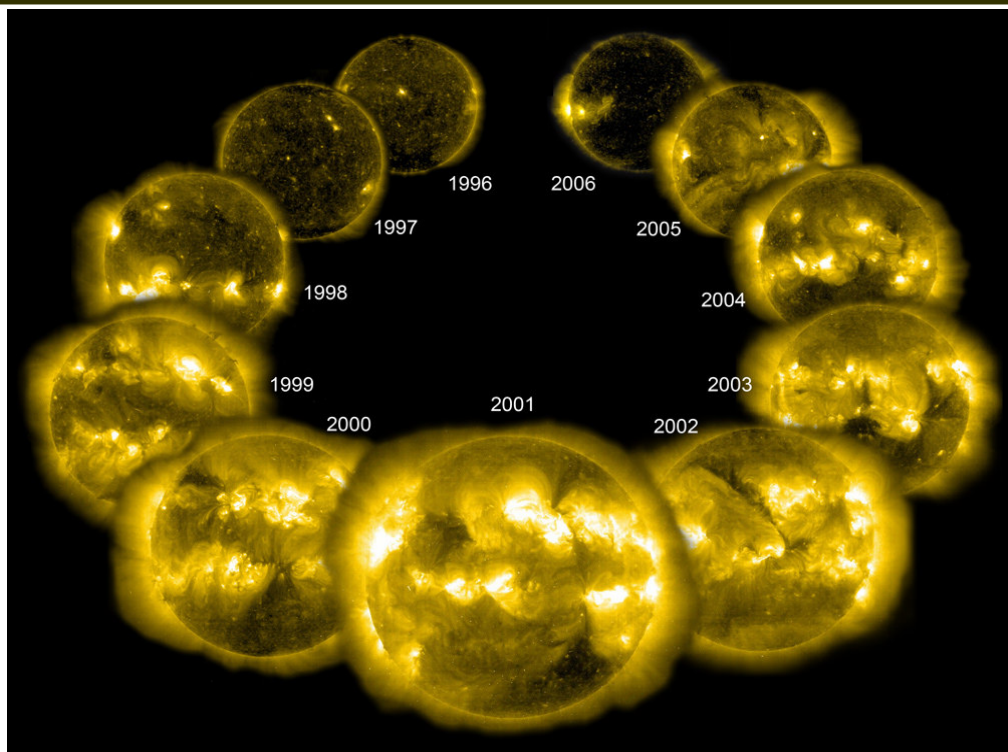
A Complete Solar Cycle from SOHO - Credit: **SOHO - EIT Consortium, ESA, NASA**

Every eleven years, our Sun goes through a solar cycle. A complete **solar cycle** has now been imaged by the sun-orbiting **SOHO spacecraft**, celebrating the 12th anniversary of its launch yesterday. A **solar cycle** is caused by the changing **magnetic field** of the Sun, and varies from **solar maximum**, when **sunspot**, **coronal mass ejection**, and **flare phenomena** are most frequent, to solar minimum, when such activity is relatively infrequent. Solar minimums occurred in 1996 and 2007, while the last solar maximum occurred in 2001 Pictured above is a SOHO image of the **Sun** in extreme **ultraviolet light** for each year of the last **solar cycle**, with images picked to illustrate the relative **activity** of the Sun.

Are you a S*T*A*R Member?

S*T*A*R is the proud owner of a monstrous 25" Dobsonian Obsession reflector – which members can gain access to!

Meetings are the first Thursday of each month, except July and August, at 8:00 PM at the King of Kings Lutheran Church, 250 Harmony Rd. in Middletown. Meetings generally consist of lectures and discussion by members or guest speakers on a variety of interesting astronomical topics. S*T*A*R is a member of United Astronomy Clubs of New Jersey (UACNJ), the Astronomical League (AL), and the International Dark Sky Association (IDA).

Memberships: ( )Individual....$25 ( ) Family...$35

Name_____

Address_____

City_____State___Zip_____

Phone_____

Email_____

Make checks payable to: S*T*A*R Astronomy Society, Inc. and mail to P.O. Box 863, Red Bank, NJ 07701

2008 January Celestial Events
Supplied by J. Randolph Walton (Randy)

Day	Date	Time (EDT)	Event
Fri	4	02:00	Quadrantid meteors peak (ZHR 120)
		04:13	Moon Rise
Sat	5	04:30	Venus Rises
		05:14	Moon Rise
		06:40	Mars Sets
		06:40	Jupiter Rises
		07:22	Sunrise
		16:49	Sunset
		17:35	Mercury Sets
		21:05	Saturn Rises
Tue	8	06:37	**New Moon**
		07:46	Moon Rise
Sat	12	04:45	Venus Rises
		06:02	Mars Sets
		06:20	Jupiter Rises
		07:21	Sunrise
		16:55	Sunset
		18:05	Mercury Sets
		20:35	Saturn Rises
		21:32	Moon Set
Tue	15	10:57	Moon Rise
		14:46	**First Quarter Moon**
Sat	19	04:55	Venus Rises
		05:30	Mars Sets
		06:00	Jupiter Rises
		07:18	Sunrise
		13:45	Moon Rise
		17:03	Sunset
		18:35	Mercury Sets
		20:05	Saturn Rises
Tue	22	08:35	**Full Moon**
		17:22	Moon Rise
Sat	26	04:57	Mars Sets
		05:10	Venus Rises
		05:37	Jupiter Rises
		07:14	Sunrise
		17:11	Sunset
		18:37	Mercury Sets
		19:35	Saturn Rises
		21:53	Moon Rise
Wed	30	00:03	**Last Quarter Moon**
		00:59	Moon Rise

In the Eyepiece

Here is a list of objects for this month. This is reproduced from www.skyhound.com with the kind permission of its creator and author of SkyTools Greg Crinklaw.

Object(s)	Class	Con	RA	Dec	Mag
NGC 1501	Planetary Nebula	Camelopardus	04h06m59.4s	+60°55'14"	13.3
Cleopatra's Eye	Planetary Nebula	Eridanus	04h14m15.8s	-12°44'21"	9.6
The California Nebula	Diffuse Nebula	Perseus	04h03m12.0s	+36°22'00"	5.0
NGC 1664	Open Cluster	Auriga	04h51m04.4s	+43°42'04"	7.2
MSH 04-12	Quasar	Eridanus	04h07m48.4s	-12°11'36"	14.8
NGC 1360	Planetary Nebula	Fornax	03h33m14.6s	-25°52'18"	9.6
Crystal Ball	Planetary Nebula	Taurus	04h09m17.0s	+30°46'33"	10.0
Palomar 2	Globular Cluster	Auriga	04h46m06.0s	+31°22'54"	13.0
K 2-1	Planetary Nebula	Auriga	05h07m07.1s	+30°49'18"	13.8
NGC 1624	Open Cluster	Perseus	04h40m25.4s	+50°26'49"	11.8
M 38	Open Cluster	Auriga	05h28m39.4s	+35°50'24"	6.8
Sigma Ori	Multiple Star	Orion	05h38m44.8s	-02°36'00"	3.8
M37	Open Cluster	Auriga	05h52m22.3s	+32°32'40"	6.2
The Trapezium	Multiple Star	Orion	05h35m16.5s	-05°23'23"	5.1
NGC 2017/HR 1944	Multiple Star	Lepus	05h39m16.2s	-17°50'58"	6.4
Beta Mon	Multiple Star	Monoceros	06h28m49.1s	-07°01'59"	3.8
NGC 2112	Open Cluster	Orion	05h53m52.2s	+00°23'32"	9.1
NGC 1893 & IC 410	Open Cluster in Nebula	Auriga	05h22m41.1s	+33°23'49"	7.8
M 50	Open Cluster	Monoceros	07h03m12.3s	-08°19'28"	7.2
Crab Nebula	Diffuse Nebula	Taurus	05h34m30.0s	+22°01'00"	8.4
IC 443	Diffuse Nebula	Gemini	06h17m48.0s	+22°49'00"	12.0
Focus on the Cone Nebula	Open Cluster	Monoceros	06h41m03.2s	+09°53'07"	4.1
NGC 2242	Planetary Nebula	Auriga	06h34m07.4s	+44°46'37"	15.2
K 2-2	Planetary Nebula	Monoceros	06h52m28.4s	+09°58'17"	12.5

Moon Phases

Jan 8	Jan 15	Jan 22	Jan 30

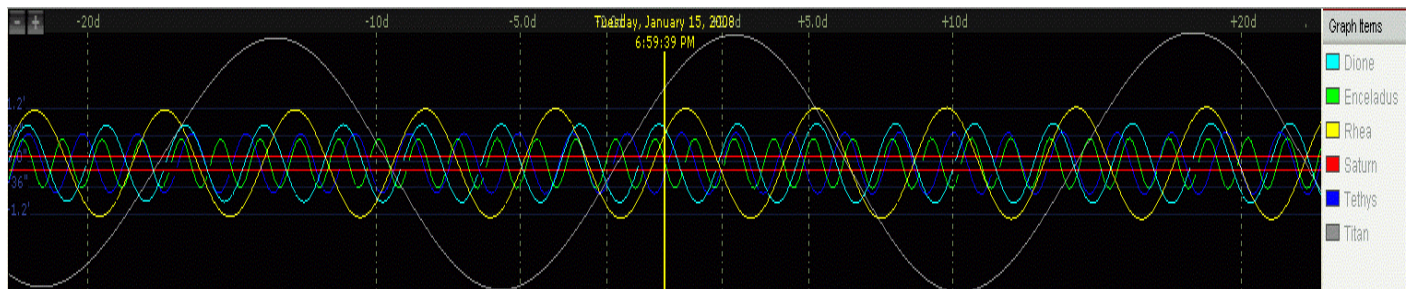| Feb 7	Feb 14	Feb 21	Feb 29

Jupiter Moon Calendar

Here is a graphical depiction of the visible moons of Jupiter for the month of January 2008.
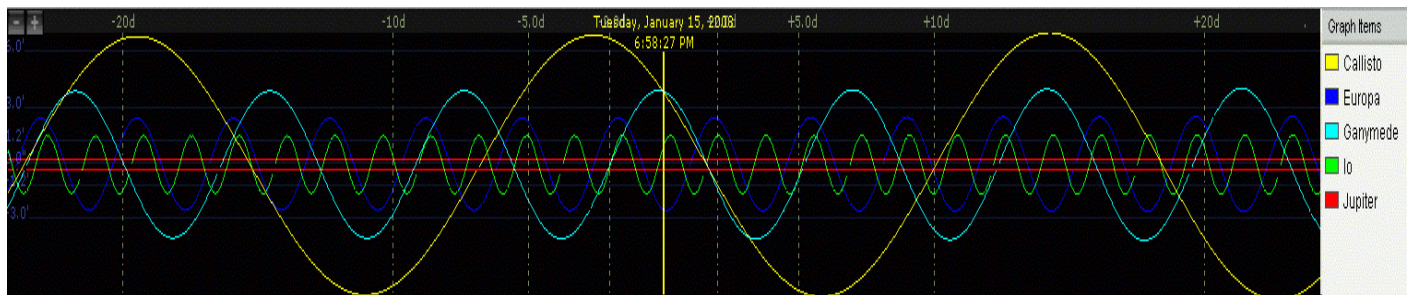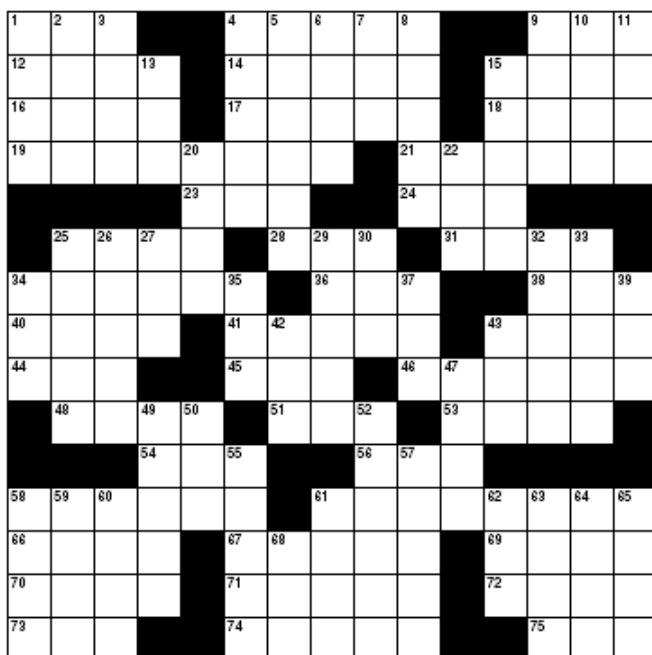

Saturn Moon Calendar

Here is a graphical depiction of the visible moons of Saturn for the month of January 2008.

AstroPuzzle - January 2008

www.CrosswordWeaver.com

ACROSS

1 Not good
4 Take place
9 Shanty
12 Copied
14 River
15 Baloney
16 Not taped
17 *A particle that carries force; one of two types of elementary particles.*
18 Dueling sword
19 Entree (2 wds.)
21 Mock
23 Southwestern Indian
24 Heavens
25 Long time
28 Badger
31 Women's magazine
34 *Beautiful eruptions in the outer part of the Sun's atmosphere.*
36 Chat
38 Single
40 Advance
41 Senile
43 Goose egg
44 Conger
45 Compass point
46 Displayer of emotions
48 Representatives
51 Gone by
53 Attention-Deficit Hyperactive Disorder (abbr.)
54 Acid drug
56 Child
58 Disputer
61 *A meteorite which is stoney.*
66 Talk
67 *The dark inner part of a sunspot, or shadow.*
69 As previously cited
70 Air (prefix)
71 African nation
72 Freshwater fish
73 *Amount of time it takes the Earth to spin once on its axis.*
74 Lingo
75 Goof|

DOWN

1 Unguent
2 Capital of Western Samoa
3 Hindu goddess, consort of Siva
4 *The path one object takes around another.*
5 Elect
6 Sap
7 Card game
8 Tears
9 Shoshonean
10 Secondhand
11 Biblical "you"
13 Lair
15 Transparent gem
20 Sand pile
22 Stretch to make do
25 Tree
26 *Name of Appolo 11 Lunar module used to land on the moon.*
27 Lode yield
29 Growing older
30 Miss
32 Unwilling
33 Complete
34 Toll
35 Looked
37 Spelling contest
39 Serving of corn
42 BB association
43 Head motion
47 Bread spread
49 *Recently kicked out of the exclusive Solar System Planetary club.*
50 South southeast
52 *Moon of Uranus named after a Shakespeare character.*
55 Medicines
57 Great ape
58 University (abbr.)
59 *The second largest moon of Saturn.*
60 Farside's Larson
61 Syrian bishop
62 Brim
63 Wading bird
64 Carved Polynesian pendant
65 Eve's garden
68 Bad (prefix)

Solution at mysite.verizon.net/vzescqc2/astropuzzle/id7.html