

IO - June 2010

Issue 2010-06
Eugene Astronomical Society

Eugene Astronomical Society
Annual Club Dues \$25
President: Sam Pitts - 688-7330
Secretary: Jerry Oltion - 343-4758
Additional Board members:
Jacob Strandlien, Tony Dandurand,
John Loper.

www.eugeneastro.org

EAS is a proud member of:

The Astronomical League
The World's Largest Federation of Amateur Astronomers



Next Meeting: Thursday, June 24th

Catalogs, Lists, and Charts

by Jerry Oltion

We've all heard about Charles Messier's list of objects that aren't comets (and therefore weren't worth another look). Likewise the NGC catalog of 7,840 deep-sky objects. But what about the IC catalog, or the Herschel 400, or the Caldwell Catalog? Ever heard of the Hubble Guide Star Catalog? There's a bewildering array of catalogs and lists of astronomical objects, more than a person could ever look at on paper, much less through a telescope.

What's in these compilations of stars, and more to the point, how can you use them to your advantage when you go out for a night's observing? Jerry did some digging around through the list of lists and selected the ones most often recommended for amateur astronomers, then he looked at how each of those came to be, who created them, and what were their criteria for inclusion.

He did the same for star charts. What charts do most people find useful, and why? Come to our June meeting and learn a little about the signposts that guide our way through the night sky.

Jerry and his wife, Kathy, also went to Florida last month to watch the launch of the Space Shuttle *Atlantis*. Jerry will present a short slide show of what they saw, including the view of the late spring sky from 25° latitude.

In addition, Jacob Strandlein will present the astronomy news of the month, and as always there will also be time for others to bring items for show & tell. If you've got a new scope or piece of equipment you'd like to show off, bring it! The meeting is at 7:00 in EWEB's Community Room, 500 E. 4th in Eugene.

Next First Quarter Friday: June 18th

Our May First Quarter Friday was clouded out. Here's hoping June will be less nebulous.

First Quarter Fridays are laid-back opportunities to do some observing and promote astronomy at the same time. Mark your calendar and bring your scope to the College Hill Reservoir (24th and Lawrence in Eugene) and share the view with whoever shows up.

Here are the dates for First Quarter Fridays through December of 2010:

June 18

September 17

December 10

July 16

October 15

August 13

November 12

May Meeting Report

At our May 27th meeting, Sam Pitts gave an entertaining presentation of his and Frank Casebolt's trip to New York for the Northeast Imaging Conference and Astronomy Forum. We all relived the drama of watching Sam and Frank struggle to keep from buying several of the high-end telescopes on display there.

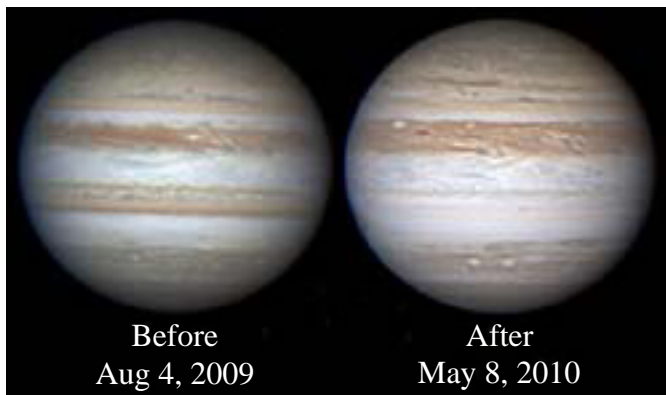
Also at the meeting, Bob Moser showed off the 6" refractor that he and Frank Szczepanski mounted on a beautiful and highly portable alt-azimuth mount. Jerry Oltion showed off a homemade 80mm finder scope he built. Bill Murray reported that the surface work on the College Hill Reservoir is now finished and the entire deck is once again open for observing. Yay! Jacob Strandlien reported the astronomical news of the month, including the rather startling information below:

Jupiter Loses a Band

When Jupiter disappeared behind the Sun last fall, it was sporting its usual two equatorial belts. When it came out from behind the solar glare this spring, it was missing the southern belt.

The Southern Equatorial Belt (SEB) fades at irregular intervals, most recently in 1973-75, 1989-90, 1993, and 2007. When the belt returns, it is usually accompanied by a spectacular outburst of storms and vortices. It begins at a single point and a disturbance spreads out rapidly around the planet from there.

In the meantime, conditions are perfect for observing the Great Red Spot, which in recent years has tended to blend into the SEB and be difficult to see.



Story and photos courtesy NASA and Australian astrophotographer Anthony Wesley.



Our next meeting will be on Thursday, June 24th, at 7:00 PM in the EWEB north building's Community Room. This is the first room in the semicircular building to the north of the fountain at EWEB's main campus on the east end of 4th Avenue.

Meeting dates for 2010: (All meetings are at 7:00 in the Community Room)

June 24	September 23	December 23
July 22	October 28	
August 26	November 24 (Wednesday)	

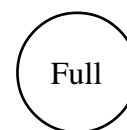
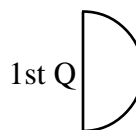


Thank You Castle Storage

For the last two years, Castle Storage has generously provided EAS a place to store its telescopes and equipment. EAS would like to thank Castle Storage for their generosity and support for our group. Please give them a call if you need a storage space, and tell your friends. They are great people and offer secure and quality storage units.



Observing in June



June 4	June 12	June 18	June 26
Mercury Rise: 4:34 AM	Mercury Rise: 4:35 AM	Mercury Rise: 4:46 AM	Mercury Rise: 5:17 AM
Venus Set: 11:29 PM	Venus Set: 11:29 PM	Venus Set 11:27 PM	Venus Set: 11:21 PM
Mars Set: 1:22 AM	Mars Set: 1:00 AM	Mars Set: 12:43 AM	Mars Set: 12:21 AM
Jupiter Rise: 2:24 AM	Jupiter Rise: 1:55 AM	Jupiter Rise: 1:33 AM	Jupiter Rise: 1:03 AM
Saturn Set: 2:33 AM	Saturn Set: 2:01 AM	Saturn Set: 1:38 AM	Saturn Set: 1:07 AM
Uranus Rise: 2:23 AM	Uranus Rise: 1:52 AM	Uranus Rise: 1:28 AM	Uranus Rise: 12:57 AM
Neptune Rise: 1:11 AM	Neptune Rise: 12:40 AM	Neptune Rise: 12:16 AM	Neptune Rise: 11:41 PM
Pluto Rise: 9:49 PM	Pluto Rise: 9:16 PM	Pluto Rise: 8:52 PM	Pluto Rise: 8:20 PM

All times: Pacific Standard Time (Nov 1, 2009-March 13, 2010) = UT -8 hours or U.S. Pacific Daylight Time (March 14-November 7, 2010) = UT -7 hours.

Date	Moonrise	Moonset	Sunrise	Sunset	Twilight Begin	Twilight End
6/1/2010	00:00	09:55	05:32	20:49	03:15	23:07
6/2/2010	00:27	10:58	05:32	20:49	03:13	23:08
6/3/2010	00:50	11:59	05:31	20:50	03:12	23:10
6/4/2010	01:10	13:01	05:31	20:51	03:11	23:11
6/5/2010	01:31	14:02	05:31	20:52	03:10	23:13
6/6/2010	01:51	15:05	05:30	20:52	03:09	23:14
6/7/2010	02:13	16:09	05:30	20:53	03:08	23:15
6/8/2010	02:38	17:17	05:30	20:54	03:08	23:16
6/9/2010	03:08	18:26	05:29	20:54	03:07	23:17
6/10/2010	03:45	19:35	05:29	20:55	03:06	23:18
6/11/2010	04:31	20:40	05:29	20:55	03:05	23:19
6/12/2010	05:29	21:37	05:29	20:56	03:05	23:20
6/13/2010	06:36	22:25	05:29	20:56	03:05	23:21
6/14/2010	07:51	23:04	05:29	20:57	03:04	23:22
6/15/2010	09:09	23:37	05:29	20:57	03:04	23:22
6/16/2010	10:27		05:29	20:58	03:04	23:23
6/17/2010	11:43	00:05	05:29	20:58	03:03	23:24
6/18/2010	12:58	00:30	05:29	20:58	03:03	23:24
6/19/2010	14:11	00:55	05:29	20:59	03:03	23:24
6/20/2010	15:24	01:20	05:29	20:59	03:03	23:25
6/21/2010	16:37	01:48	05:29	20:59	03:04	23:25
6/22/2010	17:48	02:20	05:30	20:59	03:04	23:25
6/23/2010	18:54	02:58	05:30	20:59	03:04	23:25
6/24/2010	19:53	03:43	05:30	20:59	03:05	23:25
6/25/2010	20:44	04:36	05:31	21:00	03:05	23:25
6/26/2010	21:26	05:35	05:31	21:00	03:06	23:25
6/27/2010	22:00	06:38	05:31	21:00	03:06	23:24
6/28/2010	22:29	07:42	05:32	20:59	03:07	23:24
6/29/2010	22:53	08:45	05:32	20:59	03:08	23:23
6/30/2010	23:14	09:48	05:33	20:59	03:09	23:23

Items of Interest This Month

- 6/1 Ceres in south portion of Lagoon Nebula
- 6/6 Mars within 1° of Regulus
- 6/8 Uranus and Jupiter within 1/2°
- 6/11 Venus, Castor, and Pollux form straight line
- 6/18 First Quarter Friday Star Party**
- 6/19 & 20 Venus near Beehive Cluster
- 6/21 Summer solstice 4:28 a.m.
- 6/26 Partial Lunar eclipse in early a.m.



For Current Occultation Information

Visit Derek C. Breit's web site

"BREIT IDEAS Observatory"

<http://www.poyntsource.com/New/Regions/EAS.htm>

Go to Regional Events and click on the Eugene, Oregon section. This will take you to a current list of Lunar & asteroid events for the Eugene area. Breit continues to update and add to his site weekly if not daily. This is a site to place in your favorites list and visit often.

All times are for Eugene, Oregon, Latitude 44° 3' Longitude 123° 06' for listed date

Jim Jackson Receives Galaxy Groups and Clusters Pin and Certificate

At our May 27th meeting, Jim Jackson received his Galaxy Groups and Clusters pin and certificate from the Astronomical League acknowledging that he has observed at least 120 of the 250 objects listed in the League's *Galaxy Groups & Clusters Guide*. Those 120 objects must be divided evenly in four categories: 1) 30 Galaxy Trios; 2) 30 Hickson compact galaxy groups; 3) 30 Additional Galaxy Groups; and 4) 30 Abell galaxy clusters. Jim didn't stop at 120; he logged 123 before applying for his certificate.

Making all these observations and logging them accurately is a major accomplishment that took Jim over three years to complete. Regarding the degree of patience and dedication required, Jim said, "If you don't have a diagnosis of OCD, you have to be close to it."

Of the 123 groups and clusters Jim recorded, he found 81 from his dark-sky site in eastern Oregon, 28 from Eagle's Rest, and 14 at the Oregon Star Party. All of the observations were made with his 18" scope and all were found "manual," without the benefit of go-to or digital setting circles. Jim identified 751 individual galaxies within the 123 groups and clusters he observed. Most galaxies were Mag 14+, but he did identify a 16.1 Mag (v) galaxy.



Jim and his 18" telescope await dark sky to search for more galaxy groups and clusters



Going for this certificate taught Jim a great deal about the night sky and about observing techniques. That's by far the greatest benefit of a challenge like this: what you learn along the way.

Jim hasn't said what his next observing project will be, but the Astronomical League offers 33 different challenges. These "observing clubs" are excellent opportunities to spur you into action and get you out observing with a purpose. Maybe you should pick one and go for your own certificate and pin. Check them out at <http://www.astroleague.org/observing.html>.

Summer Star Party and Campout

The EAS has two major activities planned this summer. Mark your calendars!

- July 10th: our dark sky star party at Dexter State Park.
- August 6-8: EAS dark sky campout at Sacandaga Campground, 26 miles southeast of Oakridge on the Middle Fork of the Willamette River. This was an excellent campout last year, missing only one thing: you! Join us in making this year's campout even better. There are plenty of campsites, a great open meadow for telescopes, and some of the darkest sky you're likely to see anywhere. Tony and Louise Dandurand will be there from the 4th onward. Contact Tony at <tdandurand@comcast.net> for more information.

SOFIA Gets First Light

The Stratospheric Observatory for Infrared Astronomy (SOFIA), a joint program by NASA and the German Aerospace Center (DLR), achieved a major milestone May 26, 2010, when the airborne observatory made its first in-flight nighttime observations. Astronomers call the first observations by a new observatory “first light.”

“With this flight, SOFIA begins a 20-year journey that will enable a wide variety of astronomical science observations not possible from other Earth- and space-borne observatories,” said Jon Morse, NASA’s Astrophysics Division director. “It clearly demonstrates that SOFIA will provide us with ‘Great Observatory’-class astronomical science.”



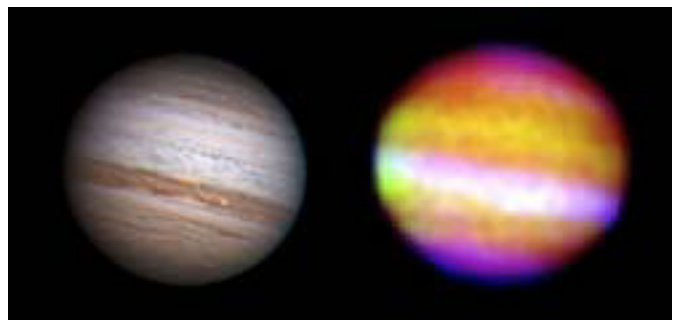
The highly modified Boeing 747SP jetliner, fitted with a 100-inch (2.5-meter) diameter reflecting telescope, took off from NASA’s Dryden Aircraft Operations Facility in Palmdale, Calif. The in-flight personnel consisted of an international crew from NASA, Universities Space Research Association (USRA), the German SOFIA Institute (DSI) and Cornell University, Ithaca, N.Y. During the six-hour flight at altitudes up to 35,000 feet, the crew of 10 scientists, engineers and technicians worked at consoles in the aircraft’s main cabin to gather telescope performance data.

The results, according to NASA SOFIA project scientist Pam Marcum, were gratifying. “Wind tunnel tests and supercomputer calculations made at the start of the SOFIA program predicted we would have sharp enough images for front-line astronomical research; a preliminary look at the first light data indicates we indeed accomplished that,” said Marcum.

The stability and precise pointing of the German-built telescope met or exceeded the expectations of the engineers and astronomers who put it through its paces during the flight.

“The crowning accomplishment of the night came when scientists on board SOFIA recorded images of Jupiter at wavelengths unobservable by either ground-based observatories or current space telescopes,” said USRA SOFIA senior science advisor Eric Becklin. “The composite image from SOFIA shows heat, trapped since the formation of the planet, pouring out of Jupiter’s interior through holes in its clouds.”

The highly sensitive Faint Object infraRed CAmera for the SOFIA Telescope (FORCAST), used for these inaugural observations was operated in flight by its builders, a team led by Cornell’s Terry Herter. In a few minutes FORCAST is able to capture images that would require many-hour exposures by ground-based observatories blocked from a clear infrared view of the universe by the Earth’s water vapor. SOFIA’s operational altitude, above more than 99 percent of the water vapor in Earth’s atmosphere, will allow the airborne observatory to receive 80 percent or more of the infrared light accessible to a space observatory.



Jupiter imaged by SOFIA in visible light (left) and infrared (right). Note the missing band even in infrared.

Magnification, Exit Pupil, and Field of View

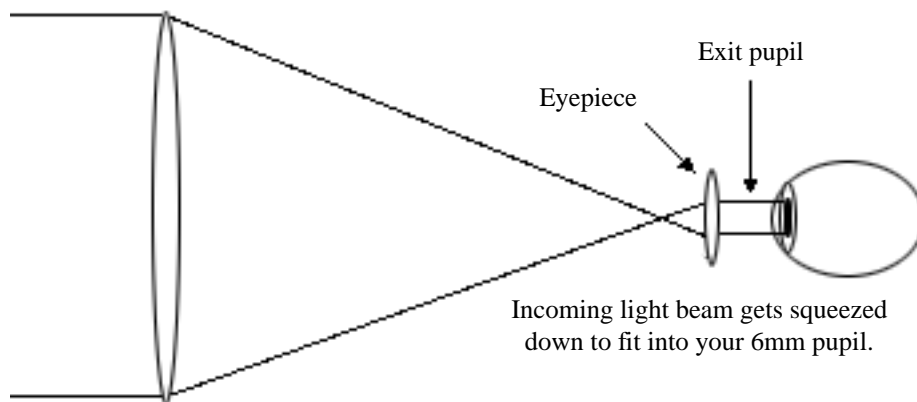
by Jerry Oltion

Math alert: Reading this article quickly could make your brain explode. Take it slow. None of the math is hard, but there's a lot of it, so make sure you understand each step before you go on. You've got time. It's cloudy out, or you wouldn't be reading this, right? Also note: you can get by fine without knowing any of this stuff. Stick an eyepiece in the scope and see how it works. But if you're interested in *how* it works, and *why*, then this article is for you.

When people first get into astronomy, we learn fairly quickly that magnification can be calculated by dividing the focal length of the telescope by the focal length of the eyepiece. That's a useful calculation, but there are other things to consider when choosing an eyepiece.

“Exit pupil” is one such factor. The exit pupil is the width of the light beam that leaves the eyepiece and enters your eye. An adult's pupil will only dilate to about 6mm, so any eyepiece that gives you a larger exit pupil is wasting part of your scope's light-gathering capability. Different magnifications give you different exit pupils, and different telescopes will give you different exit pupils with the same eyepiece.

In order to see why this is, we need to look at what ultimately causes magnification. You can think of magnification as simply the number of times you compress the light beam entering the telescope. If you have a pair of binoculars with a 35mm objective and they squeeze the light down to a 5mm exit pupil (the beam entering your eye), then they're magnifying by 7x ($35\text{mm} \div 5\text{mm}$). 5mm is a useful exit pupil size — it gives you a little leeway in placing the eyepieces up to your eyes — hence you see a lot of 7 x 35mm



binoculars. Likewise, you see 10 x 50mm binoculars, but you don't see many 7 x 50mm, because they would give you an exit pupil of 7.1mm ($50 \div 7$). Since an adult's eyes will only open to about 6mm, that last millimeter is wasted. (Or looking at it another way, at 7x your eye is only seeing about 42mm of the objective (7x times the 6mm exit pupil that makes it into the eye), so the outer 8mm

of a 50mm objective is wasted at 7x.) The lowest useful magnification for 50mm binoculars would be $50\text{mm} \div 6\text{mm}$ (your dilated pupil diameter), or 8.3x. And you do see a few 8 x 50mm binoculars out there.

Move up to a 10-inch telescope. That's 254mm wide. To get a 6mm exit pupil, your lowest magnification would be $254\text{mm} \div 6\text{mm}$, or about 42x.

What does that mean in terms of eyepiece choice? If your 10-inch scope has an f-ratio of f/5, then its focal length is 50 inches (f/5 times the 10-inch mirror diameter). 50 inches is 1270 mm, so to get 42x with that scope you would need a 30mm eyepiece ($1270 \div 42$). Any eyepiece with a longer focal length would give you a lower magnification and a wider exit pupil, wasting light.

There are times when wasting light is okay. The lower your magnification, the wider your field of view, so sometimes it makes sense to waste a little light in order to fit a large object into the view. The Pleiades

A 30mm eyepiece, eh? Notice that $30\text{mm} \div f/5 = 6$. What's special about 6? That's your ideal exit pupil! This ratio works for any eyepiece: simply divide the eyepiece's focal length by your telescope's f-ratio and you'll get the exit pupil for that combination. So a 10mm eyepiece on an f/5 scope would give you a 2mm exit pupil; well within the 6mm limit for using all of your telescope's light.

are a good example. They're 2 degrees across; way larger than the field of view of any but the lowest power eyepieces. If you want to see the whole works at once, you'll want the lowest power you can get.

How can you tell, short of experimentation, what will fit in a given eyepiece? First, you need to know your eyepiece's *apparent* field of view. That's how wide the edges of the field appear to your eye when you're looking through it. Most plössl eyepieces have an apparent field of view of 50° . Their actual field of view is simply the apparent field divided by the magnification, so if the 30mm eyepiece mentioned above is a plössl, then at 42x it would give you a field of view of $50^\circ \div 42x$, or 1.2° . That's not enough to see the entire Pleiades. If you want a 2° field, you would need an eyepiece that gave you 25x (50° apparent field $\div 2^\circ$ real field). On the 1270mm scope mentioned above, that would require a 51mm eyepiece. That would give you a view of the entire Pleiades, but such an eyepiece would give you a 10mm exit pupil, wasting a lot of light. Fortunately the Pleiades are bright enough to withstand the loss.

You'll have a hard time finding a 51mm eyepiece, though, and even if you did, you'd run into another problem: longer focal length eyepieces reveal more of your secondary shadow if you're using a reflector-style telescope. (More on that below.)

Is there another way to get a wider field without running into this problem? Sure. Other eyepiece designs produce different fields of view. Panoptics will give you 68° apparent field, so a 30mm Panoptic in the situation mentioned above (at 42x) would give you a 1.6° real field of view ($68^\circ \div 42x$). Hmm. Still not quite enough to see the entire Pleiades.

Nagler eyepieces give you an apparent field of 82° . A 30mm Nagler would give you 1.95° , just enough to do the job. Or you could get an Ethos eyepiece. With a whopping 100° apparent field, you'd get 2.4° of real field at 42x. And since you're sticking with a 30mm eyepiece, you don't sacrifice any light, either. It all squeezes down to a 6mm exit pupil, perfect for your dark-adapted eye.

Of course you'd be out the cost of your entire telescope just for the eyepiece, but that's the tradeoff you make for a wide field of view.

Or is it?

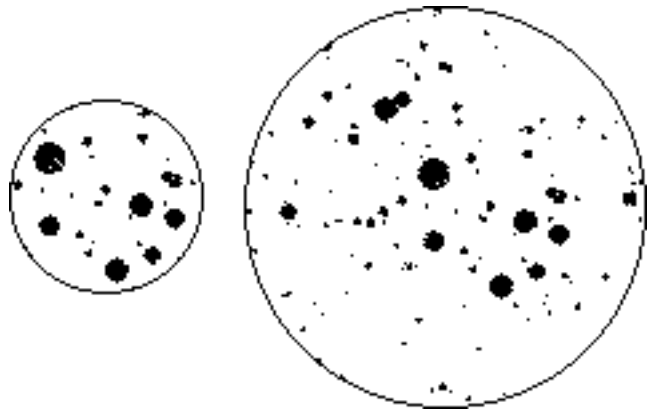
We got to this point by taking a 10" f/5 scope for our example. What if we cut that scope's focal length in half? At f/2.5, the same scope would give you half the magnification. Your exit pupil would be twice as big with the same eyepiece, but your field of view would be twice what it was before, too. So in this shorter scope, a plain old 30mm plössl would give you a real field of view of 2.4° . More than enough to see the entire Pleiades.

But alas, that combination would also give you a huge secondary shadow. Why? Because your eye is only seeing the inner 6" of the primary mirror, and a secondary mirror that's appropriately sized for a 10" primary would be grossly oversized for a 6" primary. (It would be 3.7" in diameter, obstructing over 60% of the primary's diameter.) However, a 6" scope with the same focal length would give you a great view because its secondary would be appropriately sized.

What? A cheapo little 6" Dob with a plössl eyepiece would give you as good a view of the Pleiades as a fast 10" with an \$800 Ethos eyepiece? (Assuming they made a 30mm Ethos, which they don't.)

Well...er...yeah. Even better, actually, since the 6" scope would be operating at f/4.2, and it would have a lot less distortion around the edges (called coma) than a 10" scope operating at f/2.5.

Just imagine what a little 3" refractor could do! Let's do the math:



The field of view in a plössl versus an Ethos eyepiece

Most 3" scopes are just a nudge over 3" in objective diameter, going for an even 80mm, so the lowest useful magnification to give you a 6mm exit pupil would be 13.3x ($80 \div 6$). At f/5, a typical f-ratio for a cheap doublet refractor, the scope would have a focal length of 400mm. $400\text{mm} \div 13.3\text{x}$ gives us a 30mm eyepiece for our lowest-power, widest-field view. If we're using a plössl with a 50° apparent field, then it would give us an incredible 3.75° field of view. The Pleiades could fit almost twice over in there! And we'd have no secondary shadow at all, nor much coma to speak of, either.

Of course the image wouldn't be as bright. After all, you're only squeezing down an 80mm light beam rather than a 254mm light beam to fit it into your eye. That's the tradeoff with a small refractor.

Does your brain hurt yet? No? Okay, let's look at the other end of the spectrum. What happens at really high power? I mean really, really high power.

The European Southern Observatory is planning to build what they call their Extremely Large Telescope in the next few years. It has a 42-meter primary mirror. That's 42,000mm wide. Divide that by your 6mm exit pupil and you get 7000x for the *lowest* useful magnification.*

Now figure what you can see at 7000x. A plössl eyepiece with an apparent field of view of 50° would give you a 0.007° real field of view (50° apparent field divided by 7000x). That's about 25 arc-seconds. The Ring Nebula is 2 arc-minutes across, or about 120 arc-seconds. That means you couldn't fit it into the field of view of a plössl eyepiece at 7000x.

An Ethos eyepiece with its 100-degree apparent field of view gives you twice the field of a plössl, or 0.014 degrees. That's 50 arc-seconds. Still not even close. The Ring Nebula is just too big for 7000x.

Let's try something smaller. Castor is a close double star. Its two components are about 3 arc-seconds apart, so they would fit within the 25-second field of a plössl. They would fit 8.3 times across (25-second field divided by 3-second target), so if we divide the 50° apparent field by 8.3, we see that they would look like they were 6 degrees apart. That's 12 times wider than the Moon looks to the naked eye!

We can double-check our math by multiplying Castor's real size of 3 arc-seconds by 7000 (our magnification). Sure enough, we get 5.8 degrees, which is close to the 6 degrees we calculated the other way.

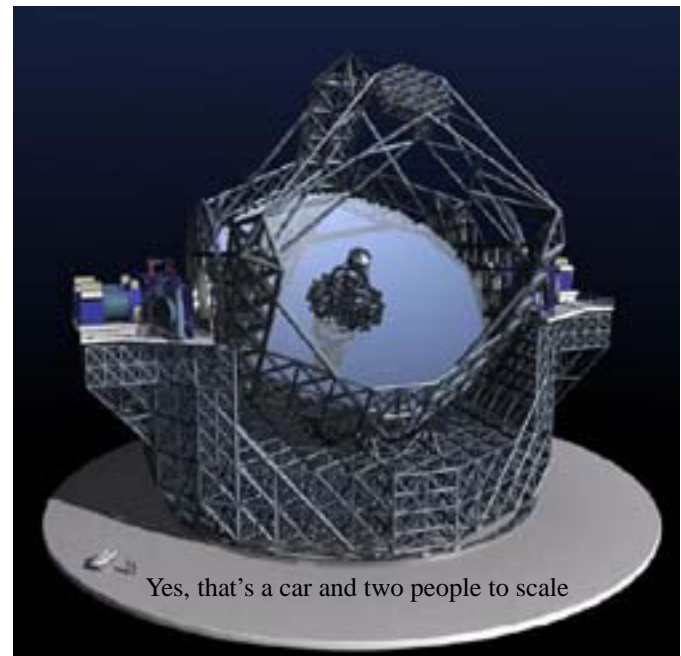
What size eyepiece would you need in order to get 7000x in the 42-meter scope? ESO says it will work at a focal ratio of f/10 to f/20, so picking a mid range of f/15 gives us a focal length of 630 meters (42m mirror times f/15) or 630,000mm. Dividing 630,000mm by 7,000x gives us a 90mm eyepiece. I don't think they make one of those, but you could probably use a camera lens.

Oh yes: you'd also need a solar filter. A mirror 42 meters across would amplify Castor's magnitude 1.6 glow to about -18th magnitude. That's dimmer than the Sun, but it's 100 times brighter than the full Moon. That's more than enough light to damage your eyes if it were concentrated on only a few rods and cones.

Want to calculate the size of the image on your retina? No, I thought not.

Hey, wait. That's the same eyepiece we started out with on the 10" scope. What gives?

Both scopes are f/5. Remember that you can calculate exit pupil by simply dividing the eyepiece focal length by the f-ratio. So any f/5 scope will use a 30mm eyepiece for its lowest useful power.



Yes, that's a car and two people to scale

The ESO's Extremely Large Telescope

*That's for the human eye. A larger-area CCD chip would allow for lower magnification and a wider field of view.