



# Desert Sky Observer

Volume 32

Antelope Valley Astronomy Club Newsletter

May 2012

## Up-Coming Events

- May 11: Club Meeting\*
- May 12: Prime Desert Woodlands Moon Walk @ [Prime Desert Woodlands](#)
- May 23-28: RTMC Astronomy Expo @ [Camp Oakes](#)
- May 23: Leona Valley Science Fair @ [Leona Valley Elementary School](#)
- May 30: Acton Library Astronomy Lecture Series @ [Acton Library](#)

\* Monthly meetings are held at the S.A.G.E. Planetarium on the Cactus School campus in Palmdale, the second Friday of each month. The meeting location is at the northeast corner of Avenue R and 20<sup>th</sup> Street East. Meetings start at 7 p.m. and are open to the public. *Please note that food and drink are not allowed in the planetarium*



## President

### Don Bryden

Well the sun is shining and the stars are bright – actually as I write this it's raining and cloudy – but I suspect that we'll be out in the warmth of the evening under the stars in no time. Can you recall your first real star party or observing session? My dad had showed me all the constellations and I probably had my Boy Scout Astronomy Merit badge, but my first real concerted effort to observe with a plan happened at college when we were observing comet Halley back in '85-'86.

So what got you out there? A Messier Marathon? A weekend star party? Or just some event you showed up at and got to look through other folks' scopes. I like to think that public outreach is our prime focus. It grows the club, sparks an interest with young astronomers and exposes people who would otherwise have no idea what we do to this wonderful hobby.

It's a lot of work, though. Spending the weekend in the hot sun at the poppy festival is not nearly as relaxing as spending a leisurely weekend up at Mt. Pinos. Still, what a club we have! On the weekend before the Poppy festival Kris Chase spent her Saturday introducing middle school students at the Los Amigos Super Science Saturday to the joy of astronomy. The next Friday Kris and her family were back at it along with some of the newest members of the club, Guy Blackwell and Carly and Isaiah Rossil were out at Templin Highway with about fifty students and parents fielding questions and showing off their star-hopping talents. The kids were impressed and I'm sure a few of them will be bitten by the astronomy bug.

The next day was the Poppy festival – what a zoo! It was HOT, too! But I can't thank the members who helped out enough. First of all, and they were there all weekend, Frank and Rose Moore as well as Pam, Doug and Virginia and of course Pam and Bill Grove. Robert Lynch made it out Sunday as did Deb Pedroza and Dennis. Ann, Jim and Kennedy also helped out.

I'm sure I've missed someone but that's what's so great – all the members helping out and sharing their love of astronomy. Now's your chance, come out to the Prime Desert Moonwalk on the 12th or the Annular eclipse on the 20th and see if you can't inspire a young mind, too!

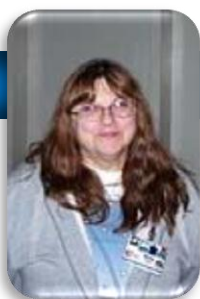


## Vice President

### Doug Drake

This coming meeting (May 11, Friday) Dr. Gary Peterson shall give a presentation on "Comets and the implication for Earth." This should be a good presentation about comets, some history of what they have contributed to our Earth and the future ahead for comet impact. Virginia and I will not be at this meeting and will be flying our airplane up to Pismo Beach for the weekend. I am asking Rose to introduce Dr. Peterson for you. Virginia has asked Pam Grove to fill in as Treasure at the meeting, so Pam should be able to take care of treasury details for you. Virginia and I shall miss all of you, but will be back for our June meeting.

May you have clear skies and visibility unlimited.



## Director of Community Development

### Rose Moore

Many thanks to all the members who came out to brave the sun and the heat for the Poppy Festival! We had the public looking at the Sun and Venus. Saturday's viewing of the Sun presented us with a huge prominence, and the viewing of Venus on both days gave us lots of 'wows' and 'it's the Moon!'.....Venus was a beautiful crescent!

Our next event is a Prime Desert Woodlands Moon Walk with Jeremy on Saturday May 12th, at 8pm. Come on out with your telescopes, or just to take a walk with Jeremy and the public.

Sunday May 20th, at approximately 2pm, will be our public outreach event for the Annular Eclipse at the SAGE Planetarium. We need members with filtered telescopes, or come just to view the event!

On Wednesday May 23rd at 6-7pm, we will be presenting a Star Party for the Leona Valley Science Fair. We need members with telescopes for this event! Please contact Don if you are able to attend and help out!!

Also on Wednesday May 23rd, we have the opening of RTMC for 2012! This event is at Camp Oakes at Big Bear City. Come out early to get in some stargazing, or come for Friday and/or Saturday to check out the vendors and astronomy talks.

The end of the month, Wednesday May 30th at 6:30pm is another Acton Library Astronomy Lecture Series talk with Jeremy. Check the calendar later in May for further information!

Tuesday June 5th at 3pm is the start of the Transit of Venus. This will be held outside at the SAGE Planetarium, and we need members with filtered telescopes for this public outreach event!

Also don't forget our upcoming club star parties at Mt. Pinos, our club picnic at Brite Lake (Tehachapi), and the Mt. Wilson trip!

See you there!



## Secretary

### Frank Moore

The Poppy Festival, our biggest public outreach event of the year, is over and once again it was a rousing success. As usual both our booth and our telescopes were busy both days and we shared our love of astronomy with many thousands of people.

Though it's a pleasure to share with the public, it's hard work while we're at Lancaster City Park with folks manning the booth and the telescopes, as well as setting everything up and taking it down, but it doesn't start there.

Months before the festival your board was discussing the event at board meetings and putting plans in motion to ensure it's a success. This year we decided to have a larger booth so we would have more room for members to sit in the shade and more display area. The application and request for booth space was submitted by Rose Moore way back in February. This year, the City of Lancaster required either the purchase of an insurance policy for the event from them, or that we provide proof of insurance with a rider naming the city and parks department as "additional insureds". As a result, Virginia Reed had to meet with our insurance agent to obtain these documents and give them to Rose for inclusion with the application.

In mid-March, Don and I drove to our sponsor, Woodland Hills Camera and Telescopes, to pick out our Poppy Festival raffle item as well as the prizes for the YEA essay contest winners. While there, we made our annual delivery of AVAC hats to our friends at WHCT. Those who go to RTMC will, no doubt, see Jon Betancourt faithfully wearing his every day.

In the days leading up to the Poppy Festival, most of the board members, as well as Librarians Bill and Pam Grove, were making last minute preparations. Bill and Pam volunteered to pick up our festival packet with the badges, parking permits, and other information at City Hall. Don cleaned out and organized the club's trailer removing items we would not need for the festival and ensuring everything we would need was. Rose went through our supply of club brochures and made copies of those that were in short supply. Everyone rounded up posters, signs, and other items for display or distribution from our booth. A special thanks to Tom Koonce and Lockheed Martin for the supply of posters depicting the Orion Crew Capsule and the International Space Station. They were a big hit.

We'd like to thank all of you who stopped by the booth at the Poppy Festival, whether to help with the telescopes, man the booth, or just visit.

You are ALL appreciated!

## Space Place

### NASA Helps Europe Study a Comet—Up Close and Personal

By Dr. Tony Phillips

Europe's Rosetta spacecraft is on its way to intercept comet 67P/Churyumov-Gerasimenko. Comets have been intercepted before, but this mission is different. Rosetta aims to make history by landing a probe on the comet's surface while the mother ship orbits overhead.

"Rosetta is the European equivalent of a NASA flagship mission," explains Claudia Alexander, project scientist for the U.S. Rosetta Project at NASA's Jet Propulsion Laboratory. "It will conduct the most comprehensive study of a comet ever performed."

Rosetta's payload contains 21 instruments (11 on the orbiter, 10 on the lander) designed to study almost every aspect of the comet's chemistry, structure, and dynamics. Three of the sensors were contributed by the U.S.: Alice (an ultraviolet spectrometer), IES (an ion and electron sensor), and MIRO (a microwave sounder).

The main event of the mission will likely be the landing. The 100-kg lander, which looks a bit like a cross between NASA's old Viking Mars landers and a modern microsatellite, will spend two weeks fastened to the comet's icy surface. The European-built probe will collect samples for analysis by onboard microscopes and take stunning panoramic images from ground level.

"First the lander will study the surface from close range to establish a baseline before the comet becomes active," explains Alexander. "Then the orbiter will investigate the flow of gas and dust around the comet's active, venting nucleus."

Rosetta's sensors will perform the experiments that reveal how the chemicals present interact with one another and with the solar wind. Alice and MIRO detect uncharged atoms and molecules, while IES detects the ions and electrons as the solar wind buffets the nucleus.

One problem that often vexes astronomers when they try to study comets is visibility. It's hard to see through the dusty veil of gas billowing away from the heated nucleus. The microwaves MIRO detects can penetrate the dust, so MIRO can see and measure its target molecules even when other instruments can't.

MIRO is one of several experiments focused on the comet's structural properties. It will determine the comet's dielectric constant, emissivity, and thermal conductivity to determine whether it is made of a powdery loose material, has a detectable layer of loose material, or is hard as rock.

"We want to find out whether comets have retained material from when the solar system formed," says Alexander. "If the ancient materials are still there, we can get an idea of what conditions were like at the dawn of the solar system."

Rosetta enters orbit in 2014. Stay tuned for updates!

Check out "Comet Quest," the new, free iPhone/iPad game that has you operating the Rosetta spacecraft yourself. Get the link at [spaceplace.nasa.gov/comet-quest](http://spaceplace.nasa.gov/comet-quest).

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

## Solar Eclipse Coming Our Way by Paul Derrick

The May 20 new Moon will produce a solar eclipse visible over the western half of the U.S. Those in a narrow band from the Texas panhandle to northern California will see a rather rare annular eclipse while the rest of us will see an impressive partial eclipse around sunset.

As the Moon orbits our planet each month, the point at which it passes between the Sun and Earth is new Moon. If the plane of the Moon's orbit around Earth was exactly the same as the plane of the Earth's orbit around the Sun, we would see a total solar eclipse every new Moon (and a total lunar eclipse every full Moon). But since the two orbital planes aren't exactly the same, solar (and lunar) eclipses occur far less frequently.

When the Moon does pass exactly between the Sun and Earth, it can create a total solar eclipse, temporarily blocking out the Sun and casting a moving shadow across part of Earth. If it passes partly, but not quite exactly, between and blocks out part of the Sun, it creates a partial solar eclipse.

The Sun is 400 times larger than the Moon, and by coincidence, is also 400 times further away, thus they appear very nearly the same size. But since the orbits of the Earth and Moon are elliptical rather than circular, the distances between the Earth and Sun, and between Moon and Earth, vary making their apparent sizes change slightly.

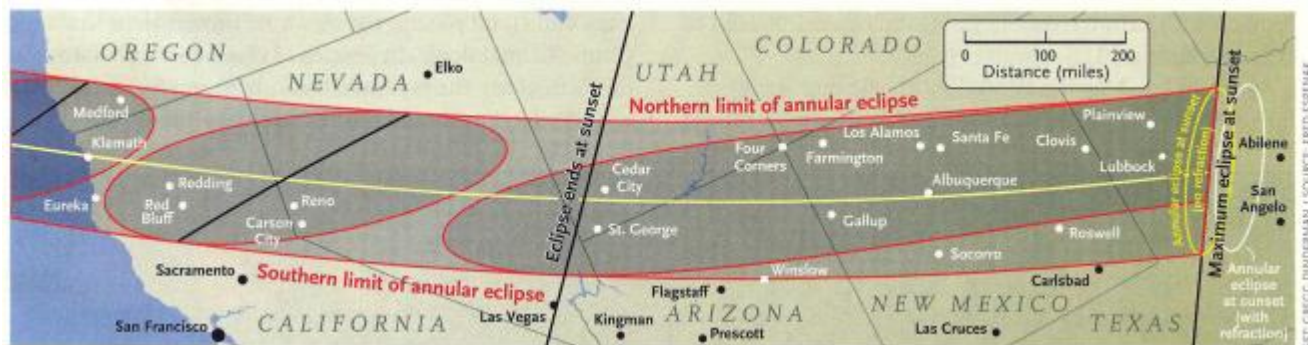
Since the Moon's orbit around Earth is more eccentric (less circular) than Earth's orbit around the Sun, the change in the Moon's apparent size is more pronounced. When solar eclipses occur with the Moon further from Earth, the Moon isn't large enough to cover the entire Sun, leaving a "ring of fire" around the Moon's silhouette. What would otherwise be a total eclipse becomes an annular eclipse.



*When an eclipsing Moon isn't large enough to cover the entire Sun, the result is the "ring of fire" of an annular eclipse. (Credit: sancho\_panza / Wikimedia Commons)*

This is what those within a narrow band less than 200 miles wide from Texas to California will see, weather permitting. At the extreme eastern end of this band in Texas, the eclipse will reach annularity just as the sun is setting. The further west from which one views, the earlier before sunset the eclipse begins and the longer it will be visible.





Area from which the May 20 annular eclipse can be seen. (Credit: Fred Espenak and Sky & Telescope)

The rest of the western U.S. not within the area of annularity will see a partial eclipse of the Sun where the Moon covers part of the Sun. The nearer one is to the area of annularity, the greater the percentage of the Sun will be eclipsed.



Increasing amounts of partial eclipse leading toward an annular eclipse. (Credit: Fred Espenak)

In Central Texas the partial eclipse begins at 7:35 p.m. with the Sun less than a fist-width (held at arm's length) from the western horizon. By sunset (8:21 p.m. in Waco), the Moon will be covering more than half of the Sun. Further east, the show will be shorter with less coverage; further west, longer and more coverage.

At the extreme eastern end, in the Lubbock area, the partial eclipse reaches annularity just as the Sun is setting. Further west, like in Albuquerque, the entire 4-minute period of annularity occurs just before the Sun sets. For points beyond the Nevada-Arizona-Utah border area, the entire eclipse – partial and annularity – will be visible before sunset.

It is essential to view this event safely. Even when partly eclipsed and near the horizon, the Sun can produce serious and permanent eye damage if viewed without proper protection. Make-shift devices like stacked sunglasses, soot-covered glass, and CDs are not adequate; while they block out visible light, they don't protect against the invisible but more dangerous ultraviolet and infrared radiation. For direct viewing use approved solar glasses or #14 welders glass. Even safer is indirect viewing of projected images of the Sun using "pin-hole" projectors or binocular images cast on a sheet of white paper. Never look at the Sun with binoculars (or telescope) without using a proper solar filter.

Here's hoping for a cloudless western horizon May 20 before sunset. But even if you're clouded out, the event should generate some exceptional photos of the eclipsed Sun near the horizon, so watch the media for postings the next day.

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## News Headlines

### **Minivan-sized Asteroid Exploded Over California**

The source of loud "booms" accompanied by a bright object traveling through the skies of Nevada and California on Sunday morning has been confirmed: It was a meteor. A big one. It is thought to have been a small asteroid that slammed into the atmosphere at a speed of 15 kilometers per second (33,500 mph), turning into a fireball, and delivering an energy of 3.8 kilotons of TNT as it broke up over California's Sierra Nevada mountains. Bill Cooke, head of NASA's Meteoroid Environment Office, classified it as a "big event."

<http://news.discovery.com/space/meteor-the-size-of-a-minivan-exploded-over-california-120423.html>

### **NASA's Kepler Mission Approved For Mission Extension**

NASA's Kepler mission has been approved for extension through fiscal year 2016 based on a recommendation from the Agency's Senior Review of its operating missions. The extension provides four additional years to find Earth-size planets in the habitable zone -- the region in a planetary system where liquid water could exist on the surface of an orbiting planet -- around sun-like stars in our galaxy.

<http://www.nasa.gov/centers/ames/news/releases/2012/12-33AR.html>

### **Cassini finds Saturn moon has planet-like qualities**

Data from NASA's Cassini mission reveal Saturn's moon Phoebe has more planet-like qualities than previously thought. Scientists had their first close-up look at Phoebe when Cassini began exploring the Saturn system in 2004. Using data from multiple spacecraft instruments and a computer model of the moon's chemistry, geophysics, and geology, scientists found Phoebe was a so-called planetesimal, or remnant planetary building block.

<http://www.astronomy.com/~link.aspx?id=3f0d30d8-0a95-4ec3-9eb4-71f6cc8f1804>

### **Dwarf Galaxies Help to Unlock Secrets of Dark Matter**

While scientists still don't know what makes up the mysterious dark matter thought to dominate the universe, a new study of dwarf galaxies orbiting the Milky Way presented here Sunday (April 1) at the American Physical Society has chipped away at the possibilities, offering intriguing hints about the nature of dark matter.

<http://www.space.com/15134-dark-matter-clues-dwarf-galaxies.html>

### **NASA'S Chandra Sees Remarkable Outburst from Old Black Hole**

An extraordinary outburst produced by a black hole in a nearby galaxy has provided direct evidence for a population of old, volatile stellar black holes. The discovery, made by astronomers using NASA's Chandra X-ray Observatory, provides new insight into the nature of a mysterious class of black holes that can produce as much energy in X-rays as a million suns radiate at all wavelengths.

[http://www.nasa.gov/home/hqnews/2012/apr/HQ\\_12-139\\_Chandra\\_Old\\_Black\\_Hole.html](http://www.nasa.gov/home/hqnews/2012/apr/HQ_12-139_Chandra_Old_Black_Hole.html)

### **Durable NASA Rover Beginning Ninth Year of Mars Work**

Eight years after landing on Mars for what was planned as a three-month mission, NASA's enduring Mars Exploration Rover Opportunity is working on what essentially became a new mission five months ago. Opportunity reached a multi-year driving destination, Endeavour Crater, in August 2011. At Endeavour's rim, it has gained access to geological deposits from an earlier period of Martian history than anything it examined during its first seven years.

[http://www.marsdaily.com/reports/Durable\\_NASA\\_Rover\\_Beginning\\_Ninth\\_Year\\_of\\_Mars\\_Work\\_999.html](http://www.marsdaily.com/reports/Durable_NASA_Rover_Beginning_Ninth_Year_of_Mars_Work_999.html)

## May Sky Data

**Best time for deep sky observing this month:  
May 12 through May 22**

**Mercury** is at superior conjunction (behind the Sun) at the end of May. We are unlikely to see this elusive little planet this month.

**Venus** is now rapidly coming to the end of its spectacular performance as a brilliant “Evening Star”. At the start of May, it’s still high in the western sky immediately after sunset, and not setting until after midnight. But each night it appears a little lower, and sets a little earlier. By the end of the month it’s setting less than an hour after the Sun.

**Mars** is high in the south-western sky at dusk, and doesn’t set until just before sunrise. Relative to the stars, the “Red Planet” is moving steadily south-eastwards in the constellation of Leo, drawing away from the bright star Regulus. Mars is brighter than Regulus, though it is gradually fading as it moves further from Earth; Mars is more orange in colour than blue-white Regulus, and it shines with a steadier light.

The giant planet **Jupiter** is in conjunction (with the Sun) on May 13th, so it rises as the Sun is rising and it sets at sunset so we’re unlikely to see it all this month.

**Saturn** is on the opposite side of the sky to Jupiter: it was at opposition (to the Sun) on April 15th, and in May it is still well placed for viewing: it’s high in the southern sky at dusk, and sets in the west just before sunrise. Relative to the stars, Saturn is moving slowly north-westwards in the constellation of Virgo, close above its brightest star Spica; throughout the month, the two objects are less than 5 degrees apart. Saturn is a little brighter than Spica, and shines with a steadier light.

There are no significant **meteor-showers** for northern-hemisphere observers in May.

Full May 5      Last Qtr May 12      New May 20      First Qtr May 28



## Sun and Moon Rise and Set

Date	Moonrise	Moonset	Sunrise	Sunset
5/1/2012	14:56	02:48	06:00	19:37
5/5/2012	19:37	05:22	05:57	19:40
5/10/2012	-----	10:22	05:52	19:44
5/15/2012	02:41	15:21	05:48	19:48
5/20/2012	05:29	19:54	05:45	19:52
5/25/2012	09:43	23:38	05:42	19:55
5/31/2012	16:01	02:31	05:40	19:59

## Planet Data

	May 1			
	Rise	Transit	Set	Mag
<b>Mercury</b>	04:54	11:19	17:41	-0.1
<b>Venus</b>	07:45	15:24	23:01	-4.5
<b>Mars</b>	13:56	20:38	03:19	0.0
<b>Jupiter</b>	06:17	13:19	20:18	-2.0
<b>Saturn</b>	17:51	23:41	05:32	0.3

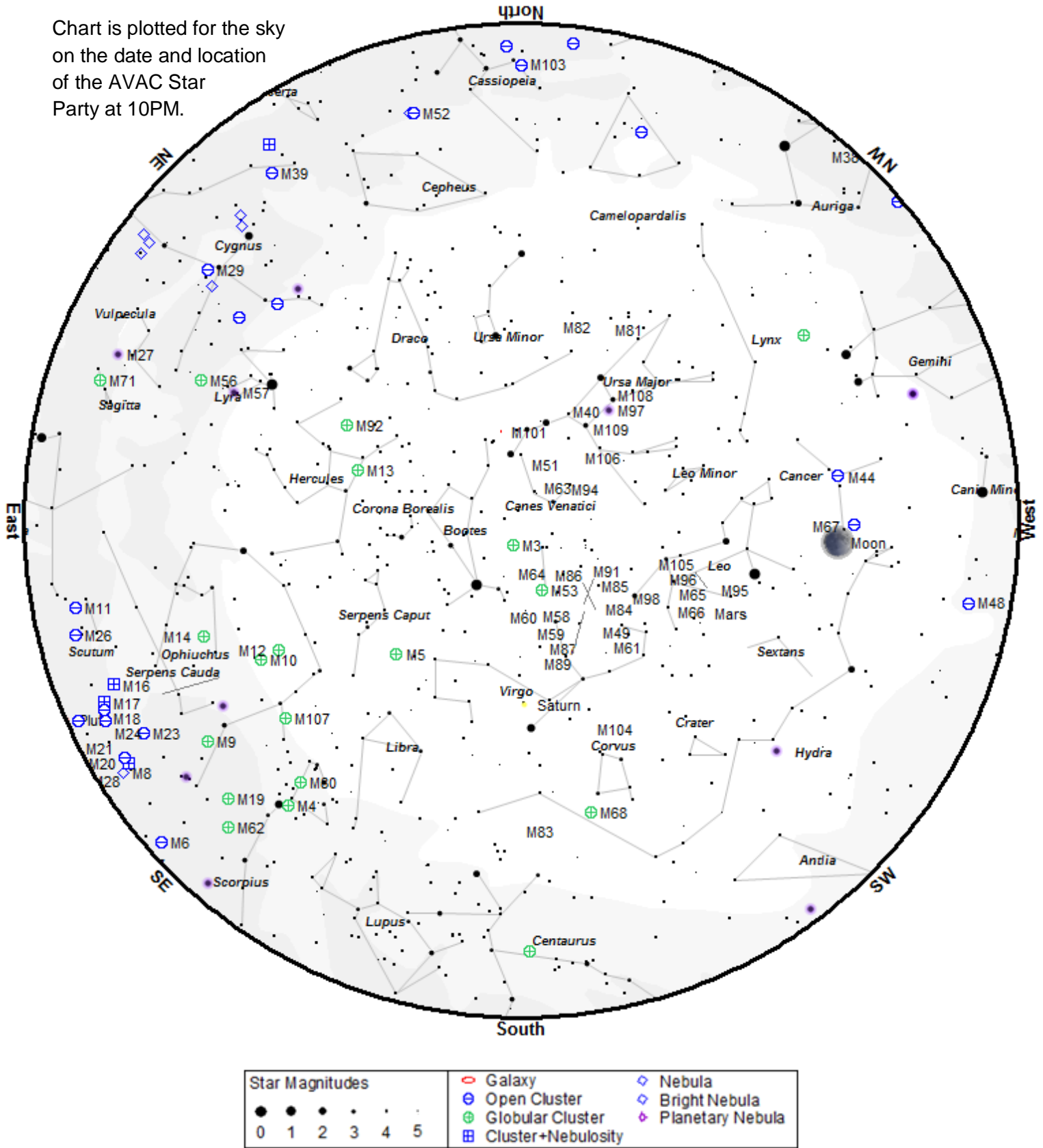
	May 15			
	Rise	Transit	Set	Mag
<b>Mercury</b>	05:02	11:55	18:44	-1.0
<b>Venus</b>	07:06	14:44	22:18	-4.4
<b>Mars</b>	13:18	19:55	02:32	0.3
<b>Jupiter</b>	05:33	12:37	19:39	-2.0
<b>Saturn</b>	16:51	22:43	04:34	0.4

	May 31			
	Rise	Transit	Set	Mag
<b>Mercury</b>	05:48	13:07	20:32	-1.8
<b>Venus</b>	05:52	13:19	20:41	-3.9
<b>Mars</b>	12:43	19:13	01:42	0.5
<b>Jupiter</b>	04:42	11:47	18:55	-2.0
<b>Saturn</b>	15:45	21:37	03:29	0.5

Planet, Sun, and Moon data calculated for local time at Lancaster, CA



Chart is plotted for the sky on the date and location of the AVAC Star Party at 10PM.



To use the chart, go outside within an hour or so of the time listed and hold it up to the sky. Turn the chart so the direction you are looking is at the bottom of the chart. If you are looking to the south then have 'South horizon' at the lower edge.

## Suggested Observing List

The list below contains objects that will be visible on the night of the AVAC Star Party. The list is sorted by the best time to observe the object. The difficulty column describes how difficult it is to observe the object from the current location on a perfect night in a 6 inch Newtonian telescope.

ID	Cls	Mag	Con	RA 2000	Dec 2000	Begin	Best	End	Difficulty
NGC 3132	PNe	8.2	Vel	10h07m01.8s	-40°26'11"	20:52	21:06	21:26	easy
NGC 3132	PNe	8.2	Vel	10h07m01.8s	-40°26'11"	20:52	21:06	21:26	easy
M 67	Open	7.4	Cnc	08h51m18.0s	+11°48'00"	20:54	21:19	21:25	detectable
NGC 3242	PNe	8.6	Hya	10h24m46.1s	-18°38'32"	20:54	21:20	22:45	obvious
M 44	Open	3.9	Cnc	08h40m24.0s	+19°40'00"	21:01	21:22	21:33	easy
NGC 3227	Gal	11.5	Leo	10h23m30.6s	+19°51'54"	21:07	21:27	22:29	difficult
M 66	Gal	9.7	Leo	11h20m14.9s	+12°59'30"	21:03	21:28	23:29	detectable
M 65	Gal	10.1	Leo	11h18m55.7s	+13°05'32"	21:04	21:29	23:24	detectable
M 68	Glob	7.3	Hya	12h39m28.0s	-26°44'36"	21:04	21:31	23:15	detectable
3C 273.0	QSO	12.8	Vir	12h29m06.7s	+02°03'08"	21:01	21:32	23:57	difficult
3C 273.0	QSO	12.8	Vir	12h29m06.7s	+02°03'08"	21:01	21:32	23:57	difficult
M 82	Gal	9.0	UMa	09h55m52.4s	+69°40'47"	21:04	21:33	00:46	detectable
M 81	Gal	7.8	UMa	09h55m33.1s	+69°03'56"	21:06	21:33	00:42	detectable
M 97	PNe	9.7	UMa	11h14m47.7s	+55°01'09"	21:06	21:33	01:06	detectable
M 104	Gal	9.1	Vir	12h39m59.3s	-11°37'22"	21:01	21:34	23:50	detectable
M 86	Gal	9.8	Vir	12h26m12.2s	+12°56'44"	21:05	21:34	00:37	detectable
M 84	Gal	10.1	Vir	12h25m03.9s	+12°53'12"	21:03	21:34	00:46	detectable
M 49	Gal	9.3	Vir	12h29m46.8s	+08°00'01"	21:03	21:34	00:48	detectable
M 87	Gal	9.6	Vir	12h30m49.2s	+12°23'29"	21:04	21:35	00:54	detectable
Col 256	Open	2.9	Com	12h25m06.0s	+26°06'00"	20:59	21:35	01:32	easy
NGC 4565	Gal	10.1	Com	12h36m20.8s	+25°59'15"	21:05	21:36	00:56	difficult
M 106	Gal	9.1	CVn	12h18m57.6s	+47°18'13"	21:04	21:37	01:38	detectable
M 94	Gal	8.7	CVn	12h50m53.1s	+41°07'12"	21:01	21:39	02:21	easy
M 64	Gal	9.3	Com	12h56m43.8s	+21°41'00"	21:01	21:39	01:40	detectable
NGC 5128	Gal	7.8	Cen	13h25m27.7s	-43°01'07"	21:14	21:50	22:38	challenging
NGC 5139	Glob	3.9	Cen	13h26m46.0s	-47°28'36"	21:09	21:53	22:46	difficult
M 83	Gal	7.8	Hya	13h37m00.8s	-29°51'56"	21:03	21:59	00:35	detectable
M 101	Gal	8.4	UMa	14h03m12.4s	+54°20'53"	21:10	00:08	02:50	detectable
NGC 5195	Gal	10.5	CVn	13h29m59.6s	+47°15'58"	21:07	00:08	02:25	detectable
M 3	Glob	6.3	CVn	13h42m11.0s	+28°22'42"	21:03	00:08	02:35	easy
M 5	Glob	5.7	Ser	15h18m34.0s	+02°05'00"	21:11	00:08	03:18	easy
NGC 5897	Glob	8.4	Lib	15h17m24.0s	-21°00'36"	22:59	00:08	01:22	difficult
M 51	Gal	8.7	CVn	13h29m52.3s	+47°11'40"	21:02	00:08	03:04	easy
NGC 5986	Glob	7.6	Lup	15h46m03.0s	-37°47'12"	23:20	00:13	01:44	difficult
M 80	Glob	7.3	Sco	16h17m02.0s	-22°58'30"	23:28	00:44	02:00	detectable
NGC 6124	Open	6.3	Sco	16h25m20.0s	-40°39'12"	00:08	00:52	01:48	challenging
NGC 6167	Open	6.6	Nor	16h34m34.0s	-49°46'18"	00:08	01:02	01:59	detectable
NGC 6178	Open	7.2	Sco	16h35m47.0s	-45°38'36"	23:48	01:02	02:32	detectable

ID	Cls	Mag	Con	RA 2000	Dec 2000	Begin	Best	End	Difficulty
NGC 6193	Open	5.4	Ara	16h41m20.0s	-48°45'48"	00:07	01:08	02:15	detectable
M 13	Glob	5.8	Her	16h41m41.0s	+36°27'36"	21:17	01:09	04:23	easy
M 12	Glob	6.1	Oph	16h47m14.0s	-01°56'48"	22:09	01:14	04:18	easy
M 10	Glob	6.6	Oph	16h57m09.0s	-04°06'00"	23:04	01:24	04:12	detectable
M 62	Glob	6.4	Oph	17h01m13.0s	-30°06'48"	23:50	01:28	03:40	detectable
M 19	Glob	6.8	Oph	17h02m38.0s	-26°16'06"	00:08	01:29	03:38	detectable
M 92	Glob	6.5	Her	17h17m07.0s	+43°08'12"	21:31	01:43	04:24	easy
NGC 6322	Open	6.5	Sco	17h18m25.0s	-42°56'00"	00:05	01:45	03:39	easy
M 9	Glob	7.8	Oph	17h19m12.0s	-18°31'00"	00:07	01:46	03:45	detectable
NGC 6383	Open	5.4	Sco	17h34m48.0s	-32°34'00"	00:02	02:01	04:17	easy
NGC 6388	Glob	6.8	Sco	17h36m17.0s	-44°44'06"	00:51	02:03	03:16	difficult
M 14	Glob	7.6	Oph	17h37m36.0s	-03°14'48"	23:52	02:04	04:20	detectable
M 6	Open	4.6	Sco	17h40m20.0s	-32°15'12"	23:47	02:07	04:23	easy
IC 4665	Open	5.3	Oph	17h46m18.0s	+05°43'00"	00:08	02:13	04:19	detectable
M 7	Open	3.3	Sco	17h53m51.0s	-34°47'36"	00:10	02:20	04:18	easy
M 23	Open	5.9	Sgr	17h57m04.0s	-18°59'06"	00:28	02:24	04:19	detectable
NGC 6543	PNe	8.3	Dra	17h58m33.4s	+66°37'59"	20:57	02:24	04:35	obvious
M 20	Open	5.2	Sgr	18h02m42.0s	-22°58'18"	01:13	02:29	03:45	easy
M 21	Open	7.2	Sgr	18h04m13.0s	-22°29'24"	01:09	02:30	03:52	detectable
M 8	Neb	5.0	Sgr	18h04m02.0s	-24°23'14"	01:37	02:31	03:24	easy
NGC 6541	Glob	6.3	CrA	18h08m02.0s	-43°42'54"	01:20	02:34	03:48	difficult
NGC 6572	PNe	8.0	Oph	18h12m06.4s	+06°51'12"	22:47	02:39	04:41	obvious
M 16	Open	6.5	Ser	18h18m48.0s	-13°48'24"	00:15	02:46	04:31	obvious
M 18	Open	7.5	Sgr	18h19m58.0s	-17°06'06"	00:36	02:46	04:28	easy
M 17	Open	7.3	Sgr	18h20m47.0s	-16°10'18"	00:35	02:47	04:18	difficult
M 28	Glob	6.9	Sgr	18h24m33.0s	-24°52'12"	02:07	02:51	03:35	detectable
NGC 6633	Open	5.6	Oph	18h27m15.0s	+06°30'30"	23:21	02:53	04:28	easy
M 25	Open	6.2	Sgr	18h31m47.0s	-19°07'00"	01:03	02:59	04:22	detectable
M 22	Glob	5.2	Sgr	18h36m24.0s	-23°54'12"	02:00	03:03	04:06	detectable
IC 4756	Open	5.4	Ser	18h39m00.0s	+05°27'00"	00:08	03:05	04:25	easy
M 70	Glob	7.8	Sgr	18h43m13.0s	-32°17'30"	01:12	03:10	04:22	detectable
M 11	Open	6.1	Sct	18h51m05.0s	-06°16'12"	00:14	03:17	04:23	detectable
M 57	PNe	9.4	Lyr	18h53m35.1s	+33°01'45"	22:52	03:19	04:29	easy
NGC 6716	Open	7.5	Sgr	18h54m34.0s	-19°54'06"	01:32	03:20	04:25	detectable
M 54	Glob	7.7	Sgr	18h55m03.0s	-30°28'42"	01:37	03:21	04:20	difficult
NGC 6723	Glob	6.8	Sgr	18h59m33.0s	-36°37'54"	01:42	03:26	04:23	detectable
M 56	Glob	8.4	Lyr	19h16m36.0s	+30°11'06"	00:08	03:37	04:23	detectable
NGC 6871	Open	5.8	Cyg	20h05m59.0s	+35°46'36"	00:07	03:49	04:27	easy
M 71	Glob	8.4	Sge	19h53m46.0s	+18°46'42"	00:10	03:49	04:27	easy
M 27	PNe	7.3	Vul	19h59m36.3s	+22°43'16"	00:09	03:49	04:28	easy
NGC 6910	Open	7.3	Cyg	20h23m12.0s	+40°46'42"	00:06	03:50	04:27	easy
M 29	Open	7.5	Cyg	20h23m57.0s	+38°30'30"	00:07	03:51	04:28	easy
NGC 6818	PNe	10.0	Sgr	19h43m57.8s	-14°09'12"	01:41	03:51	04:34	easy
M 55	Glob	6.3	Sgr	19h40m00.0s	-30°57'42"	02:02	03:52	04:25	detectable
NGC 7160	Open	6.4	Cep	21h53m40.0s	+62°36'12"	00:19	03:52	04:29	obvious

ID	Cls	Mag	Con	RA 2000	Dec 2000	Begin	Best	End	Difficulty
IC 1396	Neb		Cep	21h39m06.0s	+57°30'00"	00:19	03:52	04:25	challenging
M 39	Open	5.3	Cyg	21h31m48.0s	+48°26'00"	00:30	03:54	04:27	easy
NGC 7243	Open	6.7	Lac	22h15m08.0s	+49°53'54"	01:47	03:55	04:20	detectable
Cocoon	Neb	10.0	Cyg	21h53m24.0s	+47°16'00"	00:56	03:55	04:26	challenging
M 52	Open	8.2	Cas	23h24m48.0s	+61°35'36"	02:21	03:56	04:17	detectable
NGC 7790	Open	7.2	Cas	23h58m24.0s	+61°12'30"	02:28	03:57	04:26	obvious
NGC 7789	Open	7.5	Cas	23h57m24.0s	+56°42'30"	02:50	03:57	04:16	detectable
NGC 559	Open	7.4	Cas	01h29m31.0s	+63°18'24"	03:53	03:58	04:23	easy
M 15	Glob	6.3	Peg	21h29m58.0s	+12°10'00"	01:54	03:58	04:26	easy
NGC 637	Open	7.3	Cas	01h43m04.0s	+64°02'24"	01:11	03:59	04:26	obvious
NGC 663	Open	6.4	Cas	01h46m09.0s	+61°14'06"	02:19	03:59	04:22	easy
M 103	Open	6.9	Cas	01h33m23.0s	+60°39'00"	01:45	03:59	04:26	obvious
NGC 457	Open	5.1	Cas	01h19m35.0s	+58°17'12"	03:56	03:59	04:24	obvious
M 2	Glob	6.6	Aqr	21h33m27.0s	-00°49'24"	02:31	04:00	04:24	detectable
M 110	Gal	8.9	And	00h40m22.3s	+41°41'09"	03:53	04:01	04:17	detectable
M 31	Gal	4.3	And	00h42m44.3s	+41°16'07"	03:56	04:01	04:21	easy
M 32	Gal	8.9	And	00h42m41.8s	+40°51'58"	03:57	04:01	04:21	easy
NGC 7009	PNe	8.3	Aqr	21h04m10.9s	-11°21'48"	02:45	04:01	04:36	obvious
M 30	Glob	6.9	Cap	21h40m22.0s	-23°10'42"	03:07	04:06	04:25	detectable
NGC 7293	PNe	6.3	Aqr	22h29m38.5s	-20°50'14"	03:27	04:09	04:27	detectable

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- The Reflector – the publication of the Astronomical League.
- The A.V.A.C. Membership Manual.
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