



Desert Sky Observer

Volume 35

Antelope Valley Astronomy Club Newsletter

March 2015

Up-Coming Events

March 7: [Prime Desert Moon Walk](#)

March 13: Club Meeting*

March 21: [Messier Marathon](#)

March 25: [Acton Library Star Party](#)

* Monthly meetings are held at the S.A.G.E. Planetarium in Palmdale, the second Friday of each month. The meeting location is at the northeast corner of Avenue R and 20th 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

Frank Moore

Winter astronomy strikes again. For those of you who missed it, and quite a few did, on February 21 we had our February Dark Sky Star Party at the Antelope Valley California Poppy Reserve. The hearty souls who attended braved cold temperatures and a biting wind to set up and view the cosmos.

Because of the threat of rain Matt Leone brought his 16" dob, in lieu of his 24", as it afforded easier and faster take down if we had to make a retreat. Darrell Bennett had his 12" Meade SCT, Rose and Frank Moore their Celestron C-11, and Ellen Mahler her 6" Orion dob. The other brave souls in attendance included Ruth Olson, Inga Nagel, and Bob Gauldin. Bob Ayres brought his SCT and mount but as it was near dark when he arrived, and already biting cold, he held in abeyance in his truck while we waited, and hoped, the weather would improve. It didn't.

Though clouds were threatening on the horizons, especially to the south, views were crystal clear in the open parts of the sky. The performance of the night was put on by Venus and Mars, which were half a degree apart as they descended in the western sky. To the north, in Ursa Major, the sky containing M81/M82, Bode's and the Cigar Galaxies, was clear throughout the night and the pair were clearly visible together in wider field eyepieces. Other objects in the their group offered satisfying views between the gusts of wind as well. Still, conditions were challenging, and with the gusting wind stars sometimes appeared to be figure eights or infinity signs instead of pinpricks of light in the eyepieces.

The weather forecast had called for the wind to die down by 8:00 and, when it hadn't, and the clouds began to move in from the south, we all made the collective decision to call it night by 9:00 pm.

Events coming up in March include the monthly Moon Walk and public observing at Prime Desert Woodland Preserve on Saturday March 7 at 6:30 pm, the club meeting at the SAGE Planetarium on Friday March 13, and our annual Messier Marathon at Saddleback Butte State Park on March 21. We have the group site at Saddleback Butte reserved from 2:00 pm on March 21 till 8:00 am on March 22. Let's all think good thoughts and hope for better weather for the Messier Marathon.

Stay tuned for announcements and watch the calendar, as April will be a busy month as well. We have a lunar eclipse in the early morning hours of Saturday April 4, a Beginner's Astronomy Class at 2:00 pm at the SAGE and Prime Desert Woodland Moon Walk at 7:45pm on Saturday April 11, and our booth at the California Poppy Festival on Saturday and Sunday April 18 and 19. We'll also be supporting the Edwards Air Force Base Youth "Lock-In" with a star party on Friday April 24. Watch for times and sign up information on these events.

Remember to support our sponsors as they help make our activities and public outreach possible.

Wishing us all clear skies for the rest our annual events.



Vice President

Don Bryden

March is upon us! This weekend we have a PDW outing (if the skies clear!) and of course the monthly meeting. We're still hoping for a speaker from Griffith Observatory but as of yet it is not final. Still, we'll have a nice dome show and several raffles and then Jeremy can give us a tour of the night sky. We'll have information on the Lunar eclipse on April 4th and the Messier Marathon on the 21st of March at Saddleback Butte.

Let's talk about the Messier Marathon. The early objects can be tough since they are low in the western sky and that tends to be too bright and murky just after sunset. Of course the last few objects can be tough, not just because the sun is now rising but by the fact that you must stay up all night to get to them!

Of course about half way through you can "hit the wall". It's late, cold and Matt hasn't brought out the bacon yet and you are now working your way through the dreaded Virgo Cluster. The Virgo cluster of galaxies, in the heart of the Virgo Supercluster comprises some 1500 to 2000 galaxies. So you can see the difficulties of finding a handful of Messier objects that all look just like the other 2000!

If you can make it through the Virgo cluster then you've earned your reward. Not only do you get bacon from Matt and coffee from Frank but soon Ophiuchus, Sagittarius and all those lovely globular clusters are on the rise!

Of course, you could just come out for the cookout and just enjoy the company of fellow AVAC members so let's hope for clear skies and no wind!



Secretary

Rose Moore

We have sign-ups started for the Poppy Festival and for the Teens Group Star Party at Edwards for the month of April. Please sign up if you can attend and help out at either event. The Poppy Festival is the weekend of April 18-19, and you can sign up for a couple of hours or more to help out at the booth. The Edwards event is on Friday, April 24th and is an evening star party.

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Desert Sky Observer

Sign-ups for the Mt. Wilson trip for the 100 inch scope will start at May's meeting. You must be a member to sign up, and payment is due when you sign. There will be no online sign-ups or payments. There will be a stand by list for members who are not sure they want to attend, or for non members. Unfortunately, there are only 18 slots. If you are signing up for people who are not at the meeting, they must go on the standby list!

Other items of importance: children must be at least 12; the facilities are not ADA compliant for those who are handicapped; the telescope is at an elevation of 5700 feet - so is not recommended to those with heart or lung issues; smoking is not permitted at Mt. Wilson; climbing stairs is needed to reach the scope.

If any questions, please contact me,
Thanks,
Rose

Space Place

The heavyweight champion of the Cosmos

By Dr. Ethan Siegel

As crazy as it once seemed, we once assumed that the Earth was the largest thing in all the universe. 2,500 years ago, the Greek philosopher Anaxagoras was ridiculed for suggesting that the Sun might be even larger than the Peloponnesus peninsula, about 16% of modern-day Greece. Today, we know that planets are dwarfed by stars, which themselves are bound together by the billions or even trillions into galaxies.

But gravitationally bound structures extend far beyond galaxies, which themselves can bind together into massive clusters across the cosmos. While dark energy may be driving most galaxy clusters apart from one another, preventing our local group from falling into the Virgo Cluster, for example, on occasion, huge galaxy clusters can merge, forming the largest gravitationally bound structures in the universe.



Image credit: NASA, ESA, J. Jee (UC Davis), J. Hughes (Rutgers U.), F. Menanteau (Rutgers U. and UIUC), C. Sifon (Leiden Observatory), R. Mandelbaum (Carnegie Mellon U.), L. Barrientos (Universidad Catolica de Chile), and K. Ng (UC

Take the "El Gordo" galaxy cluster, catalogued as ACT-CL J0102-4915. It's the largest known galaxy cluster in the distant universe. A galaxy like the Milky Way might contain a few hundred billion stars and up to just over a trillion (10^{12}) solar masses worth of matter, the El Gordo cluster has an estimated mass of 3×10^{15} solar masses, or 3,000 times as much as our own galaxy! The way we've figured this out is fascinating. By seeing how the shapes of background galaxies are distorted into more elliptical-than-average shapes along a particular set of axes, we can reconstruct how much mass is present in the cluster: a phenomenon known as weak gravitational lensing.

That reconstruction is shown in blue, but doesn't match up with where the X-rays are, which are shown in pink! This is because, when galaxy clusters collide, the neutral gas inside heats up to emit X-rays, but the individual galaxies (mostly) and dark matter (completely) pass through one another, resulting in a displacement of the cluster's mass from its center. This has been observed before in objects like the Bullet Cluster, but El Gordo is much younger and farther away.

At 10 billion light-years distant, the light reaching us now was emitted more than 7 billion years ago, when the universe was less than half its present age.

It's a good thing, too, because about 6 billion years ago, the universe began accelerating, meaning that El Gordo just might be the largest cosmic heavyweight of all. There's still more universe left to explore, but for right now, this is the heavyweight champion of the distant universe!

Learn more about "El Gordo" here: <http://www.nasa.gov/press/2014/april/nasa-hubble-team-finds-monster-el-gordo-galaxy-cluster-bigger-than-thought/>

El Gordo is certainly huge, but what about really tiny galaxies? Kids can learn about satellite galaxies at NASA's Space Place <http://spaceplace.nasa.gov/satellite-galaxies/>.

News Headlines

Leonard Nimoy, 'Star Trek's' Spock, dead at 83

Leonard Nimoy, whose portrayal of "Star Trek's" logic-driven, half-human science officer Spock made him an iconic figure to generations, died Friday. He was 83. Nimoy died this morning in Bel Air, California, his son Adam Nimoy told CNN. According to his granddaughter, Madeleine Nimoy, the cause of death was chronic obstructive pulmonary disease.

<http://www.cnn.com/2015/02/27/entertainment/feat-obit-leonard-nimoy-spock/>

Monster Black Hole in Early Universe

A supermassive black hole found only a billion years after the Big Bang adds to growing questions about how such black holes grew so quickly. Astronomers have discovered one of the brightest quasars in the early universe. The source, SDSS J010013.02+280225.8, is powered by a supermassive black hole at a redshift of 6.3, meaning that its light left it 12.8 billion years ago.

<http://www.skyandtelescope.com/astronomy-news/monster-black-hole-in-early-universe-0226201523/>

A Solution to the Puzzle of the Origin of Matter in the Universe

Most of the laws of nature treat particles and antiparticles equally, but stars and planets are made of particles, or matter, and not antiparticles, or antimatter. That asymmetry, which favors matter to a very small degree, has puzzled scientists for many years. New research by UCLA physicists offers a possible solution to the mystery of the origin of matter in the universe.

<http://spaceref.com/astronomy/a-solution-to-the-puzzle-of-the-origin-of-matter-in-the-universe.html>

Close Call! 'Scholz's Star' Grazed Our Solar System 70,000 Years Ago

A dim red dwarf and its brown-dwarf companion likely grazed the outer edges of the solar system 70,000 years ago in what scientists say was the closest encounter ever between our sun and another star.

<http://www.space.com/28611-star-flew-through-solar-system.html>

NASA's Magnetospheric Multiscale (MMS) Spacecraft Set for March Blastoff

NASA's first mission dedicated to study the process in nature known as magnetic reconnection undergoing final preparation for launch from Cape Canaveral, Florida in just under two weeks time. The Magnetospheric Multiscale (MMS) mission is comprised of a quartet of identically instrumented observatories aimed at providing the first three-dimensional views of a fundamental process in nature known as magnetic reconnection.

<http://www.universetoday.com/119095/nasas-magnetospheric-multiscale-mms-spacecraft-set-for-march-blastoff-to-study-earths-magnetic-reconnection-events/#more-119095>

Physicists working to understand how and why matter came about

Neutrinos, subatomic remnants of the early universe, are high-energy particles that pass at nearly the speed of light through everything -- our planet, our bodies -- while rarely interacting with other matter. Most of them were born in the beginning, nearly 14 billion years ago, though more are continually made in the nuclear reactions of stars, in human-built nuclear reactors and in particle accelerators used for experimentation.

<http://www.sciencedaily.com/releases/2015/02/150206125117.htm>

March Sky Data

Full Mar 5 Last Qtr Mar 13 New Mar 20 First Qtr Mar 26



**Best time for deep sky observing this month:
March 9 through March 23**

Mercury sinks into the Sun's glare as March begins, so this is not a good month to observe it.

Venus, is now an evening object appearing a little higher in the sky as the month progresses. So, shining at magnitude -4 all month, it should be easy to spot above the southwestern horizon about one hour after sunset. Its angular size increases a little from 12 to 14 arc seconds during the month while its gibbous phase wanes from 86% to 78%.

Mars is getting dimmer as it lags behind us in its larger and slower orbit. Mars sets about two hours after the sun in early March. It is slowly but surely disappearing into the glow of sunset as Earth races ahead of Mars in its orbit. By late March 2015, Mars will set about one and one-half hours after the sun and will be hard to find in the glare of evening twilight.

Jupiter, having reached opposition on the 6th of February, is high in the south in late evening and visible through much of the night. It starts March shining at at magnitude -2.5, dropping slightly to -2.3 as the month progresses. Jupiter is still moving slowly westwards in retrograde motion towards the Beehive Cluster in Cancer. The size of Jupiter's disk falls slightly from 44.5 to 41.6 arc seconds as March progresses.

Saturn rises around midnight this month lying in the constellation Scorpius very close to the left hand star of the 'fan' that marks its head. Its diameter increases from 16.9 to 17.8 arc seconds during the month as its magnitude increases from +0.4 to +0.3. It will be high enough in the south-south-east before dawn to make out the beautiful ring system which has now opened out to ~25 degrees - virtually as open as they ever become.

There are no major **meteor-showers** in March, but we may see a handful of meteors from the Virginid shower, which is usually active during March and April; they appear to radiate outwards from the constellation of Virgo.

Sun and Moon Rise and Set

Date	Moonrise	Moonset	Sunrise	Sunset
3/1/2015	14:32	03:42	06:20	17:47
3/5/2015	18:06	06:04	06:15	17:51
3/10/2015	22:38	08:51	06:09	17:55
3/15/2015	02:17	13:03	06:02	17:59
3/20/2015	06:04	18:46	05:55	18:03
3/25/2015	09:50	-----	05:48	18:07
3/31/2015	15:08	03:33	05:40	18:11

Planet Data

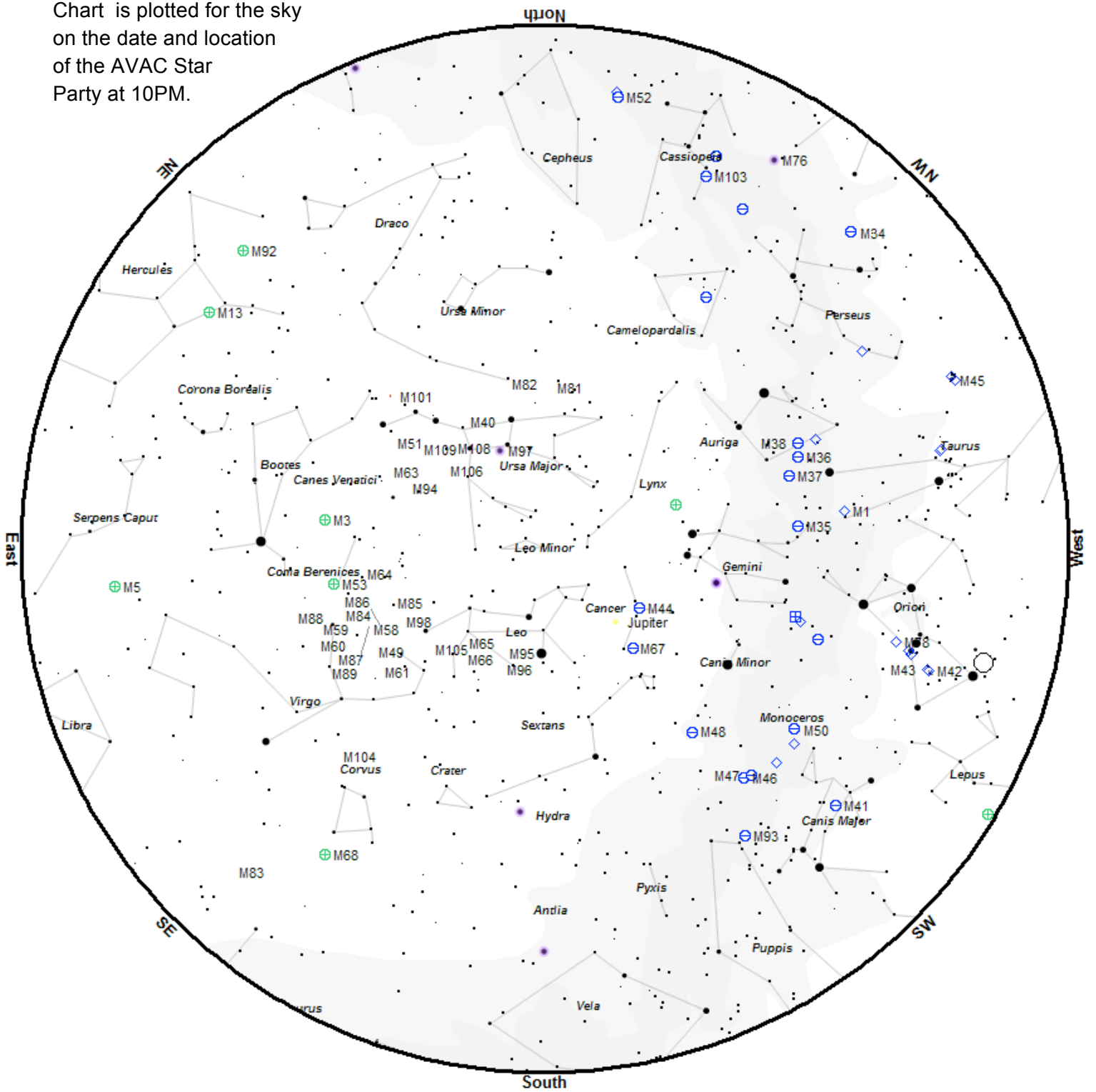
	Mar 1			
	Rise	Transit	Set	Mag
Mercury	05:05	10:25	15:43	0.0
Venus	07:37	13:56	20:15	-4.0
Mars	07:26	13:42	19:57	1.3
Jupiter	15:25	22:22	05:20	-2.5
Saturn	00:12	05:24	10:37	0.5

	Mar 15			
	Rise	Transit	Set	Mag
Mercury	06:12	11:48	17:21	-0.2
Venus	08:24	15:03	21:42	-4.0
Mars	07:58	14:26	20:53	1.3
Jupiter	15:24	22:22	05:21	-2.5
Saturn	00:17	05:30	10:42	0.4

	Mar 31			
	Rise	Transit	Set	Mag
Mercury	06:20	12:24	18:30	-1.0
Venus	08:13	15:14	22:15	-4.0
Mars	07:26	14:08	20:48	1.4
Jupiter	14:17	21:16	04:15	-2.4
Saturn	23:13	04:26	09:38	0.3

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.



Star Magnitudes						Galaxy	Nebula
●	●	●	●	●	●	⊕ Open Cluster	◇ Bright Nebula
0	1	2	3	4	5	⊕ Globular Cluster	◇ Planetary Nebula
						⊕ Cluster+Nebulosity	

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. Since this month is our Messier Marathon the list is the observing order for the night. You can download the order in Excel format at http://www.avastronomyclub.org/docs/marathon_order.xls or Adobe PDF at http://www.avastronomyclub.org/docs/marathon_order.pdf

Order	Time	M #	NGC	Con	R.A.	Dec	Mag	Type	Comments
1		M 77	1068	CET	2h 43m	0° 1'	8.8	SG	
2		M 74	628	PSC	1h 37m	15° 47'	9.2	S	
3		M 33	598	TRI	1h 34m	30° 39'	5.7	SG	Pinwheel galaxy
4		M 31	224	AND	0h 43m	41° 16'	3.4	SG	Andromeda galaxy
5		M 32	221	AND	0h 43m	40° 52'	8.2	EG	
6		M 110	205	AND	0h 40m	41° 41'	8.0	EG	
7		M 52	7654	CAS	23h 24m	61° 35'	6.9	OC	
8		M 103	581	CAS	1h 33m	60° 42'	7.4	OC	
9		M 76	650	PER	1h 42m	51° 34'	11.5	PN	The Little Dumbell
11		M 34	1039	PER	2h 42m	42° 47'	5.2	OC	
11		M 45		TAU	3h 47m	24° 7'	1.2	OC	Pleiades
12		M 79	1904	LEP	5h 24m	-24° 33'	8.0	GC	
13		M 42	1976	ORI	5h 35m	-5° 27'	4.0	DN	Great Orion nebula
14		M 43	1982	ORI	5h 35m	-5° 16'	9.0	DN	
15		M 78	2068	ORI	5h 47m	0° 3'	8.0	DN	
16		M 1	1952	TAU	5h 34m	22° 1'	8.4	PN	Crab nebula
17		M 35	2168	GEM	6h 09m	24° 20'	5.1	OC	
18		M 37	2099	AUR	5h 52m	32° 33'	5.6	OC	
19		M 36	1960	AUR	5h 36m	34° 8'	6.0	OC	
20		M 38	1912	AUR	5h 29m	35° 50'	6.4	OC	
21		M 41	2287	CMA	6h 47m	-20° 44'	4.5	OC	
22		M 93	2447	PUP	7h 45m	-23° 52'	6.2	OC	
23		M 47	2422	PUP	7h 37m	-14° 30'	4.4	OC	
24		M 46	2437	PUP	7h 42m	-14° 49'	6.1	OC	
25		M 50	2323	MON	7h 03m	-8° 20'	5.9	OC	
26		M 48	2548	HYA	8h 14m	-5° 48'	5.8	OC	
27		M 44	2632	CNC	8h 40m	19° 59'	3.1	OC	Beehive Cluster
28		M 67	2682	CNC	8h 50m	11° 49'	6.9	OC	
29		M 95	3351	LEO	10h 44m	11° 42'	9.7	SG	
30		M 96	3368	LEO	10h 47m	11° 49'	9.2	SG	
31		M 105	3379	LEO	10h 48m	12° 35'	9.3	EG	
32		M 65	3623	LEO	11h 19m	13° 5'	9.3	SG	Leo's triplet
33		M 66	3627	LEO	11h 20m	12° 59'	9.0	SG	Leo's triplet
34		M 81	3031	UMA	9h 56m	69° 4'	6.8	SG	Bodes Galaxy
35		M 82	3034	UMA	9h 56m	69° 41'	8.4	IG	Cigar Galaxy
36		M 97	3587	UMA	11h 15m	55° 1'	11.2	PN	Owl Nebula
37		M 108	3556	UMA	11h 12m	55° 40'	10.0	SG	

Order	Time	M #	NGC	Con	R.A.	Dec	Mag	Type	Comments
38		M 109	3992	UMA	11h 58m	53° 23'	9.8	SG	
39		M 40		UMA	12h 22m	58° 5'	8.0	dbl	
40		M 106	4258	CVN	12h 19m	47° 18'	8.3	SG	
41		M 94	4736	CVN	12h 51m	41° 7'	8.1	SG	
42		M 63	5055	CVN	13h 16m	42° 2'	8.6	SG	Sunflower galaxy
43		M 51	5194	CVN	13h 30m	47° 12'	8.1	SG	Whirlpool galaxy
44		M 101	5457	UMA	14h 03m	54° 21'	7.7	SG	
45		M 102	5457	UMA	14h 03m	54° 21'	7.7	SG	Duplicate of M101
46		M 53	5024	COM	13h 13m	18° 10'	7.7	GC	
47		M 64	4826	COM	12h 57m	21° 41'	8.5	SG	Black eye galaxy
48		M 3	5272	CVN	13h 42m	28° 23'	6.4	GC	
49		M 98	4192	COM	12h 14m	14° 54'	10.1	SG	
50		M 85	4382	COM	12h 25m	18° 11'	9.2	EG	
51		M 99	4254	COM	12h 19m	14° 25'	9.8	SG	Pin Wheel nebula
52		M 100	4321	COM	12h 23m	15° 49'	9.4	SG	
53		M 84	4374	VIR	12h 25m	12° 53'	9.3	EG	
54		M 86	4406	VIR	12h 26m	12° 57'	9.2	EG	
55		M 87	4486	VIR	12h 31m	12° 24'	8.6	EG	
56		M 89	4552	VIR	12h 36m	12° 33'	9.8	EG	
57		M 90	4569	VIR	12h 37m	13° 10'	9.5	SG	
58		M 88	4501	COM	12h 32m	14° 25'	9.5	SG	
59		M 91	4548	COM	12h 35m	14° 30'	10.2	SG	
60		M 58	4579	VIR	12h 38m	11° 49'	9.8	SG	
61		M 59	4621	VIR	12h 42m	11° 39'	9.8	EG	
62		M 60	4649	VIR	12h 44m	11° 33'	8.8	EG	
63		M 49	4472	VIR	12h 30m	8° 0'	8.4	EG	
64		M 61	4303	VIR	12h 22m	4° 28'	9.7	SG	
65		M 104	4594	VIR	12h 40m	-11° 37'	8.3	SG	Sombrero galaxy
66		M 68	4590	HYA	12h 40m	-26° 45'	8.2	GC	
67		M 83	5236	HYA	13h 38m	-29° 52'	7.6	SG	Southern Pinwheel
68		M 5	5904	SER	15h 18m	2° 5'	5.8	GC	
69		M 13	6205	HER	16h 42m	36° 28'	5.9	GC	Hercules Cluster
70		M 92	6341	HER	17h 17m	43° 8'	6.5	GC	
71		M 57	6720	LYR	18h 54m	33° 2'	9.0	PN	Ring nebula
72		M 56	6779	LYR	19h 17m	30° 11'	8.2	GC	
73		M 29	6913	CYG	20h 23m	38° 32'	6.6	OC	
74		M 39	7092	CYG	21h 32m	48° 26'	4.6	OC	
75		M 27	6853	VUL	20h 00m	22° 43'	8.1	PN	Dumbbell nebula
76		M 71	6838	SGE	19h 54m	18° 47'	8.3	GC	
77		M 107	6171	OPH	16h 33m	-13° 3'	8.1	GC	
78		M 10	6254	OPH	16h 57m	-4° 6'	6.6	GC	
79		M 12	6218	OPH	16h 47m	-1° 57'	6.6	GC	
80		M 14	6402	OPH	17h 38m	-3° 15'	7.6	GC	
81		M 9	6333	OPH	17h 19m	-18° 31'	7.9	GC	
82		M 4	6121	SCO	16h 23m	-26° 32'	5.9	GC	

Order	Time	M #	NGC	Con	R.A.	Dec	Mag	Type	Comments
83		M 80	6093	SCO	16h 17m	-22° 59'	7.2	GC	
84		M 19	6273	OPH	17h 03m	-26° 16'	7.2	GC	
85		M 62	6266	OPH	17h 01m	-30° 7'	6.6	GC	
86		M 6	6405	SCO	17h 40m	-32° 13'	4.2	OC	Butterfly cluster
87		M 7	6475	SCO	17h 54m	-34° 49'	3.3	OC	Ptolemy's Cluster
88		M 11	6705	SCT	18h 51m	-6° 16'	5.8	OC	Wild Duck cluster
89		M 26	6694	SGR	18h 45m	-9° 24'	8.0	OC	
90		M 16	6611	SER	18h 19m	-13° 47'	6.0	DN	Eagle nebula
91		M 17	6618	SGR	18h 21m	-16° 11'	7.0	DN	Swan nebula
92		M 18	6613	SGR	18h 20m	-17° 8'	6.9	OC	
93		M 24	6603	SGR	18h 16m	-18° 29'	4.5	OC	
94		M 25		SGR	18h 32m	-19° 15'	4.6	OC	
95		M 23	6494	SGR	17h 57m	-19° 1'	5.5	OC	
96		M 21	6531	SGR	18h 05m	-22° 30'	5.9	OC	
97		M 20	6514	SGR	18h 02m	-23° 2'	8.5	DN	Trifid nebula
98		M 8	6523	SGR	18h 03m	-24° 23'	5.8	DN	Lagoon nebula
99		M 28	6626	SGR	18h 25m	-24° 52'	6.9	GC	
100		M 22	6656	SGR	18h 36m	-23° 54'	5.1	GC	
101		M 69	6637	SGR	18h 31m	-32° 21'	7.7	GC	
102		M 70	6681	SGR	18h 43m	-32° 18'	8.1	GC	
103		M 54	6715	SGR	18h 55m	-30° 29'	7.7	GC	
104		M 55	6809	SGR	19h 40m	-30° 58'	7.0	GC	
105		M 75	6864	SGR	20h 06m	-21° 55'	8.6	GC	
106		M 15	7078	PEG	21h 30m	12° 10'	6.4	GC	
107		M 2	7089	AQR	21h 33m	0° -49'	6.5	GC	
108		M 72	6981	AQR	20h 54m	-12° 32'	9.4	GC	
109		M 73	6994	AQR	20h 58m	-12° 38'		ast	
110		M 30	7099	CAP	21h 40m	-23° 11'	7.5	GC	

A.V.A.C. Information

Membership in the Antelope Valley Astronomy Club is open to any individual or family.

The Club has three categories of membership.

- Family membership at \$30.00 per year.
- Individual membership at \$25.00 per year.
- Junior membership at \$15.00 per year.

Membership entitles you to...

- Desert Sky Observer—monthly newsletter.
- The Reflector – the publication of the Astronomical League.
- The A.V.A.C. Membership Manual.
- To borrow club equipment, books, videos and other items.

AVAC

**P.O. BOX 8545,
LANCASTER, CA 93539-8545**

Visit the Antelope Valley Astronomy Club website at www.avastronomyclub.org/

The Antelope Valley Astronomy Club, Inc. is a 501(c)(3) Non-Profit Corporation.

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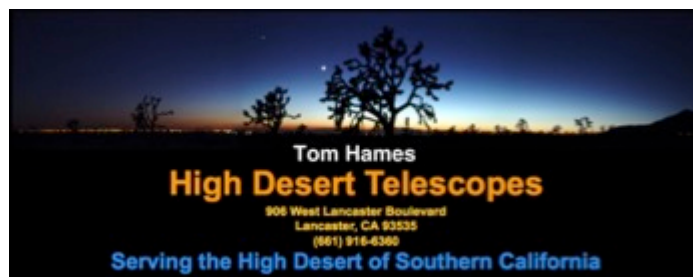
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