



Desert Sky Observer

Volume 36

Antelope Valley Astronomy Club Newsletter

April 2016

Up-Coming Events

- April 2: [Messier Marathon](#)
- April 6: [Quarterly Board Meeting](#)
- April 8: Club Meeting*
- April 23: [Prime Desert Moonwalk](#)

* 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

Back home and, after a nap, I'm feeling better though still a bit "beaten up" after our Messier Marathon.

We had a hardy crew up at Chuchupate for our annual Messier Marathon on Saturday April 2. Some of us arrived on Friday April 1 and we had a good pre-marathon night of observing and getting things set up for the marathon. Don Bryden set up his "Foot Scope" dobsonian reflector and the club's 13" truss dobsonian as well. Matt Leone came up in his motor home towing a trailer with his 24' dob and his motorcycle for the commute to and from Lancaster on Saturday. Rose and I had our Celestron C-11 and Jim Pendleton set up his Meade SCT. Friday night was gorgeous, clear, dark, and COLD, and the early crew stayed up till after midnight before turning in for the night.

On Saturday morning, I set up the club's Coronado hydrogen-alpha solar scope on our Orion Atlas mount and we enjoyed the views of some huge prominences and a large sunspot complex throughout the day. Some of the crew went into Frazier Park for lunch and to peruse the antique stores and yard sales. In the late afternoon, the wind came up and clouds began to move in from the southwest. We thought they might threaten the Messier viewing but they broke up shortly after dark. The Ventura County Astronomical Society (VCAS) set up for their Messier Marathon in the opposite in the end of the parking lot and some of us socialized with them. Darrell Bennet, Bob Ayres, and Tom Hames came up and set up telescopes as well and Inga Nagel came up to visit.

After dinner, we all settled in for our night of observing with Matt Leone and Don Bryden leading the way through the Messier list. Don was also working on his double star list and 92 out of 110 doubles. I used our C-11 on the Losmandy mount to "verify" objects for Matt and to view objects from the Messier, NGC, and few more obscure catalogs throughout the night. We had a great night of viewing, with great skies, though as predicted, the weather was crisp and cold. At about 2:00am, and when my feet began to get too cold and the equipment covered with dew, I packed it in for the night. Don, Darrell, and Bob remained on the telescope field when I went in. It was about 39% out at the time and I later learned that Don was the last to leave the field at about 3:30 am.

All in all, it was a great time, with great people, and I hope we can get more members to come out for further star parties at Chuchupate, Red Cliffs, and other dark sky observing sites throughout the viewing season. I know some of the observing sites may seem like a way to go for a star party, but as an astronomy club based in an urban area that's the price we have to pay to find clear and dark skies for observing deep sky objects. To put in in perspective, it's 56 miles from JetHawk Stadium to Chuchupate. Rose and I drive that far from our home near Tehachapi for each and every monthly Moon Walk at Prime Desert Woodland Preserve and for our board meetings and 65 miles for club meetings at the SAGE Planetarium. We'll try to have a few events closer in to town, but we sacrifice the viewing conditions a bit to do so.

In other events, we had a great night at the last Prime Desert Woodland Moon Walk. The moon didn't come up till after the event was complete and for the first time this year we had a clear night, free of clouds, to share the cosmos with the public. Jupiter and the Orion Nebula looked gorgeous and Darrell Bennet gave the public the "spacewalk view" of the Orion Nebula with the binoviewer on his SCT. Robert Lynch and Ellen Mahler were sharing views through their dobsonian reflectors and I was able to share a few objects, normally hard to see from the city, like The Ghost of Jupiter planetary nebula (NGC3242) and M3, a globular cluster of stars in the northern constellation of Canes Venatici. Bumped up to 200 power, with a wide field Explore Scientific 14mm eyepiece, people were easily able to resolve that the cluster was made of individual stars rather than just being a bright "fuzz ball". It produced the much desired exclamations of "Ooh", "Ahh", and "Wow", from the public.

As those who have been at recent meetings are aware, the AVAC will not be having a presence at the California Poppy Festival this year. Many of our regular Poppy Festival volunteers will be unable to participate this year, myself and Rose included, and we didn't seem to have the staffing available to make it work. In addition, and as I've previously noted, we felt the location in which they wanted to put our booth was not conducive to astronomy outreach. We'll work with the Poppy Festival administration to ensure we have a more desirable location for our return next year.

The annual Riverside Telescope Maker's Conference (RTMC) is coming on Memorial Day weekend, at the end of May (Thursday, May 26 through Monday, May 30, 2016), and it is our intention to be a "Planet Level Sponsor" (formerly Bronze) and to actively participate with a booth showcasing our activities and outreach. The RTMC board is working toward building the event back up to its former glory and size, increasing vendor and manufacturer counts, and is actively enlisting the help of regional clubs to assist them in this goal. It is my intention that we will be a part of that. An email will follow with some information in that regard from the RTMC board.

As we move beyond the winter months and into the viewing season, I look forward to seeing more and more of you at our events. Remember, you don't need a telescope to participate as we are all willing to share. The only price to use our telescopes, is that we expect and an occasional exclamation of delight. "Oh wow!!"

Clear skies to you all.

Vice President

Bill Schebeck

The March meeting was highlighted by a talk by Dr. Webb, Professor of Astronomy at Florida International University about 'Ancient Mayan Astronomy', via Skype, from his home in Miami FL. He emailed his power point presentation and it all worked well. Using the technology may open our scope of potential guest speakers.

We supported the science evening for the Palmdale Aerospace Academy, next to Sage Planetarium. The moon was out but Jupiter and Orion were easy to observe and it was a nice spring evening. It was the last day of school before Spring break so the students were in a festive mood.

April may be a great month for astronomy if the weather holds. Mercury will be at its peak mid-month and Jupiter continues to be bright and Mars and Saturn are up after midnight. Comet Ikeye-Murakami will trek across Leo this month and all our scopes should be able to view it.

April is Global Astronomy Month. See you at the marathon and/or next meeting.

Space Place

Gravitational Wave Astronomy Will Be The Next Great Scientific Frontier

By Ethan Siegel

Imagine a world very different from our own: permanently shrouded in clouds, where the sky was never seen. Never had anyone see the Sun, the Moon, the stars or planets, until one night, a single bright object shone through. Imagine that you saw not only a bright point of light against a dark backdrop of sky, but that you could see a banded structure, a ringed system around it and perhaps even a bright satellite: a moon. That's the magnitude of what LIGO (the Laser Interferometer Gravitational-wave Observatory) saw, when it directly detected gravitational waves for the first time.

An unavoidable prediction of Einstein's General Relativity, gravitational waves emerge whenever a mass gets accelerated. For most systems -- like Earth orbiting the Sun -- the waves are so weak that it would take many times the age of the Universe to notice. But when very massive objects orbit at very short distances, the orbits decay noticeably and rapidly, producing potentially observable gravitational waves. Systems such as the binary pulsar PSR B1913+16 [the subtlety here is that binary pulsars may contain a single neutron star, so it's best to be specific], where two neutron stars orbit one another at very short distances, had previously shown this phenomenon of orbital decay, but gravitational waves had never been directly detected until now.

When a gravitational wave passes through an objects, it simultaneously stretches and compresses space along mutually perpendicular directions: first horizontally, then vertically, in an oscillating fashion. The LIGO detectors work by splitting a laser beam into perpendicular "arms," letting the beams reflect back and forth in each arm hundreds of times (for an effective path lengths of hundreds of km), and then recombining them at a photodetector. The interference pattern seen there will shift, predictably, if gravitational waves pass through and change the effective path lengths of the arms. Over a span of 20 milliseconds on September 14, 2015, both LIGO detectors (in Louisiana and Washington) saw identical stretching-and-compressing patterns. From that tiny amount of data, scientists were able to conclude that two black holes,

of 36 and 29 solar masses apiece, merged together, emitting 5% of their total mass into gravitational wave energy, via Einstein's $E = mc^2$.

During that event, more energy was emitted in gravitational waves than by all the stars in the observable Universe combined. The entire Earth was compressed by less than the width of a proton during this event, yet thanks to LIGO's incredible precision, we were able to detect it. At least a handful of these events are expected every year. In the future, different observatories, such as NANOGrav (which uses radiotelescopes to the delay caused by gravitational waves on pulsar radiation) and the space mission LISA will detect gravitational waves from supermassive black holes and many other sources. We've just seen our first event using a new type of astronomy, and can now test black holes and gravity like never before.

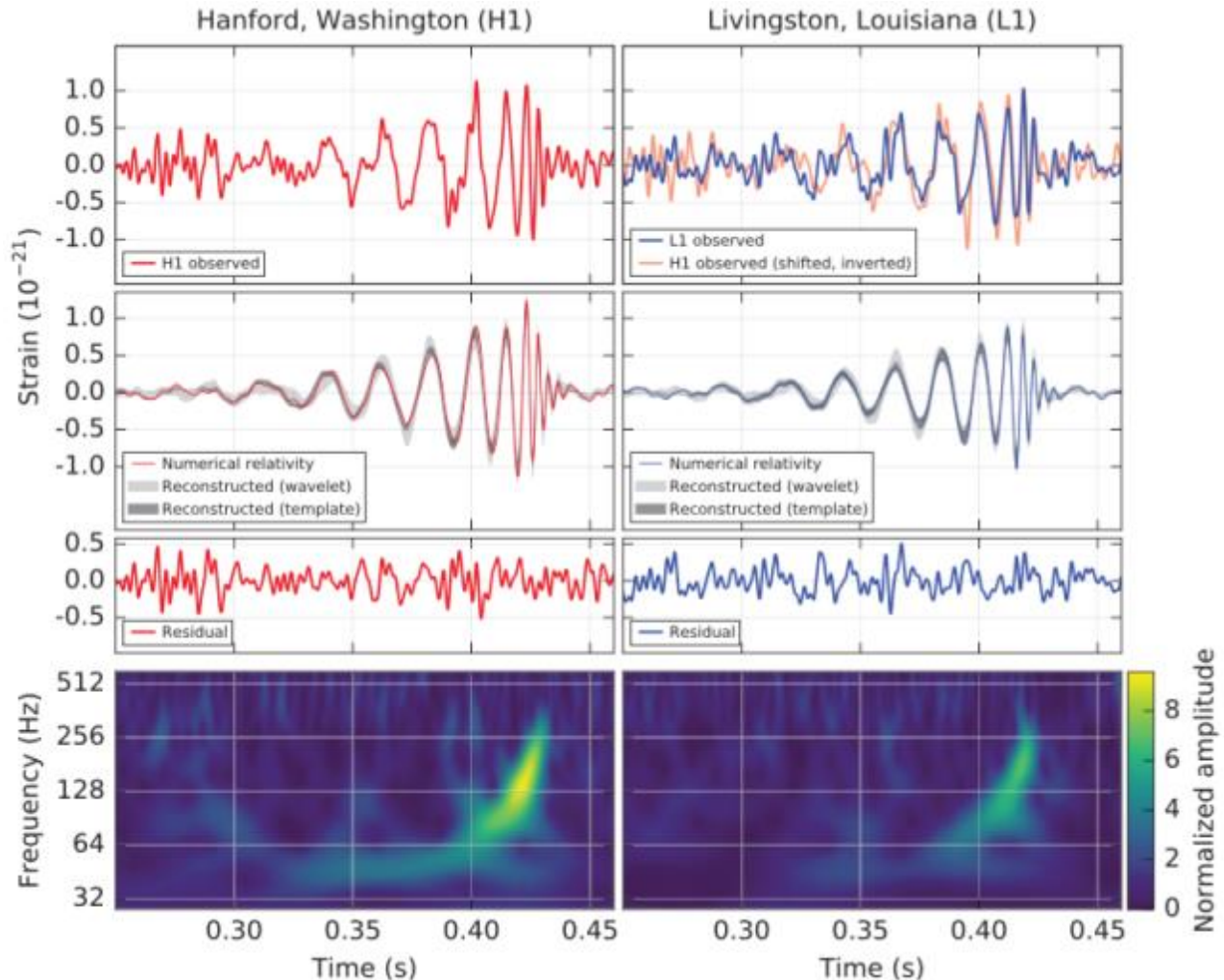


Image credit: Observation of Gravitational Waves from a Binary Black Hole Merger B. P. Abbott et al., (LIGO Scientific Collaboration and Virgo Collaboration), Physical Review Letters 116, 061102 (2016). This figure shows the data (top panels) at the Washington and Louisiana LIGO stations, the predicted signal from Einstein's theory (middle panels), and the inferred signals (bottom panels). The signals matched perfectly in both detectors.

News Headlines

At Venus, a Japanese Spacecraft is Almost Ready for Big Science

A Japanese spacecraft's long-awaited Venus campaign is finally about to begin. Japan's Akatsuki probe was originally supposed to arrive at Venus in December 2010, but an engine failure caused the spacecraft to miss its target and zoom off into orbit around the sun. But this past December, Akatsuki's handlers managed to guide the craft back to Venus, and now the probe is just about ready to start science operations.

<http://goo.gl/1QipZ3>

Rover Takes on Steepest Slope Ever Tried on Mars

NASA's long-lived Mars rover Opportunity is driving to an alternative hillside target after a climb on the steepest slope ever tackled by any Mars rover. Opportunity could not quite get within reach of a target researchers hoped the rover could touch earlier this month.

A new image shows the view overlooking the valley below and catches the rover's own shadow and wheel tracks as Opportunity heads toward its next target.

The rover's tilt hit 32 degrees (that's a 62.5% grade) on March 10 while Opportunity was making its closest approach to an intended target near the crest of "Knudsen Ridge."

<http://www.jpl.nasa.gov/news/news.php?feature=6193>

NASA Marks Major Milestones for the James Webb Space Telescope

NASA's James Webb Space Telescope just got a little closer to launch with the completion of cryogenic testing on its science cameras and spectrographs and the installation of the final flight mirrors.

On March 6, 2016, shortly after the successful instrument testing, the last mirrors in Webb's optical path were installed into the telescope. Now the telescope is officially optically complete.

<http://www.nasa.gov/feature/goddard/2016/nasa-marks-major-milestones-for-the-james-webb-space-telescope>

New Horizons: Peering into Pluto's Past

Members of NASA's New Horizons mission team presented nearly 40 scientific reports on the Pluto system during the 47th Lunar and Planetary Science Conference near Houston. The scientists discussed results included in the March 18 issue of the journal Science, as well as results gathered from analyses of new data since the Science papers were submitted. "The New Horizons team has been inundated with high-quality data beaming back from our spacecraft, now out in the Kuiper Belt beyond Pluto," says New Horizons Principal Investigator Alan Stern, of the Southwest Research Institute in Boulder, Colorado. "The findings we report this week at LPSC cover every aspect of the Pluto system, from its surface and atmosphere, to its origin and the nature and origin of its satellites. We're excited to share these many results."

Video and Powerpoints in the article.

<http://pluto.jhuapl.edu/News-Center/Press-Conferences/March-21-2016.php>

April Sky Data

**Best time for deep sky observing this month:
April 1 through April 10**

This month, **Mercury** has its best apparition of the year, shining in the west-northwest during the evening twilight. As April begins, it is low above the horizon, but shining brightly at magnitude -1.5. It reaches greatest elongation (east) on the 18th of April. Its disk will be 7.5 arc seconds across with 38% of the disk illuminated. During the latter part of the month, it fades to magnitude +1.5 and disappears into the Sun's glare around the 28th of the month as it moves towards inferior conjunction on the 9th of May - when we will observe a transit of Mercury.

Venus rises less than half an hour before sunrise at the start of April and could be seen given a low eastern horizon, but it will be unobservable after the 9th or so.

At the beginning of April, **Mars** rises around midnight. As the month progresses it rises earlier each night so at about 10pm by month's end. Its brightness increases dramatically this month, increasing from magnitude -0.6 to -1.4. At the same time its angular size increases from 12 to 16 arc seconds!

Jupiter reached opposition on March 8th but this is still an excellent month to observe it. It crosses the meridian at around 23:00 at the beginning of the month and around 21:00 by month's end. Its brightness falls slightly from magnitude -2.4 to -2.3 while its angular size drops from 44 to 41 arc seconds.

Saturn rises at ~00:00 as April begins and a little earlier each night so that by month's end it rises at about 22:00. Shining at magnitude +0.3 and brightening to +0.2 during the month. Its diameter increases from 17.4 to 18.1 arc seconds as April progresses.

The annual Lyrid **meteor shower** is active each year from about April 16 to 25. In 2016, the peak of this shower - which tends to come in a burst and usually lasts for less than a day - is expected to fall on the morning of April 22, though under the glaring light of the full moon.

New Apr 7 First Qtr Apr 14 Full Apr 21 Last Qtr Apr 29



Sun and Moon Rise and Set

Date	Moonrise	Moonset	Sunrise	Sunset
4/1/2016	02:29	13:13	06:37	19:13
4/5/2016	06:25	18:33	07:32	20:16
4/10/2016	10:09	00:18	07:25	20:20
4/15/2016	14:49	03:43	07:19	20:24
4/20/2016	19:20	06:34	07:13	20:28
4/25/2016	23:46	09:35	07:07	20:32
4/31/2016	02:55	14:03	07:01	20:36

Planet Data

	Apr 1			
	Rise	Transit	Set	Mag
Mercury	06:58	13:30	20:04	-1.5
Venus	05:54	11:54	17:53	-3.9
Mars	23:23	04:30	09:37	-0.6
Jupiter	16:49	23:15	05:42	-2.4
Saturn	00:01	05:08	10:14	0.4

	Apr 15			
	Rise	Transit	Set	Mag
Mercury	06:59	14:04	21:08	-0.1
Venus	05:44	12:02	18:20	-3.9
Mars	22:35	03:40	08:46	-1.0
Jupiter	15:48	22:16	04:44	-2.4
Saturn	23:05	04:11	09:18	0.3

	Apr 30			
	Rise	Transit	Set	Mag
Mercury	06:24	13:36	20:44	2.9
Venus	05:33	12:12	18:50	-3.9
Mars	21:32	02:36	07:40	-1.5
Jupiter	14:45	21:14	03:43	-2.3
Saturn	22:03	03:09	08:16	0.2

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

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	
38		M 109	3992	UMA	11h 58m	53° 23'	9.8	SG	
39		M 40		UMA	12h 22m	58° 5'	8.0	dbl	

Order	Time	M #	NGC	Con	R.A.	Dec	Mag	Type	Comments
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	
83		M 80	6093	SCO	16h 17m	-22° 59'	7.2	GC	
84		M 19	6273	OPH	17h 03m	-26° 16'	7.2	GC	

Order	Time	M #	NGC	Con	R.A.	Dec	Mag	Type	Comments
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.

The A.V.A.C. is a Sustaining Member of The Astronomical League and the International Dark-Sky Association.

Board Members

President:

Frank Moore (661) 972-4775
president@avastronomyclub.org

Vice-President:

Bill Schebeck (661) 233-5123
vice-president@avastronomyclub.org

Secretary:

Rose Moore (661) 972-1953
secretary@avastronomyclub.org

Treasurer:

Virginia Reed (661) 824-3932
treasurer@avastronomyclub.org

Director of Community Development:

Robert Lynch, Jr.
community@avastronomyclub.org

Appointed Positions

Newsletter Editor:

Steve Trotta (661) 269-5428
dso@avastronomyclub.org

Equipment & Library:

Bill Grove
library@avastronomyclub.org

Club Historian:

Tom Koonce (661) 943-8200
history@avastronomyclub.org

Webmaster:

Steve Trotta (661) 269-5428
webmaster@avastronomyclub.org

Astronomical League Coordinator:

Don Bryden (661) 270-0627
al@avastronomyclub.org

Our Sponsors

Thank you to our sponsors for your generous support!

Cosmos Level Sponsors

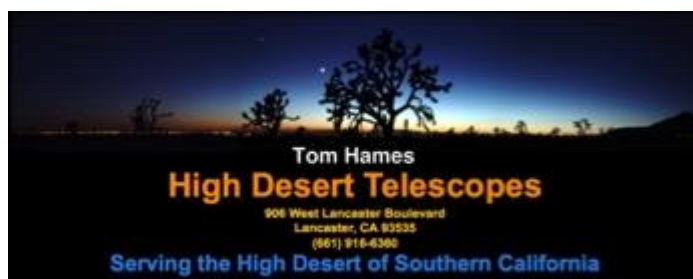


Woodland Hills Camera

5348 Topanga Canyon Blvd., Woodland Hills
888-427-8766.

www.telescopes.net

Universe Level Sponsors



Galaxy Level Sponsors



Al's Vacuum and Sewing

904 West Lancaster Blvd., Lancaster
(661) 948-1521