



Astronomy Club of Tulsa

Observer

May 2014



*Photo: Left to Right: Scorpius. Saturn. Libra, the Moon with Spica underneath, and Mars, all in a row over my street.
Taken during the total lunar eclipse of April 14-15, 2014 by Tamara Green.*

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MAY 2014

JUNE 2014

SUN	MON	TUE	WED	THU	FRI	SAT	SUN	MON	TUE	WED	THU	FRI	SAT
				1	2	3	1	2	3	4	5	6	7
4	5	6	7	8	9	10	8	9	10	11	12	13	14
11	12	13	14	15	16	17	15	16	17	18	19	20	21
18	19	20	21	22	23	24	22	23	24	25	26	27	28
25	26	27	28	29	30	31	29	30					

UPCOMING EVENTS:

General Meeting	Fri, May 9	TCC NE Campus	7:00 PM
Sidewalk Astronomy	Sat, May 10	Bass Pro	7:30 PM
Mothers' Day	Sun, May 11		
Public Star Party	Fri, May 23	ACT Observatory	8:00 PM
Back-Up Night	Sat, May 24	ACT Observatory	8:00 PM
Memorial Day	Mon, May 26		
Members' Night	Fri, May 30	ACT Observatory	8:00 PM
Back-Up Night	Sat, May 31	ACT Observatory	8:00 PM
Sidewalk Astronomy	Sat, Jun 14	Bass Pro	8:15 PM
Fathers' Day	Sun, Jun 15		
Public Star Party	Fri, Jun 20	ACT Observatory	8:15 PM
Back-Up Night	Sat, Jun 21	ACT Observatory	8:15 PM
SUMMER SOLSTICE	Sat, Jun 21		5:51 AM CDT
Members' Night	Fri, Jun 27	ACT Observatory	8:15 PM
Back-Up Night	Sat, Jun 28	ACT Observatory	8:15 PM

MidStates Astronomy convention

MSRAL Website: <http://www.msral.org/>

St. Louis June 6-8, 2014



The St. Louis Astronomical Society in conjunction with the McDonnell Planetarium and Washington University wish to invite all Astronomical League members to the 2014 Mid-States Convention in St. Louis Missouri.

We hope the following information will give you a feel for what we are offering this year. Whether you spend just the weekend or extend your stay in St. Louis and visit our many tourist sites, we think you will have a great time.

We are planning a Friday night through Sunday morning convention. The traditional Friday Star-B-Q will be at our James S. McDonnell Planetarium, which just celebrated its 50th anniversary. There will be Friday night public telescope viewing, a Sky show and guest speaker as well as Laserium shows. On Saturday we will have our morning and afternoon paper presentations; and a tour of the Earth and Planetary Sciences Center at Washington University. Saturday night will feature our annual MSRAL banquet, Amateur of the Year presentation, and keynote speaker, Dr Ray Arvidson, James S McDonnell Distinguished University Professor at Washington University in the Earth and Planetary Sciences Department. Dr. Arvidson is involved with the Mars Rover missions and will give us the current status of their findings.

On Sunday, we plan to offer workshops on astrophotography as well as other talks, including Night Sky Network. The hope is to provide you with skills to increase your fun and productivity. Bring your laptops, photos, etc.

For people needing hotel rooms, Washington University's Knight Center offers first class executive rooms. The Knight Center will also be the site of our Banquet, making for easy access to your rooms before and after the meetings. Information regarding accommodations will be updated on the registration page.

Our registration website is now open. Please visit it as soon as possible. We have included important dates and links below, and these are also on our website.

Here is the link for the convention information including registration: <http://slasonline.org/msral2014.html>

Please distribute this information to your club members. We have created the following slide show that will provide more details. We would appreciate it if you would present this at one of your club meetings.

<http://slasonline.org/msralpreview.pdf>

We hope to see all of you here in St. Louis June 6-8, 2014.

Best Regards,

2014 MSRAL Committee, St. Louis Astronomical Society

Important Links:

St. Louis Astronomical Society Home Page: <http://www.slasonline.org/>

MSRAL2014 Home Page: <http://www.slasonline.org/msral2014.html>

St. Louis Astronomical Society Night Sky Network: http://nightsky.jpl.nasa.gov/club-view.cfm?Club_ID=718

MSRAL Website: <http://www.msral.org/>

Meeting Location, Saturday 8-5, Sunday 8-noon: Crow Hall, Washington University, St. Louis, MO

When: Friday, June 6 - Sunday June 8

Star-BQ: James S. McDonnell Planetarium, Friday Night

Banquet: Knight Center, Washington University, Saturday Night

MSRAL Yahoo Group: <https://groups.yahoo.com/neo/groups/msral/info>



Vice President's Message

By Richard Brady

Hi everyone! We are already through four months of 2014. Time flies. It seems like just last week we were out at public night freezing to death. Now we are into spring. As I'm writing this (April 29), the weather forecast is for highs near 90 late next week. Only in Oklahoma.

You may have noticed there is no President's message this month. Mandy is deeply involved (some would say buried) with end-of-term papers and projects, and finals the first week in May, so she asked me to write this month's message for the newsletter.

Saturday, April 26, we had another Observatory Appreciation Day. We got a lot accomplished. I want to thank those that came out and helped maintain our observatory and make it even better. We had 11 people there to help: Stan Davis, Skip Whitehurst, Deana and Ed Underhill, Owen and Tamara Green, Chris Proctor, James Taggart, Cory Suddarth, Mandy, and myself. Some of the things we got done were: Stan replaced another step leading up to the dome, Skip worked on replacing the area of the ceiling with the hole in it, James worked on the dome drive and basically coordinated on what needed to be done, with the rest of us doing whatever was needed. Several brought food, since we worked up quite an appetite. Thanks to everyone who came out and thanks to everyone that brought food. We will probably be having another Appreciation Day in May, maybe to do some painting if everything is ready. We will be calling for additional volunteers soon.

I want to give a special thank you to Cory Suddarth. For those who don't know him, he has his own optical repair shop in Henryetta. He was kind enough to come and clean all our eyepieces and the outside of the corrector plate for the telescope in the dome. He pointed out that there looks to be fungus growing inside the scope, do to the cover that we use. The problem is that it doesn't allow any air circulation (it doesn't breathe), so moisture builds up inside the scope and the fungus grows on the moisture. He said he will need to take the scope apart to clean the fungus, and will schedule some time in the near future to do this. As for the cover, we are going to get a small heater/dehumidifier to put under the cover to help reduce the moisture in the short term. Longer term we are looking at modifying the current cover and eventually replacing it with something that breathes. The telescope is the observatory's most valuable asset and we can't afford to damage or destroy it.

On Friday May 9, we have our last club meeting at TCC for the season. The next club meeting will be in September. I hope everyone can make it to the May club meeting, as Skip Whitehurst is going to show pictures from his trip to the Paranal Observatory in Chile. Paranal is a professional observatory roughly 8600 feet high in the Andes Mountains. Since I'll probably never get there myself, I'm looking forward to seeing it through the lens of Skip's camera. (Also, I'll be leading the meeting, since Mandy will be out of town seeing her boyfriend. I hope this doesn't keep anyone away. J I realize Mandy is prettier than I am, but still...)

One last thing. On Friday May 23, we have a public night planned. In addition, there is the possibility of a new meteor shower after midnight that night. If you subscribe to Sky & Telescope magazine, the May issue has an article describing it. In the article it says that the Earth should pass through a significant part of the meteor stream around 2 A.M. (7 UT). The radiant is in Camelopardalis at 8h 16m right ascension and +79 degrees declination. I'm planning on staying at the observatory that night, hoping for a good show. Anyone joining me?

Clear Skies!

Richard Brady



Treasurer's and Membership Report

By Tim Davis

Astronomy Club of Tulsa: 122 members, including 20 new members in 2014.

Welcome to our new member this month: Gano Perez

Club Accounts as of April 25, 2014:

Checking: \$4,074.64

Savings: \$,769.49

Investment accounts: \$18,752.88 (*Value Fluctuates with Market*)

PayPal: \$0.00



The club now has PayPal available for you to start or renew memberships and subscriptions using your credit or debit cards. Fill out the registration form at <http://astrotulsa.com/page.aspx?pageid=16> **Click Submit** and you will be given the choice of either **mailing in your dues** with a check **or using PayPal** which accepts most major credit cards. A modest processing fee is added to PayPal transactions.

You may also renew your membership or join at one of our club events using your credit card by seeing one of our officers. We can take payments with the Square card reader now. A small fee is also added on to these transactions.

NEWS NOTE: Both Sky & Telescope and Astronomy have free Digital subscriptions available with print subscriptions, or Digital subscriptions may be purchased separately. Contact their websites for details.

Membership rates for 2014 are as follows:

Adults: \$45.00 per year, includes Astronomical League Membership.

Sr. Adult: \$35.00 per year for those 65 or older, includes Astro League Membership.

Students: \$30.00 with League membership; Students: \$25.00 without League membership.

Additional Family membership: \$20.00 with voting rights and League membership.

\$15.00 with voting rights but without League Membership.

The regular membership allows all members in the family to participate in club events, but only ONE Voting Membership and one Astronomical League membership.

Join Online – Add or renew magazine subscriptions: <http://www.astrotulsa.com/page.aspx?pageid=16>

Magazine Subscriptions: If your magazines are coming up for renewal, try to save the mailing label or renewal form you get in the mail. Forms are available on the club website.

Astronomy is \$34.00 for 1 year, or \$60.00 for 2 years: www.astronomy.com

To get the club discount you must go through the club group rate.

Sky & Telescope is \$33.00 per year: www.skyandtelescope.com

Sky & Telescope also offers a 10% discount on their products.

Note: You may renew your Sky & Telescope subscription directly by calling the number on the renewal form, be sure to ask for the club rate.

NEW SUBSCRIPTIONS must still be sent to the club.



The Secretary's Stuff

By Tamara Green

ASTRONOMY CLUB OF TULSA – MINUTES – GENERAL MEETING APR 11, 2014

PRESENT:

Mandy Nothnagel, President

Richard Brady, VP

Tamara Green, Secretary

Tim Davis, Treasurer

John Land, Board

Skip Whitehurst, Board

NOT PRESENT:

Lee Bickle, Board

Michael Blaylock, Board

Stan Davis, Board

Christopher Proctor, Board

James Taggart, Board, Facilities Manager

The meeting was held at Tulsa Community College Northeast Campus and there were 25 attendees.

WELCOME AND INTRODUCTION: Mandy called the meeting to order at 7:10 PM and welcomed all members and guests. She then announced some upcoming events.

PROGRAM: Recap of lectures that our club was invited to and the Messier Marathon, and then Cory Suddarth gave a presentation on optics. Then, John Land talked about the Lunar Eclipse, taking place on April 15, 2014, beginning 12:58 AM CDT. There is also a report on it on our Club's website.

OFFICERS'/STAFF REPORTS:

PRESIDENT – Mandy talked about upcoming events, lectures that our Club was invited to, including Frank Wilczek, "Expanding the Doors of Perception" at TU (Presidential Lecture Series) and the Tulsa Town Hall lecture given by Gentry Lee at the Tulsa Performing Arts Center, and then recapped the Messier Marathon that took place at TUVA on March 29-30.

VICE PRESIDENT – Richard also recapped part of Gentry Lee's lecture. He then recapped which Club events are coming up.

SECRETARY – Tamara told the membership that if anyone wanted to see any of the minutes from Club meetings to contact her; she also, as Newsletter Editor, gave a Call for Articles for the May Newsletter, due to be out on or near April 25. She also said that she would send another call via the Yahoo! Groups and the Club Facebook page.

TREASURER – Everything fine financially. 20 new members for this year to date, 122 members total.

GROUPS – Mandy mentioned a tentative date for a group, Holy Family, but they may end up coming to a public night and there is the ORU science group in June.

FACILITIES – James not present, no report. Mandy mentioned that we need to do some painting, maybe in May.

PR/OUTREACH/SIDEWALK – Tamara announced the Sidewalk event, to take place on Sat, Apr. 12 at 7:30 PM (or earlier if you are interested in doing solar observing, at about 3:00 or 4:00) at Bass Pro, weather permitting.

OBSERVING – Richard told the membership that if they have completed an AL program to let him know and he will submit their logwork to the AL for their certificate and pin. Richard even talked about the possibility of doing AL programs together as a group at members' nights.

Being no other business, meeting was adjourned at 9:08 PM

NITELOG - Norway InTErurban Local Observing Group

by Tom Hoffelder

As promised, once we made it to the spring galaxies, the sky would catch up with us. In fact, the objects are actually a little past the meridian at the end of astronomical twilight at the end of the month, especially up here in the North Woods, where that doesn't occur until 10:30 and it's only May. Lots of cool stuff to check out this month so please read on!

OBSERVING: May open house at the Twitchell Observatory MAY happen on Monday the 5th at 8:30, weather permitting of course. With a first quarter moon minus one day, three planets, a dwarf planet and an asteroid up there, it's again a Solar System extravaganza! Maybe even a comet, but that's a little iffy with the moon. Perhaps this month we will have at least one clear Monday evening, as opposed to April, which means we did not get to view Mars near opposition.

MOON: On Tuesday the 6th, our dear old Moon will feature a Lunar X event beginning (fully formed) around 4 PM EDT. Since the X remains visible for about three hours, it is entirely a daytime event, but it can still be easily seen in about any scope. Here in the east the Moon is at least 40 degrees high at the beginning, but in the Tulsa area it is only 25; however at the end of the three hours it is nearly 60. Have to wait until Dec for the next opportunity; if you need a photo, check the last year's Dec NITELOG, or GOOGLE search.

METEORS: Ignore the fact that I have said the Perseids and the Geminids are the only showers I'll mention. That was before hearing of this brand new (possible) event, with predicted counts ranging from 100 to 1000 per hour - I'll let you decide which you think more likely. With the peak expected between 2:30 to 3:40 AM EDT on May 24th and the radiant way north at +79 dec, we are in pretty good shape if it happens, if it is clear. The moon is a bit of a problem as it rises around the peak time and is 20% illuminated, which throws a lot of light, but it could be worse. Expecting lots of media coverage of this once it gets closer; recommend only paying attention to [whatskyandtelescope.com](http://www.skyandtelescope.com) posts and [amsmeteors.org](http://www.amsmeteors.org). **COMETS:** Check the comet file for info on a couple relatively bright ones; as always, extrapolate locations using the daily motion values for dates a few days either side of those given. For info and detailed charts on a not so bright but interesting one, the source of the meteor shower noted above, check this S&T site (and my comment at the end if they don't delete it). <http://www.skyandtelescope.com/astronomy-news/observing-news/catch-a-comet-buzzing-earth/#comment-9224>

PLANETS: Jupiter in Gemini hangs around but is sinking in the west; Mars is high in Virgo at the end of twilight and only one sec less in diameter (14 vs 15) than when at opposition, but loses two more arc seconds by the end of the month. With Saturn still following in Libra, it is 10 degrees high by 9 PM (Maine) so now you can check a clear sky from then to about midnight to see the three lights in the night sky that gave us Tuesday, Thursday and Saturday, and of course Monday if the moon is there. Oh, almost forgot! Mercury is at greatest eastern elongation on the 25th, which means it (Wednesday) joins the fray for a few days. Look low in the WNW soon after sunset.

ASTEROIDS: Now that I did see Ceres and Vesta in the same field of view, I'll go back to calling Ceres a dwarf planet. Both are still close together in Virgo, even closer than last month, and bright (Ceres 7.2 and Vesta 6.0 on the 1st, dropping 0.6 mag by month's end). http://d366w3m5tf0813.cloudfront.net/wp-content/uploads/Web_Ceres_Vesta_2014.pdf

STARS: Three carbon stars with B-V's of 3.something and current mags of 7 or brighter, and six nice doubles of varying magnitudes and separations ranging from 1.7 sec to 3 minutes (get out the binocs!)

THE GOOD STUFF: Except for one lonely globular this time, the list is again all galaxies. Well, OK, there is a double star, which is only there because it is M40. There are ten other Messiers, one being the globular, and also ten Herschel 400 objects. Maybe you noticed that the last object on last month's list is the second object here. That's because I want all of you to be able to say that once upon a time 2.4 billion year old photons triggered the rhodopsin in your retina.

QUESTIONS: As always, questions and comments are welcome!

tom hoffelder

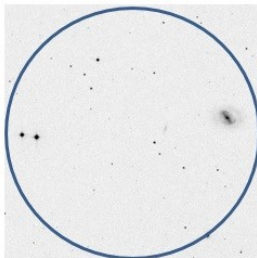
rocksnstars@gmail.com

Come with me now, Pilgrim of the stars,

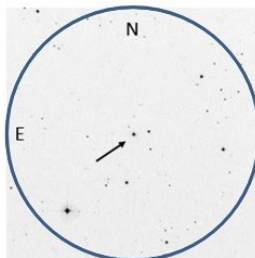
For our time is upon us and our eyes

Shall see the far country

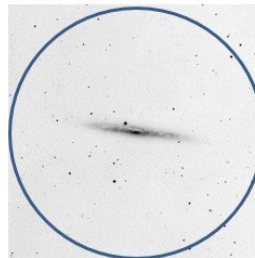
And the shining cities of infinity ~ Robert Burnham, Jr



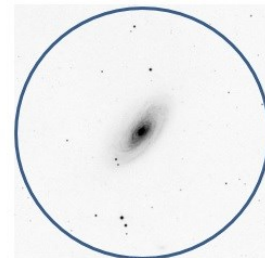
M40 + 4284 15' FOV



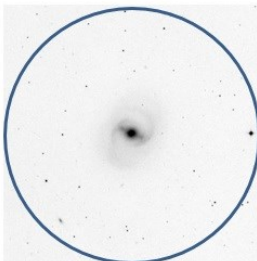
3C 273 15' FOV



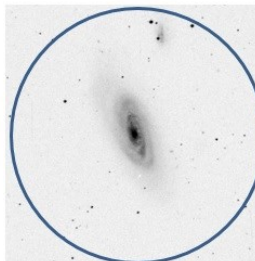
4517 20' FOV



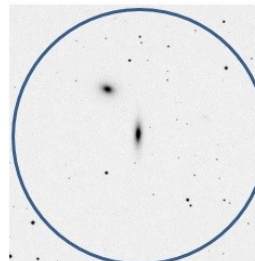
M88 15' FOV



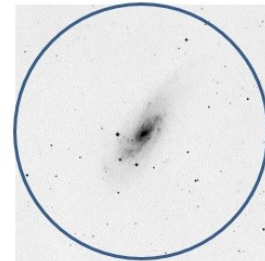
M91 15' FOV



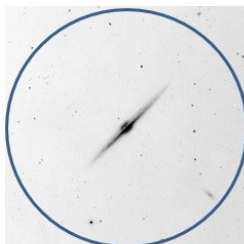
M90 15' FOV



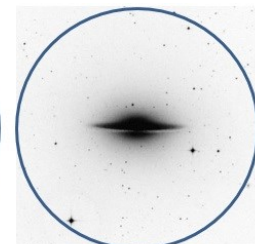
4550 + 4551 15' FOV



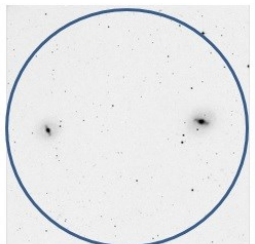
4559 15' FOV



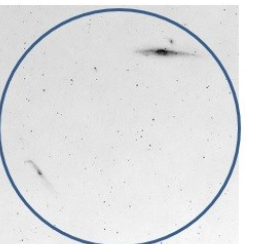
4565 30' FOV



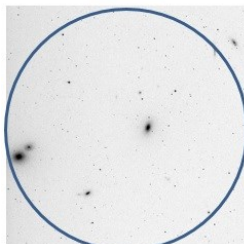
M104 15' FOV



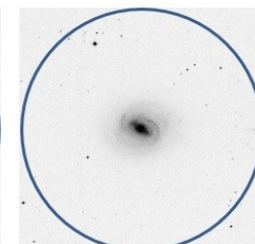
4608 + 4596 30' FOV



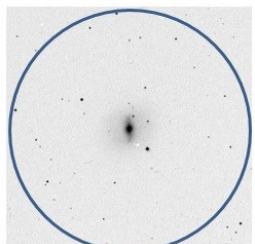
4656 + 4631 45' FOV



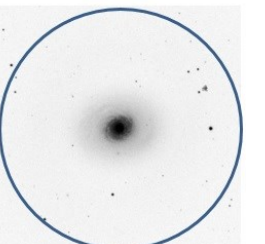
M59 + M60 + 45' FOV



M58 15' FOV



4665 15' FOV



M94 15' FOV

Comet	RA	Dec	Star	N/S	E/W	N-S/ day	E-W/ day	Mag ¹	Ura- no I	Alt ²	Date	EDT
C/2014 E2 Jacques	07 27.0	-03 21	α	8.5 S	3.0 W	0.6 N	0.6 W	8	229	17	5/2	21:3 0
C/2012 K1 Pan- STARRS	13 24.7	+49 21	η	---	3.7 W	0.1 N	1.1 W	9	76	75	5/2	22:0 0
C/2012 K1 Pan- STARRS	11 13.8	+45 17	ψ Uma	0.7 N	0.8 E	0.4 S	0.8 W	9	73	70	5/24	21:3 0
C/2012 K1 Pan- STARRS	10 46.6	+42 16	ψ Uma	2.3 S	4.3 W	0.5 S	0.6 W	9	73	50	5/31	22:3 0

¹<http://www.aerith.net/comet/>²Maine, at time

5/24				(5/25)				5/31			
SS	NTE	ATE	MR	SS	NTE	ATE	MS	SS	NTE	ATE	MS
20:1 2	21:31	22:2 5	03:17	20:18	21:40	22:37	22:30				

Object (Type)	RA	Dec	Star	N/S	E/W	Mag*/ (# of Stars)	Size (')/ Sep (")	Spect/ M# or H#	Dist (ly)	Ura- no I Page	Comment, [B- V], {~crnt mag} (opt x)
SS Vir (CS)	12 25.2	+00 46	η Vir	1.4 N	1.3 E	6.0- 9.6		CII		238	[3.9] {7}
Y CVn (CS)	12 45.1	+45 26	α	7.1 N	1.9 W	5.0- 6.4		Clab		75	[3.2] {5.5}
RY Dra (CS)	12 56.4	+66 00	κ Dra	3.8 S	2.2 E	6.0- 8.2		C		26	[3.6] {7}
δ Crv (MS)	12 29.9	-16 31	-	-	-	3, 8.5	24	A0, dK2	125	284	(20)
γ Vir (MS)	12	-01	-	-	-	3.5,	1.7	F0, F0	32	239	(280)
24 Com (MS)	12 35.1	+18 23	γ Com	10.0 S	2.0 E	5, 6.5	20	K2, A7		149	(24)
32+33 Com (MS)	12 52.3	+17 05	prv	1.3 S	4.2 E	6, 6.5	195	gM0, F8		149	(3)
2 CVn (MS)	12 16.1	+40 40	β	0.7 S	3.4 W	5.5, 8	11	M1, F7		74	(44)
α CVn (MS)	12 56.0	+38 19	-	-	-	3, 5.5	20	A0, F0	120	109	(24)
*WNC 4 (MS)	12 22.2	+58 05	δ Uma	1.0 N	0.9 E	9.0, 9.3	52	M40	500	47 (ni)	(10) 4284: 0.2 W
*3C 273 (Q)	12 29.1	+02 03	η Vir	2.8 N	2.2 E	12.9	---	---	2.4B	238	
*NGC 4517 (Sc)	12 32.8	+00 07	γ Vir	1.6 N	2.2 W	[13.3]	10X1. 5	H5-4	50M	239	
*NGC 4501 (Sb)	12 32.0	+14 25	β Leo	0.2 S	10.5 E	[12.8]	6.8X3 .7	M88	60M	194	4516: 0.1 N/0.3 E
*NGC 4548 (SBb)	12 35.4	+14 30	PRV	0.1 N	0.9 E	[13.3]	5.2X4 .2	M91	60M	194	4571: 0.3 S/0.3 E
*NGC 4569 (Sbab)	12 36.8	+13 10	PRV	1.3 S	0.4 E	[13.3]	9.5X4 .4	M90	60M	194	IC 3583: 0.1 N

NGC 4552 (E)	12 35.7	+12 33	PRV	0.5 S	0.3 W	[12.7]	3.5	M89	60M	194	
*NGC 4550 (SB0)	12 35.5	+12 13	PRV	0.4 S	---	[12.5]	3.3X0 .9	*H36- 1	50M	194	4551: 0.1 NE
*NGC 4559 (SBc)	12 36.0	+27 58	γ Com	0.3 S	2.0 E	[13.6]	10X4	*H92. 1	30M	149	
*NGC 4565 (Sb)	12 36.3	+25 59	PRV	2.0 S	0.1 E	[13.2]	15X2	*H24- 5	50M	149	4562: 0.1 S/0.2 E
NGC 4570 (S0)	12 36.9	+07 15	δ Vir	3.9 N	4.7 W	[12.3]	3.7X1 .2	*H321	55M	194	
NGC 4590 (GC)	12 39.5	-26 45	β Crv	3.4 S	1.2 E	7.3	11	M68	33K	329	
*NGC 4594	12	-11	δ Crv	4.8 N	2.4 E	[12.0]	8.6X4	M104	50M	284	*H43-1 Som-
*NGC 4608 (SB0)	12 41.2	+10 09	30 Vir	0.1 S	0.2 W	[13.3]	3.3X2 .9	H69-2	60M	194	
*NGC 4596 (SB0-a)	12 39.9	+10 11	PRV	---	0.3 W	[13.0]	4.0X3 .0	*H24- 1	55M	194	
NGC 4654 (SBcd)	12 43.9	+13 08	ϵ Vir	2.2 N	4.5 W	[13.2]	5.0X3 .1	*H126 -1	50M	194	4639: 0.3 NW
*NGC 4656 (SBm)	12 44.0	+32 10	α CVn	6.2 S	2.6 W	[13.9]	15X2	*H176 -1	25M	108	4631: 0.5 NW
NGC 4660 (E)	12 44.5	+11 11	ϵ Vir	0.3 N	4.3 W	[12.7]	2.1X1 .7	*H71- 2	40M	194	
*NGC 4649 (E2)	12 43.7	+11 33	PRV	0.4 N	0.2 W	[13.1]	7.6X6 .2	M60	60M	194	4647: 0.1 NW
*NGC 4621 (E5)	12 42.0	+11 39	PRV	0.1 N	0.4 W	[13.0]	5.4X3 .7	M59	60M	194	4606/07: 0.3 N/0.2 W
*NGC 4579 (SBb)	12 37.7	+11 49	PRV	0.3 N	1.0 W	[13.1]	6.0X4 .8	M58	60M	194	
*NGC 4665 (SB0-a)	12 45.1	+03 03	δ Vir	0.4 S	2.8 W	[12.9]	3.5	*H142 -1	50M	239	
*NGC 4736 (Sab)	12 50.9	+41 07	β CVn	0.2 S	3.2 E	[13.6]	5.0X3 .5	M94	14.5 M	75	

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The Power of the Sun's Engines

By Dr. Ethan Siegel

Here on Earth, the sun provides us with the vast majority of our energy, striking the top of the atmosphere with up to 1,000 Watts of power per square meter, albeit highly dependent on the sunlight's angle-of-incidence. But remember that the sun is a whopping 150 million kilometers away, and sends an equal amount of radiation in all directions; the Earth-facing direction is nothing special. Even considering sunspots, solar flares, and long-and-short term variations in solar irradiance, the sun's energy output is always constant to about one-part-in-1,000. All told, our parent star consistently outputs an estimated 4×10^{26} Watts of power; one *second* of the sun's emissions could power all the world's energy needs for over 700,000 years.

That's a literally astronomical amount of energy, and it comes about thanks to the hugeness of the sun. With a radius of 700,000 kilometers, it would take 109 Earths, lined up from end-to-end, just to go across the diameter of the sun once. Unlike our Earth, however, the sun is made up of around 70% hydrogen by mass, and it's the individual protons — or the nuclei of hydrogen atoms — that fuse together, eventually becoming helium-4 and releasing a tremendous amount of energy. All told, for every four protons that wind up becoming helium-4, a tiny bit of mass — just 0.7% of the original amount — gets converted into energy by $E=mc^2$, and that's where the sun's power originates.

You'd be correct in thinking that fusing $\sim 4 \times 10^{38}$ protons-per-second gives off a tremendous amount of energy, but remember that nuclear fusion occurs in a *huge* region of the sun: about the innermost quarter (in radius) is where 99% of it is actively taking place. So there might be 4×10^{26} Watts of power put out, but that's spread out over 2.2×10^{25} cubic meters, meaning the sun's energy output *per-unit-volume* is just $18 \text{ W} / \text{m}^3$. Compare this to the average human being, whose basal metabolic rate is equivalent to around 100 Watts, yet takes up just 0.06 cubic meters of space. In other words, **you emit 100 times as much energy-per-unit-volume as the sun!** It's only because the sun is so large and massive that its power is so great.

It's this slow process, releasing huge amounts of energy *per reaction* over an incredibly large volume, that has powered life on our world throughout its entire history. It may not appear so impressive if you look at just a tiny region, but — at least for our sun — that huge size really adds up!

Check out these “10 Need-to-Know Things About the Sun”:
<http://solarsystem.nasa.gov/planets/profile.cfm?Object=Sun>.

Kids can learn more about an intriguing solar mystery at NASA's Space Place:
<http://spaceplace.nasa.gov/sun-corona>.

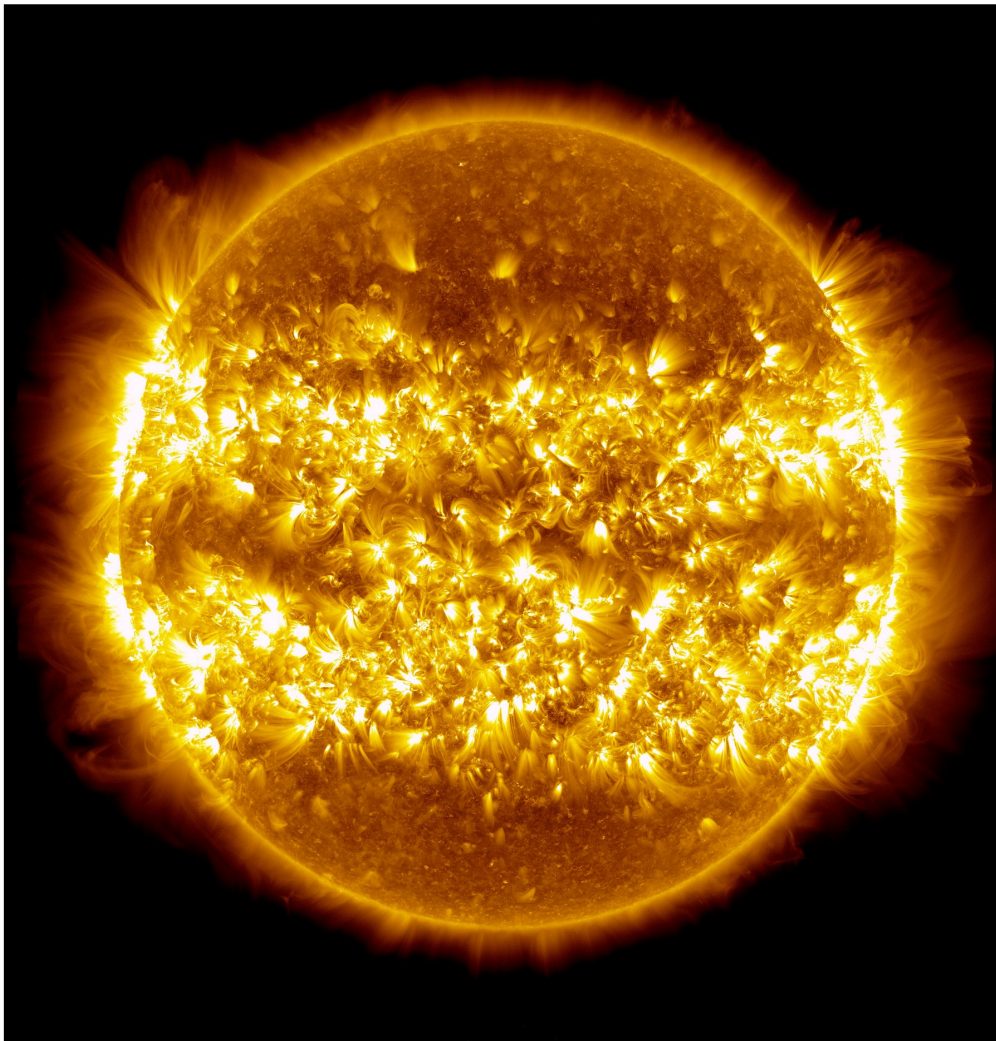


Image credit: composite of 25 images of the sun, showing solar outburst/activity over a 365 day period; NASA / Solar Dynamics Observatory / Atmospheric Imaging Assembly / S. Wiessinger; post-processing by E. Siegel.

Editors download photo here: http://spaceplace.nasa.gov/review/partners/2014-04/sun_sharp.jpg



the Space Place

May – June 2014 / Vol. 7, Issue 3

NEWS AND NOTES FOR FORMAL AND INFORMAL EDUCATORS

The Space Place is a NASA website for elementary school-aged kids, their teachers, and their parents.

It's colorful!
It's dynamic!
It's fun!

It's rich with science, technology, engineering, and math content!

It's informal.
It's meaty.
It's easy to read and understand.
It's also in Spanish.
And it's free!

It has over 150 separate modules for kids, including hands-on projects, interactive games, animated cartoons, and amazing facts about space and Earth science and technology.

*Not only is the Space Place constantly developing brand-new content, we also make sure to keep our existing products as up-to-date and as exciting as possible. Nowhere is this clearer than in our educational mobile game development. In the past couple of months we have updated our classic games *Satellite Insight* and *Comet Quest*, and our magazine-style app *Space Place Prime*. *Comet Quest* is now as exciting as ever with all-new game play. We have expanded our reach by releasing *Space Place Prime* for Android devices, and all of our products are now compatible with iOS7. The new updates of *Comet Quest* and *Satellite Insight* now include access to Apple's Game Center. See how well you stack up against players from around the world!*

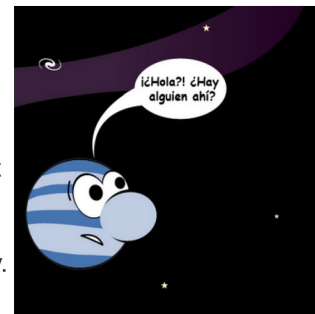
What's New? Craters!



Ever stop to think about how many craters are on the Moon? Do you wonder why Earth hasn't suffered a similar scarred fate? It's a good mystery to puzzle about, and can lead to some excellent classroom science discussions. A new page on Space Place answers this quandary with its usual dose of fun and humor. Check it out at <http://spaceplace.nasa.gov/craters>.

Space Place en Español

We are constantly adding our newest content to Space Place en Español, but we've added even more to the site recently. Our popular new pages



"The Lone Planet," "What is a Planet," "A Solar Mystery," and our new activity "Build a Spacecraft" are all available on the Spanish language site. Check them out at <http://spaceplace.nasa.gov/sp/>.

Spotlight on Game Center



The Space Place team is proud to announce that we are one of the first NASA groups to release mobile games that are compatible with Apple's Game Center app. This

app, which works with both *Comet Quest* and *Satellite Insight*, allows you to compare scores with anyone else in the world. How do your scores measure against friends, strangers, and high-scorers. Who knows? Maybe you can set the highest score in the world. You'll have to beat us first, though... Check out our mobile games at <http://spaceplace.nasa.gov/ios>.

Where kids and grown-ups have fun with space science and technology

For the Classroom



It's that time of year again—Space Place calendar time, that is! We've just released the most recent edition of our hit calendar. Perfect for the classroom, this June 2014-June 2015 calendar comes complete with fun science facts, historical notes, and beautiful images. Can't wait until then? Don't worry, we still have the remaining

months of last year's calendar ready to download as well. Spice your classroom up today! Download at <http://spaceplace.nasa.gov/calendar>.

For Out-of-School Time



With summer fast approaching, now might be a good time to get your wardrobe in order. Why not create your own fashionable summer wear this year? Space Place can help you out. We've got a printout t-shirt design that can be ironed on to the shirt of your choosing. What better way to tell the world that you are both stylish and science savvy than with a Space Place t-shirt? Check it out here: <http://spaceplace.nasa.gov/t-shirt>.

Special Days

May 2 - The first commercial jet flight takes place, 1953. Why do we need rockets? Can't an airplane just keep going into space? <http://spaceplace.nasa.gov/dr-marc-technology>.

May 6 - National Space Day. Build your own satellite to celebrate! <http://spaceplace.nasa.gov/build-a-spacecraft>.

May 18 - Eruption of Mount St. Helens, 1980. It was a pretty impressive volcanic eruption. Does anything like that happen on other planets? <http://spaceplace.nasa.gov/volcanoes>.

May 26 - Birthday of Dr. Sally Ride, 1951. She was the first American woman in space. Women do all kinds of important work at NASA. <http://spaceplace.nasa.gov/space-place-live>.



June 5 - World Environment Day. Take a look at Earth's many environments. <http://spaceplace.nasa.gov/gallery-earth/geography>.

June 13 - The first roller coaster opens, 1884. How does a roller coaster work? Build a "Newtonian Physics Machine" and find out. <http://spaceplace.nasa.gov/momentum>.

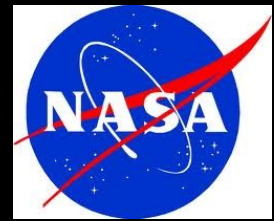
June 30 - A comet or asteroid explodes over Siberia, 1908. Do comets or asteroids do more than explode or kill off dinosaurs? <http://spaceplace.nasa.gov/comet-ocean>.

Share

Want some help spreading the word about NASA's Space Place? We've got a page with ready-to-use website descriptions, logos, and links to all our social media. Check out <http://spaceplace.nasa.gov/share>.

Send Feedback

Please let us know your ideas about ways to use NASA's Space Place in your teaching. Send to info@spaceplace.nasa.gov.



And For The Young Stargazers:
Check out these fun websites from NASA!

<http://climate.nasa.gov/kids>

<http://scijinks.gov>

<http://spaceplace.nasa.gov>



Where We Meet:

TCC Northeast Campus, 3727 E. Apache St., Student Union Bldg. 2, Room 1603

There is PLENTY of parking, lighting and security on this campus.

To get to TCC NE Campus, take the Harvard Exit off of Hwy. 11 (Gilcrease Expressway). Go south for about 1/2 mile to the campus located at the corner of N. Harvard and Apache. Turn east on Apache and take the entrance in front of Bldg. 3 (the large round building). Then turn right and park in front of Student Union Building #2. Room 1603 is just off of the lobby.

Google-type driving direction map at <http://www.tulsacc.edu/13273/>



The General Meetings are free and open to the public.

We hope to see you there!

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MEMBERSHIP INFORMATION

MEMBERSHIP RATES FOR 2014 WILL BE AS FOLLOWS:

Adults - \$45 per year. Includes Astronomical League membership.

Senior Adults - \$35 per year. *For those aged 65 and older.* Includes Astronomical League membership.

Students - \$30 per year. Includes Astronomical League Membership.

Students - \$25 per year. *Does not include Astronomical League membership.*

The regular membership allows all members of the family to participate in Club events, but only ONE voting membership and ONE Astronomical League membership per family.

Additional Family Membership - \$15 with Astronomy Club of Tulsa voting rights, \$20 with Club voting rights *and* Astronomical League membership.

THOSE WISHING TO EARN ASTRONOMICAL LEAGUE OBSERVING CERTIFICATES NEED TO HAVE A LEAGUE MEMBERSHIP.

MAGAZINES:

Astronomy is \$34 for one year or \$60 for 2 years.

www.astronomy.com

Sky & Telescope is \$33 per year.

www.skyandtelescope.com

Sky & Telescope offers a 10% discount on their products.

If you are an existing S&T subscriber, you can renew directly with S&T at the same Club rate. Both S&T and Astronomy now have digital issues for computers, iPads and smart phones.

ONLINE REGISTRATION

We now have an automated online registration form on the website for new memberships, membership renewals and magazine subscriptions. Just simply type in your information and hit "send" to submit the information. You can then print a copy of the form and mail it in with your check, or use our convenient PayPal option. .

Link: <http://www.astrotulsa.com/Club/join.asp>



Astronomy Club of Tulsa





*Wishing you and yours a safe and happy
Memorial Day Weekend*





Photo: Parade of The Stars of the Summer Milky Way,, by Tamara Green.

THE ASTRONOMY CLUB OF TULSA INVITES YOU TO MAKE PLANS THIS SUMMERTO JOIN US AT A STAR PARTY!

OPEN TO THE PUBLIC

For more information please visit www.astrotulsa.com.

The Observer is a publication by the Astronomy Club of Tulsa. The Astronomy Club of Tulsa is a 501C 3 non-profit organization open to the public. The Club started in 1937 with the single mission to bring the joy and knowledge of astronomy to the community of Tulsa, OK and the surrounding area. Today our mission remains exactly the same. We travel to local schools, churches and many other venues with scopes and people to teach. Our observatory is located in Mounds and many public programs are offered there. To join the Astronomy Club of Tulsa please visit www.astrotulsa.com where you will find all the information necessary to become a member.

