



Astronomy Club of Tulsa

Observer

April 2014



*Photo: Telescopes at Bass Pro, by Tamara Green.*

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INSIDE THIS EDITION:

ITEM	PAGE
Calendar and Upcoming Events	3
<i>President's Message</i> , by Mandy Nothnagel	4
<i>Treasurer's and Membership Report</i> , by Tim Davis	5
<i>The Secretary's Stuff</i> , by Tamara Green	6
<i>NITELOG</i> , by Tom Hoffelder	7
<i>Old Tool, New Use: GPS and the Terrestrial Reference Frame</i> By Alex H. Kasprak	13
NASA'S " <i>The Space Place</i> " Newsletter	15
Where We Meet	18
Officers, Board, Staff and Membership Info	19
Holiday Greeting with Links to Fun Activities from NASA!	20

## APRIL 2014

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

## MAY 2014

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

### UPCOMING EVENTS:

General Meeting	Fri, Apr 11	TCC NE Campus	7:00 PM
Sidewalk Astronomy	Sat, Apr 12	Bass Pro	7:30 PM
Public Star Party	Fri, Apr 18	ACT Observatory	7:30 PM
Good Friday	Fri, Apr 18		
Back-Up Night	Sat, Apr 19	ACT Observatory	7:30 PM
Easter	Sun, Apr 20		
Members' Night	Fri, Apr 25	ACT Observatory	7:30 PM
Club Work Day	Sat, Apr 26	ACT Observatory	TBA
Back-Up Night	Sat, Apr 26	ACT Observatory	7:30 PM
General Meeting	Fri, May 9	ACT Observatory	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



# President's Message

## By Mandy Nothnagel

Hello All,

I hope you have all had a great 2014 so far! It sure has been a busy one, for myself and for the club. In the last month, aside from our normal events, we've been invited to two lectures and have had many group requests. Spring is the beginning of the warm weather and the end of the school year- all of the schools are rushing to come to the observatory! Unfortunately, the weather has been pretty undesirable for Astronomy during our scheduled nights. The meteorologists are forecasting a very stormy but "unpredictable" Spring- but what do they know? Ha!

The first of the two lectures to which we were invited was that of Frank Wilczek, who won the Nobel Prize in Physics at the age of 21. As part of TU's Presidential Lecture series, Wilczek explained and demonstrated the color spectrum in his lecture titled "Expanding the Doors of Perception." One of my favorite parts, and also his, about his lecture was his section on the Mantis Shrimp- a fascinating little creature, really! He explained that Humans can only see what we know as the "visual spectrum" because we only have 3 photoreceptor proteins in our eyes. Some animals, such as birds, bees, and butterflies, have 4 to 5 of these receptors- depending on the species, they can see a mix of infrared, ultraviolet, and the familiar-to-us visible light. The Mantis Shrimp has 17 photoreceptor proteins- this means they can see A LOT of colors and things that we cannot- in my opinion, that's pretty awesome. He has written a few books, his latest titled *The Lightness of Being*, is now on my "must read" list.

The second lecture, hosted by Gentry Lee of the Jet Propulsion Laboratory and chief engineer of the Curiosity Mission to Mars, takes place on Friday, April 11th at 10:30am at the Chapman Music Hall in the Tulsa PAC. This is the same morning as our General Meeting. Hosted by the Tulsa Town Hall, Lee will be discussing his role and experiences with the NASA and the Curiosity Mission. He will provide a unique insight and perspective and share exciting stories about the team's adventures before, during, and after its landing. There will be many of us attending- if you haven't already, please make sure that you contact Richard ([act\\_vp@astrotulsa.com](mailto:act_vp@astrotulsa.com)) as soon as possible if you are interested in attending. This lecture will not be free, but the Tulsa Town Hall has offered the Astronomy Club of Tulsa discounted tickets. It is likely these tickets will cost \$20 or less. I really hope you join us!

This is going to be an exciting season for us- hopefully filled with lots of cool storms (the pretty ones, not the damaging ones!) during the day and beautiful, clear skies for us during the evenings and weekends. We'll have a few groups out to the observatory in the next few months so be sure to check your email often if you'd like to help us inspire the current and future generations!

Peace, love, and clear skies,

Mandy Nothnagel





# Treasurer's and Membership Report

## By Tim Davis

**Astronomy Club of Tulsa: 128 members, including 19 new members in 2014.**

**Welcome to our new members this month:** Russell Abbott, Dan Wooliver and Sherry Upton, and Jack Obeid.

**Club Accounts as of Mar 31, 2014:**

**Checking: \$3,779.41**

**Savings: \$2,769.09**

**Investment accounts: \$18,421.79** (*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.

**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](http://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](http://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

### PRESENT:

**Mandy Nothnagel, President**

**Richard Brady, VP**

**Tamara Green, Secretary**

**Tim Davis, Treasurer**

**Skip Whitehurst, Board**

**John Land, Board**

**Stan Davis, Board**

**Michael Blaylock, Board**

### NOT PRESENT:

**Lee Bickle, Board**

**Christopher Proctor, Board**

**James Taggart, Board, Facilities Manager**

The meeting was held at Tulsa Community College Northeast Campus and there were 28 attendees.

**WELCOME AND INTRODUCTION:** VP Richard called the meeting to order at 7:00 PM and welcomed members and guests while Mandy attempted to get the audio hooked up to the computer and projector for the presentation. When the audio was hooked up, the presentation began.

**PROGRAM:** "Live From Space" on the NatGeo channel, a special presentation from the International Space Station. Due to the program being streamed live, all officers and staff reports were given during commercial breaks.

### OFFICERS'/STAFF REPORTS:

**PRESIDENT** – Mandy had a short powerpoint touching on the "Live from Space" program. She submitted a picture of us at the dinner meeting and a picture of just her, along with questions for the astronauts via Twitter, #hellofromearth. Plus, there was a cool photo of a volcano erupting, as seen from the ISS. She also talked about the new Cosmos series that airs on Fox on Sunday nights and on NatGeo on Monday nights. You can also watch it online at [www.cosmosontv.com](http://www.cosmosontv.com). Following Richard's presentation (see below), Mandy then talked about "Spacey-type News and Stuff". She then touched on upcoming club events.

**VICE PRESIDENT** – Richard talked about a couple of exciting events coming up, such as Gentry Lee, who is giving a lecture at Chapman Music Hall, Tulsa PAC on Friday Apr. 11 at 10:30 AM. We will get 10 free tickets. Richard will send an email to the club to see how many are interested, as there will be a small fee for extra tickets. Also, he talked about the "Mars Update" Night Sky Network Telecon. This will be on Mar. 26 at 8:00 PM, call 1-888-455-9236, up to 15 min prior. The passcode is NIGHT SKY NETWORK, THEN Your Name, then Astronomy Club of Tulsa. One winner will receive a free copy of [The International Atlas of Mars Exploration: The First Five Decades](#), by Philip J. Stooke.

**SECRETARY** – There was no time after the presentation for other officers or staff reports.

**TREASURER** – There was no time after the presentation for other officers or staff reports.

**GROUPS** – There was no time after the presentation for other officers or staff reports.

**FACILITIES** - There was no time after the presentation for other officers or staff reports.

**PR/OUTREACH/SIDEWALK** – Owen announced the Sidewalk event, to take place on Sat, Mar 15 at 7:00 PM (or earlier if you are interested in doing solar observing, at about 3:00 or 4:00) at Bass Pro, provided it is not raining.

**OBSERVING** – There was no time after the presentation for other officers or staff reports. Mandy adjourned the meeting.

## NITELOG - Norway INTErurban Local Observing Group

By Tom Hoffelder

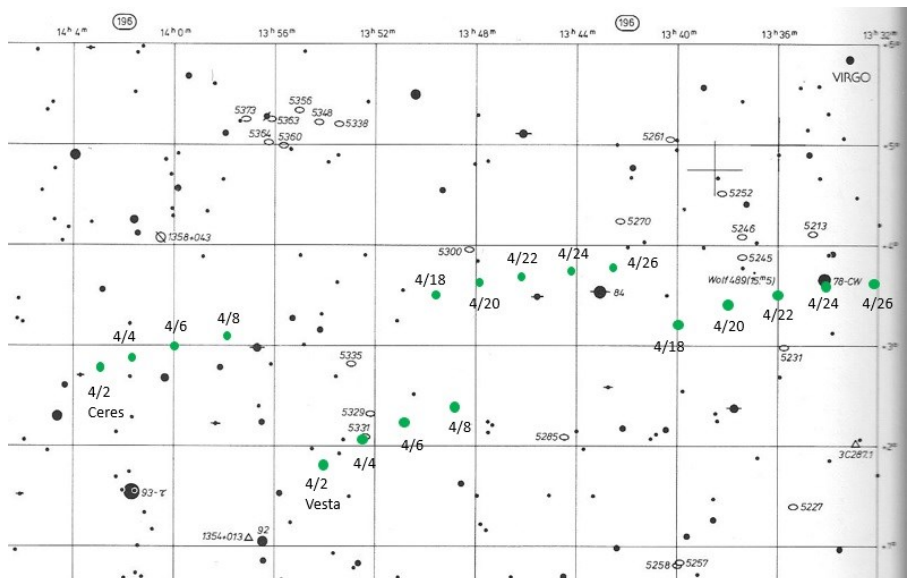
So much stuff up there to check out this month; I'll let you read about it below! Since the weather didn't cooperate for a Messier Marathon in March, we will hope it will do so the end of April. As last month, if you would like to be involved, at any level, please let me know and I will keep you updated should the opportunity arise.

**OBSERVING:** March open house at the Twitchell Observatory is scheduled for Monday the 7th at 8:00, weather permitting of course. With a first quarter moon, two planets, a dwarf planet and an asteroid up there, it's a Solar System extravaganza! If it wasn't for the darn moon (which as some of you know I now tolerate as opposed to hate), we might have been able to throw in a comet also.

**COMETS:** Nothing earthshaking but there is the possibility of a four comet night, especially if you are doing an April Marathon the end of the month. The comet file lists the details and the locations for the "observable Saturdays;" extrapolate locations using the daily motion values for dates a few days either side.

**PLANETS:** Jupiter in Gemini still rules the evening skies as far as brilliance, but Mars being at opposition takes center stage. It's not a great opposition but better than the last two, and since it is the only planet that shows surface detail in our scopes, it always deserves some attention even tho it is always rather tiny in the eyepiece. (Don't know if those Mars in August emails are still being forwarded, but if they are and you get one later this year, do a reply-all and say, "Sorry, it was here in April this year, and it wasn't that big!") I like to use S&T's Mars Profiler (<http://www.skyandtelescope.com/observing/objects/javascript/mars#>) to get an idea of what surface features might be visible if I plan to view. Opposition is on the 8th and the diameter varies from 14.8 arcsec on the 1st, to 15.2 on the 12th thru 15th, to 14.5 on the 30th, which is along the lines of the "super moon" meaning not enough difference to notice. It is high enough to observe (in New England) around 9:30 PM on April 1st, and near the meridian (for everyone and best time to observe!) around 1 AM. By the 30th that has "improved" to as soon as you can see it and 10:30 PM. You can't miss it in Virgo, so just "arc to Arcturus" and move on to Mars. With Saturn following in Libra, check a clear sky around 11 PM to see the three lights in the night sky that gave us Tuesday, Thursday and Saturday. If the moon is there, throw in Monday.

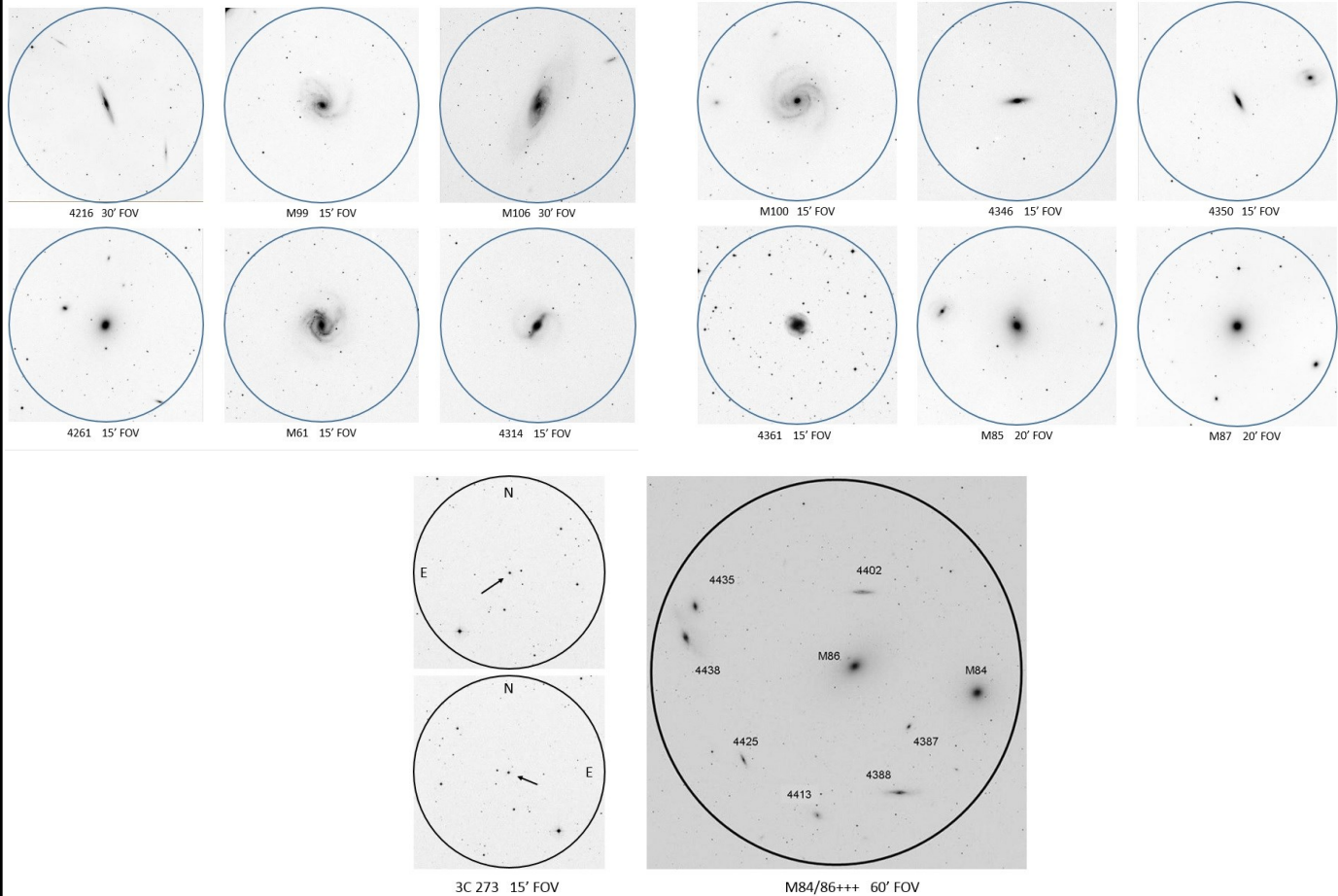
**ASTEROIDS:** February featured two relatively bright comets close enough together for viewing in a wide field scope; this month it is two asteroids, Ceres and Vesta at mag 7 and 6. As you probably know, Ceres was upgraded to a dwarf planet when Pluto (deservedly) went the other way, but as far as seeing the two at the same time I'm considering Ceres an asteroid. S&T.com has a chart ([http://media.skyandtelescope.com/documents/Web\\_Ceres\\_Vesta\\_2014.pdf](http://media.skyandtelescope.com/documents/Web_Ceres_Vesta_2014.pdf)) showing the path of the two, but those lines make me dizzy. Since they will look like stars, I need dots on a chart, and dots that represent the brightness of the asteroids similar to the star magnitudes. That is what I have attempted to do with the attached chart at two day intervals for select dates. (I originally started with red asteroids, but quickly remembered that is not a good idea.) The asteroid spreadsheet gives more detailed information, and you will note on it and the chart that the separation is less than 3 degrees the entire month.



**STARS:** Two carbon stars, one especially red with a B-V of 4.5 and current magnitude approx 9.5, and six doubles of varying magnitudes and separations ranging from 2.3 to 15 arcsec.

## NITELOG, Ct'd.

**THE GOOD STUFF:** Except for one lonely (but relatively large and bright) planetary, the list is again all galaxies, as would be expected this time of year. And as the DSS negatives indicate some of them could provide some interesting details in the eyepiece. Nine are Messier Objects, one of which, M61, doubles as a Herschel 400 Object, with ten more of those included. In the spreadsheet comments section, a "+" in front of an NGC number indicates the object is obvious in the DSS image. Two of my favorite views enhance the April list, one being the one degree field around M84/86 which includes seven other galaxies. The other, probably my all time favorite object, looks like a dim star but is so much more. 3C 273 is the brightest quasar and the only one "easily" seen in moderate sized scopes. On a clear day you can see forever; in our scopes on a clear night you can see 2.4 billion light years. Close enough!



**QUESTIONS:** As always, questions and comments are welcome!

tom hoffelder

[rocksnstars@gmail.com](mailto: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.*



4/19			(4/20)			4/26			(4/27)	
SS	NTE	ATE	MR	SS	NTE	ATE	NTB	ATE	NTB	
19:31	20:39	21:19	00:14	19:40	20:50	21:32	04:29			

Object (Type)	RA	Dec	Star	N/S	E/W	Mag*/(# of Stars)	Size (")/ Sep (")	Spect/ M# or H#	Dist (ly)	Urano Page	Comment, [B-V], {cmt mag} (opt x)
U Hya	10 37.6	-13 23	v Hya	2.9 N	3.0 W	4.7-6.2		CII	500	280	[2.7] {5.4}
V Hya	10 51.6	-21 15	v Hya	5.1 S	0.5 E	6.5-12..		C	20K	325	[4.5] {9.5}
γ Leo	10 20.0	+19 50	---	---	---	2.5, 3.5	4.4	K0, G7	125	144	(110)
Σ1434	10 27.0	+18 05	PRV	1.8 S	1.7 E	8.5, 8.5	6.4			144 ni	(75)
Σ1520	11 16.1	+52 47	β UMa	3.6 S	2.2 E	6.5, 8	13			46 ni	(35)
Σ1510	11 08.0	+52 53	PRV	0.1 N	1.2 W	7, 8.5	5			46 ni	(100)
ξ UMa	11 18.2	+31 32	---	---	---	4.5, 5	2.3		34	106	(200)
88 Leo	11 31.7	+14 22	β Leo	0.2 S	5.2 W	6.5, 8.5	15	dF7, dK6	75	192	(30)
*NGC 4216 (SBb)	12 15.9	+13 09	o Vir	4.4 N	2.7 E	[13.1]	8.1X1.8	H35-1		193	+4206/22
*NGC 4254 (Sc)	12 18.8	+14 25	PRV	1.3 N	0.8 E	[13.0]	5.3X4.6	M99	50M	193	
*NGC 4258 (SBbc)	12 19.0	+47 18	χ UMa	0.5 S	5.7 E	[13.5]	18X7	M106	23M	74	+4248
*NGC 4346 (SB0)	12 23.5	+47 00	PRV	0.3 S	0.8 E	[12.7]	3.2X1.3	*H210-1	52M	74	
*NGC 4303 (SBbc)	12 21.9	+04 28	η Vir	5.1 N	0.5 E	[13.1]	6.5X5.9	M61	65M	238	also *H139-1

*NGC 4261 (E2)	12 19.4	+05 49	PRV	0.8 W	1.3 N	[13.4]	4.1X3.6	*H139-2	100M	238	+4257/64
*NGC 4314 (SBa)	12 22.5	+29 54	$\gamma$ Com	1.7 N	1.0 W	[13.3]	4.2X3.7	*H76-1	52M	108	4308 0.3 NW
*NGC 4321 (SBbc)	12 22.9	+15 49	11 Com	2.0 S	0.5 E	[13.3]	7.5X6.1	M100	52M	193	+4322/28
*NGC 4350 (S0)	12 24.0	+16 42	PRV	0.9 N	0.3 E	[12.6]	2.9X1.6	*H86-2	52M	193	+4340
*NGC 4361 (PN)	12 24.5	-18 47	$\gamma$ Crv	1.2 S	2.1 E	10.9	2.1	*H65-1	32	328	
NGC 4365 (E3)	12 24.5	+07 19	$\circ$ Vir	1.4 S	4.8 E	[13.5]	6.9X5.0	*H30-1	70M	193	4370 0.2 NE
NGC 4371 (SB0-a)	12 24.9	+11 42	$\circ$ Vir	3.0 N	4.7 E	[13.3]	4.0X2.3	*H22-1	45M	193	
*NGC 4374 (E1)	12 25.1	+12 53	$\circ$ Vir	4.2 N	4.8 E	[13.2]	6.5X5.6	M84	54M	193	
*NGC 4406 (E3)	12 26.2	+12 56	PRV	0.1 N	0.3 E	[13.3]	8.9X5.8	M86	54M	193	+7 OTHERS
*NGC 4382 (S0-a)	12 25.4	+18 11	11 Com	0.4 N	1.1 E	[13.0]	7.1X5.5	M85	54M	148	
NGC 4394 (SBb)	12 25.9	+18 13	PRV	-	0.1 E	[13.3]	3.4X3.2	*H55-2	45M	148	
NGC 4450 (Sab)	12 28.5	+17 05	11 Com	0.7 S	1.9 E	[13.3]	5.4X4.1	*H90-2	54M	193	
NGC 4472 (E2)	12 29.8	+08 00	$\circ$ Vir	0.7 S	6.0 W	[13.2]	10X8	M49	52M	193	4470 0.2 S
*NGC 4486 (E/P)	12 30.8	+12 23	$\varepsilon$ Vir	1.5 N	7.7 W	[13.0]	8.3X6.6	M87	54M	194	+4478/86A
NGC 4478 (E2)	12 30.3	+12 20	PRV	0.1 S	0.1 W	[12.5]	1.8X1.5	*H124-2	54M	194	4476 0.1 W
*3C 273 (Q)	12 29.1	+02 03	$\eta$ Vir	2.8 N	2.2 E	12.9	---	---	2.4B	238	

\*[Surf  
Brtnss  
for GX's]

\*H400 ni=shown,

\*DSS image

mag per  
square  
arcmin  
not  
identi-  
fied

Comet	RA	Dec	Star	N/S	E/W	N-S/day	E-W/day	Mag <sup>1</sup>	Urano I	Alt <sup>2</sup>	Date	EDT
C/2014 E2 Jacques	08 09.4	-13 18	$\alpha$ Mon	3.7 S	6.8 E	0.9 N	1.0 W	10.5	275	23	4/19	21:30
C/2012 K1 PAN-STARRS	14 46.3	+45 05	$\lambda$ Boo	1.0 S	5.3 E	0.5 N	0.8 W	10	77	47	4/19	21:30
C/2014 E2 Jacques	07 43.9	-07 33	$\alpha$ Mon	2.1 N	0.7 E	0.7 N	0.8 W	10	274	21	4/26	21:30
C/2012 K1 PAN-STARRS	14 04.8	+47 59	$\lambda$ Boo	1.9 N	1.9 W	0.3 N	1.1 W	10	77	59	4/26	21:30
C/2013 R1 Lovejoy	17 54.2	-13 43	$\circ$ Ser	0.8 S	3.0 E	0.3 S	0.4 W	10	293	24	4/27	02:00
C/2012 X1 LINEAR	21 25.7	-09 45	$\beta$ Aqr	4.1 S	1.3 W	0.2 S	0.4 E	8	300	16	4/27	04:00

<sup>1</sup><http://www.aerith.net/comet/future-n.html>

<sup>2</sup>Maine, at time noted

Asteroid	RA	Dec	Star	N/S	E/W	Mag	Date	EDT
Vesta	13 54.1	+01 50	$\tau$ Vir	0.3 N	1.9 W	5.9	4/2	20:00
Ceres	14 03.2	+02 47	PRV	1.0 N	2.3 E	7.1		
Vesta	13 52.4	+02 02	$\tau$ Vir	0.5 N	2.3 W	5.9	4/4	
Ceres	14 01.7	+02 54	PRV	0.9 N	2.3 E	7.1		
Vesta	13 50.7	+02 14	$\tau$ Vir	0.7 N	2.7 W	5.8	4/6	
Ceres	14 00.1	+03 01	PRV	0.8 N	2.4 E	7.1		
Vesta	13 49.0	+02 26	$\tau$ Vir	0.9 N	3.2 W	5.8	4/8	
Ceres	13 58.4	+03 08	PRV	0.7 N	2.4 E	7.0		
Vesta	13 39.8	+03 16	$\tau$ Vir	1.7 N	5.5 W	5.8	4/18	
Ceres	13 49.7	+03 36	PRV	0.3 N	2.5 E	7.0		
Vesta	13 37.9	+03 24	$\tau$ Vir	1.9 N	5.9 W	5.8	4/20	
Ceres	13 47.9	+03 40	PRV	0.3 N	2.5 E	7.0		
Vesta	13 36.1	+03 32	$\tau$ Vir	2.0 N	6.4 W	5.8	4/22	
Ceres	13 46.1	+03 43	PRV	0.2 N	2.5 E	7.1		
Vesta	13 34.2	+03 38	$\tau$ Vir	2.1 N	6.8 W	5.9	4/24	
Ceres	13 44.4	+03 45	PRV	0.1 N	2.6 E	7.1		
Vesta	13 32.5	+03 43	$\tau$ Vir	2.2 N	7.3 W	5.9	4/26	
Ceres	13 42.7	+03 47	PRV	0.1 N	2.6 E	7.1		
Vesta	13 30.7	+03 48	$\tau$ Vir	2.3 N	7.7 W	5.9	4/28	
Ceres	13 41.0	+03 48	PRV	-	2.6 E	7.2		
Vesta	13 29.0	+03 52	$\tau$ Vir	2.4 N	8.1 W	6.0	4/30	
Ceres	13 39.3	+03 49	PRV	-	2.6 E	7.2		



## Old Tool, New Use: GPS and the Terrestrial Reference Frame

By Alex H. Kasprak

Flying over 1300 kilometers above Earth, the Jason 2 satellite knows its distance from the ocean down to a matter of centimeters, allowing for the creation of detailed maps of the ocean's surface. This information is invaluable to oceanographers and climate scientists. By understanding the ocean's complex topography—its barely perceptible hills and troughs—these scientists can monitor the pace of sea level rise, unravel the intricacies of ocean currents, and project the effects of future climate change.

But these measurements would be useless if there were not some frame of reference to put them in context. A terrestrial reference frame, ratified by an international group of scientists, serves that purpose. "It's a lot like air," says JPL scientist Jan Weiss. "It's all around us and is vitally important, but people don't really think about it." Creating such a frame of reference is more of a challenge than you might think, though. No point on the surface of Earth is truly fixed.

To create a terrestrial reference frame, you need to know the distance between as many points as possible. Two methods help achieve that goal. Very-long baseline interferometry uses multiple radio antennas to monitor the signal from something very far away in space, like a quasar. The distance between the antennas can be calculated based on tiny changes in the time it takes the signal to reach them. Satellite laser ranging, the second method, bounces lasers off of satellites and measures the two-way travel time to calculate distance between ground stations.

Weiss and his colleagues would like to add a third method into the mix—GPS. At the moment, GPS measurements are used only to tie together the points created by very long baseline interferometry and satellite laser ranging together, not to directly calculate a terrestrial reference frame.

"There hasn't been a whole lot of serious effort to include GPS directly," says Weiss. His goal is to show that GPS can be used to create a terrestrial reference frame on its own. "The thing about GPS that's different from very-long baseline interferometry and satellite laser ranging is that you don't need complex and expensive infrastructure and can deploy many stations all around the world."

Feeding GPS data directly into the calculation of a terrestrial reference frame could lead to an even more accurate and cost effective way to reference points geospatially. This could be good news for missions like Jason 2. Slight errors in the terrestrial reference frame can create significant errors where precise measurements are required. GPS stations could prove to be a vital and untapped resource in the quest to create the most accurate terrestrial reference frame possible. "The thing about GPS," says Weiss, "is that you are just so data rich when compared to these other techniques."

You can learn more about NASA's efforts to create an accurate terrestrial reference frame here: <http://space-geodesy.nasa.gov/>.

Kids can learn all about GPS by visiting <http://spaceplace.nasa.gov/gps> and watching a fun animation about finding pizza here: <http://spaceplace.nasa.gov/gps-pizza>.



*Artist's interpretation of the Jason 2 satellite. To do its job properly, satellites like Jason 2 require as accurate a terrestrial reference frame as possible. Image courtesy: NASA/JPL-Caltech.*

*Editors: download photo at*

*<http://www.jpl.nasa.gov/missions/web/ostm.jpg>*



# the Space Place

March – April 2014 / Vol. 7, Issue 2

## 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!

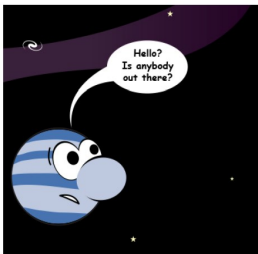
It's rich with science, technology, engineering, and math content!

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.

*The Space Place prides itself on its ability to be useful to educators—informal and formal alike. In an effort to reach as wide an audience as possible, we have made our popular 'make-and-do' activities available in a print-ready, downloadable pdf format. This will allow educators with more students than computers to easily run these fun, educational activities without limitation. Check it out at <http://spaceplace.nasa.gov/make-do-pdf>.*

### What's New? The Lone Planet



What makes a planet a planet? In our own solar system we have a pretty clear definition—something that orbits our sun, and is large enough to have its gravity mold it into

a sphere and clear out any objects floating around nearby. But what about outside our solar system? A recent discovery of a lonely planet hovering around in space without a star to call its sun makes classifying planets a bit less straightforward. The Space Place tackles this new discovery and the debate about planethood with two new articles: <http://spaceplace.nasa.gov/lone-planet> and <http://spaceplace.nasa.gov/planet-what-is>.

### Space Place en Español: Comet Quest

Not only is our popular game—'Comet Quest'—updated and better than ever. We also have a new Spanish version of the game on Space Place en Español. You get to land a rover on a comet and collect and



transmit as much data as possible as you command a comet orbiter faced with an increasing number of challenges. <http://spaceplace.nasa.gov/comet-quest/sp/>.

### Spotlight on YouTube



The Space Place now has its own YouTube channel! Be sure to check it for updates frequently. Not only will the channel be highlighting our popular 'Space Place in a Snap' videos, but we are also re-releasing our popular 'Space Place Live' animated series on YouTube in honor of the series' ten-year anniversary. <http://www.youtube.com/nasaspaceplace>.

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



### For the Classroom

We have created a new informational brochure that would be a great addition to any classroom. Interested in knowing a little bit more about the things in our solar system that are not our sun or the planets? Find out what these smaller bodies tell us about our cosmic neighborhood's formation. Check out and download 'Small Worlds, Big Discoveries' for your classroom today! <http://spaceplace.nasa.gov/posters/en/#small-bodies>.



### For Out-of-School Time

Snow day or heavy rain got you stuck inside? Why not give Space Place's latest 'make-and-do' activity a try. In this activity, you get to be the chief engineer for your own NASA mission. You will design a satellite—and all the choices are yours. We provide some suggestions in terms of materials (both edible and not edible), outline some of the basic requirements of a NASA satellite, and provide some examples of both real satellites and satellite models. <http://spaceplace.nasa.gov/build-a-spacecraft>.



### Special Days

#### March 7 - Kepler mission launched in 2009.

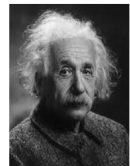
Kepler looks for habitable planets outside our solar system. It has found thousands of candidate planets! Make a model of your own Kepler spacecraft! <http://spaceplace.nasa.gov/build-a-spacecraft>.

#### March 11: - International Ask a Question Day.

Visitors to Space Place partner museums have asked a lot of good questions, to which Dr. Marc has answers. <http://spaceplace.nasa.gov/menu/dr-marc/>.

#### March 14: Albert Einstein's Birthday and Pi Day.

Not only was Einstein born on this day in 1875, but the day coincides with another very mathy holiday—Pi Day ( $\pi = 3.14 =$  March 14th)! Learn more about Einstein here: <http://spaceplace.nasa.gov/what-is-gravity>.



**April 1: April Fool's Day.** At least teach your nose not to be fooled! <http://spaceplace.nasa.gov/e-nose>.

**April 12: First Space Shuttle Launched in 1981.** See pictures of Space Shuttle launches and landings. <http://spaceplace.nasa.gov/gallery-technology/#rockets>.

**April 22: Earth Day.** Play "Missions to Planet Earth"—an online card game. <http://spaceplace.nasa.gov/earth-card-game/>.

**April 27: Tell A Story Day.** Read a couple of the storybooks on The Space Place, then make up your own story about space! <http://spaceplace.nasa.gov/menu/storybook>.

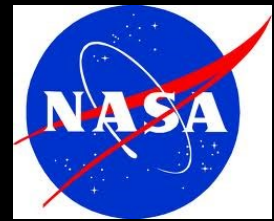
### Share

Want some help spreading the word about NASA's Space Place? Check out <http://spaceplace.nasa.gov/share>.

### Send Feedback

Please let us know your ideas about ways to use The Space Place in your teaching. Send to [info@spaceplace.nasa.gov](mailto: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!**

## CLUB OFFICERS

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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](http://www.astronomy.com)

Sky & Telescope is \$33 per year.

[www.skyandtelescope.com](http://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

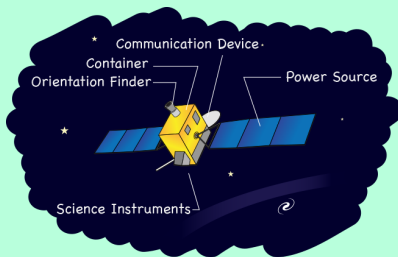




For some really cool Easter fun, after you've dyed your hard-boiled eggs and hidden your plastic, prize-filled ones about, try this fun idea from NASA's The Space Place! You can make your own SATELLITE! How do it is in the link below:

<http://spaceplace.nasa.gov/build-a-spacecraft>

Maybe you can find the Easter Bunny with it! So why not give it a try?



Also, check out this great link on BLACK HOLES!

<http://spaceplace.nasa.gov/black-holes>







Photo: Scorpius rising , ACT Observatory, Looking Southeast, May 2013, by Tamara Green.

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

OPEN TO THE PUBLIC

For more information please visit [www.astrotulsa.com](http://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](http://www.astrotulsa.com) where you will find all the information necessary to become a member.

