

# OKLAHOMA SPACE ALLIANCE

## OUTREACH – March 2018

**102 W. Linn #1, Norman, OK 73069**

Oklahoma Space Alliance will meet  
2:00 p.m. on March 10, 2018  
at Earl's Rib Palace,  
920 SW 25th St, Moore, OK.  
Directions are inside.



Figure 1  
Arecibo Observatory in Puerto Rico (NAIC photograph). See page 4.

# OKLAHOMA SPACE ALLIANCE OUTREACH March 2018

## March Meeting:

Oklahoma Space Alliance will meet at 2:00 p.m. on March 10, 2018 at Earl's Rib Palace, 920 SW 25th St, Moore, OK. This is between the 1-35 West Frontage Road and Telegraph Road. Telephone number is 793-7427.

**Saturday March 10, 2018**

### Program

Place: Earl's Rib Palace

Moore Oklahoma

2:00-5:00 PM

- 1) Introductions
  - a. What's Happening in Space, News, Pictures, and Videos by David Sheely
  - b. Technology Readiness Levels (TRL's) ten-minute Power Point presentation by David Sheely
- 2) Break
- 3) Business Discussion
  - a. Review OSA treasurer's report
  - b. Summary of February's meeting minutes
  - c. Review of new NSS website transition
  - d. Discussion of topics for future meetings
  - e. Discussion of a future trip to the Cosmosphere, International Science Center & Space Museum in Hutchinson, KS (219 miles or 3 ½ hour drive from Moore, OK)
  - f. Other issues
- 4) Video 31 minutes, "Nasa Journey to Mars" given by Dava Newman - MIT professor / former NASA Deputy Administrator - 20th Mars Society Convention <https://www.youtube.com/watch?v=LD-XTKa7pR8&t=283s>
- 5) Chat

## Minutes of February Meeting

National Space Society's Oklahoma Space Alliance chapter held its regular monthly Meeting on February 10, 2018 at Earl's Rib Palace in Moore, Oklahoma. In attendance were OSA President David Sheely, Claire and Clifford McMurray, Mike Hopkins, Tim Scott and Syd Henderson.

Dave provided links to most of the presentations in last month's *Update*, which is online at <http://chapters.nss.org/ok/Update1802.pdf>.

We watched a video simulation of a Falcon Heavy launch, then the video of the actual launch.

Claire and Clifford McMurray and Dave Sheely are going to the International Space Development Conference in Los Angeles in May.

We watched a video of the Japanese launch of a modified SS-520 sounding rocket that set a record for the smallest rocket ever to launch an orbital payload.

We watched a video on kilopower, and one on Mars colonization using small power sources.

Bridenstine invited Bill Nye the Science Guy to the State of the Union address, which caused grumbling in some quarters.

We watched a video of the bloody supermoon.

We watched a video of the Zuma launch. The SpaceX part of the launch was successful, but the satellite apparently failed to make orbit due to failure of the payload to separate from the upper stage (which was not part of the SpaceX contribution.)

Clifford wants to have a field trip to the Cosmosphere in Hutchinson, possibly as a Yuri's Night activity, or in July.

We watched a video of Elon Musk on becoming a multiplanet species. He spoke of SpaceX's upcoming BFR (Big Falcon Rocket, though people are coming up with other phrases that fit the acronym.) For Mars transit, this would contain

40 cabins, a large common area, storage, a galley, and solar storm shelter. It would run on methane and liquid oxygen. The whole upper stage could land on the Moon.

We watched a BBC video of John Young's first shuttle launch.

What would be fun for us to do as a demo? One suggestion: how do we clean up debris.

Tim has all the material he needs for the annual report except for the bylaws [which I sent him later that day as a pdf files.]

Minutes by OSA Secretary Syd Henderson

## Space News

The launch date of the James Webb Space Telescope, which last year was moved from late 2018 to the spring of 2019, looks like it will be moved again. According to Northrup Grumman, the company contractor for the Webb Telescope, this likely delay stems from "lessons learned from conducting deployment exercises of the spacecraft element and sunshield." The previous delay was also related to problems deploying the sunshield.

This delay also puts the JWST up against funding constraints, although it seems unlikely it would be abandoned this close to launch. Originally budgeted at a billion dollars, a figure that was probably unrealistic at that time, its price was capped at eight billion dollars in 2011 and it's bumping against that funding limit.

Sarah Stewart of the University of California at Davis and Simon Lock of Harvard University have come up with the wildest theory I've seen for the origin of the Moon. The problem they are trying to solve is why the Moon has same isotopic abundances as the outer layers the Earth, if, as is commonly thought, the Moon originated from debris caused by a planet-sized object hitting the Earth off-center and stripping off part of its mantle.

Stewart and Lock are sticking with the collision model, except in their version, the primordial Earth and the impactor were completely vaporized by the collision, forming a synestia, doughnut shaped cloud of silicate vapors surrounding an iron-rich bulge at the center. The Earth would coalesce around the bulge, while the Moon formed in the outer parts of the synestia. Since the material of the Earth and the impactor would be thoroughly mixed, the Earth and Moon would have the same isotopic ratios of the elements comprising them.

The paper was published online on February 28 in the *Journal of Geophysical Research*, but my source was sky-andtelescope.com.

The Arecibo Radio Telescope in Puerto Rico has apparently survived another funding crisis. The National Science Foundation has been trying to reduce its funding commitment for at least a decade, and last fall announced that over the next four years would reduce its commitment from \$8 million per year to \$2 million per year, out of a total budget of \$12 billion. (NASA made up the difference).

The University of Central Florida has agreed to takeover the shortfall and started taking over from the NSF of February 22. This means astronomers at UCF will have access to the largest radio telescope in the world, one having a diameter of 305 meters. They will also be allowing other astronomers to have access.

The President's budget request for FY19 would cancel WFIRST, the Wide Field Infrared Survey Telescope, which would provide near-infrared images as sharp as those of the Hubble Space Telescope, but over a much larger field. Among its other abilities would be discovering exoplanets using gravitational lensing, scouting the effect of dark energy and testing the Theory of General Relativity.

Part of the reason for the suggested termination of WFIRST is that the cost is estimated at \$2.7 billion in 2017 dollars.

On September 20, 2016, Argentinian amateur astronomer Victor Buso was taking short-exposure photographs of a galaxy in the constellation Sculptor, and when he checked them to make sure his equipment was working, he discovered a new star that was rapidly bright. He's the first person to photograph a supernova at the beginning of its explosion.

Astronomer Melina Bersten at the Instituto de Astrofísica de La Plata heard of his find and immediately realized its significance. The resulting paper was printed in the February 22 issue of *Nature*. The star that produced SN2016gkg was about 20 times the mass of the Sun and lost an estimated 15 solar masses in the explosion.

Ultraluminous X-ray (ULX) sources have been known since the 1980s. These emit millions of times the radiation of the Sun, which means they cannot be produced by solar mass black holes, but may be produced by thousand solar-mass black holes—if they exist.

On the other hand, at least some ULXs may not be black holes at now: at least four, and probably more, seem to be producing cyclotron radiation, which means they must have magnetic fields with a strength of up to 100 trillion Gauss. Black holes have never been found to have such fields. But they are possible in neutron stars, in which case the object is called a magnetar.

## Sky Viewing

**Mercury** and **Venus** just underwent a conjunction and are still pretty close together in the western sky after sunset. Mercury is also approaching greatest elongation on March 15, when it will be twelve degrees above the horizon a half-hour after sunset, and shining at magnitude -0.4. Mercury doesn't begin to fade until around March 23, and will be in inferior conjunction with the Sun on April 1. Mercury will be a morning star in late April, but this will be the worst elongation of Mercury in 2018, at least for viewers in the Northern Hemisphere.

**Venus** is still pretty low in the western sky at Sunset, but is returning from its superior conjunction with the Sun, and on April 1 will be eighteen degrees above the horizon at sunset, and on April 30 will be twenty-four degrees above the horizon at sunset. Venus is making a very close conjunction with Uranus this month. On March 28, Venus and Uranus will be only four minutes of arc apart, which is only a seventh of the diameter of the full moon. Unfortunately, Uranus is magnitude 5.7, and this will be close to twilight.

**Mars** is magnitude 0.7 and about fifteen degrees to the lower left of Antares, the heart of the Scorpion. Mars is in the bottom of the constellation Ophiuchus, but Scorpius is much more conspicuous. In mid-March, Mars will move into Sagittarius, where it will meet **Saturn** on April 2. By then, Mars will be magnitude 0.3 and Saturn will be magnitude 0.5, making the pair easy to find. Mars will brighten to magnitude -0.4 in April as it approaches a close opposition in July. Mars is currently a morning star, as is Saturn.

**Jupiter** is currently rising around 11 p.m. and is the brightest planet in the sky for the remainder of the night. It will be rising three hours after sunset in early April but only a half-hour after sunset at the end of April. It is currently magnitude -2.2, but will get up to magnitude -2.5 as it approaches its May 9<sup>th</sup> opposition.

**Uranus** is low in the western sky at sunset and is approaching conjunction with the Sun in mid-April. **Neptune** was in conjunction with the Sun on March 4, and won't return to (telescopic) view until the end of April

Information for this section comes from the March and April issues of *Sky & Telescope* and *Astronomy*, and from their websites.

## Viewing Opportunities for Satellites (March 10 – April 14, 2018)

You can get sighting information at [www.heavens-above.com](http://www.heavens-above.com), which allows you to get satellite-viewing data for 10-day periods and gives you a constellation map showing the trajectory of the satellite.

<https://spaceflight.nasa.gov/realdata/sightings/SSapplications/Post/JavaSSOP/JavaSSOP.html> gives coordinates at 20-second intervals from when the satellite rises, not from when it peaks. (This program requires Java. I'm currently using Microsoft Explorer to run it, and making an exception for the site in the Java Control Panel.) I'm using its information for the International Space Station and Hubble Space Telescope, interpolating when necessary. It doesn't give you information for Tiangong 1 or Tiangong 2, so I'm using Heavens Above for those. The *Sky & Telescope* web site carries International Space Station observation times for the next few nights at [skyandtelescope.com/observing/almanac](http://skyandtelescope.com/observing/almanac).

With the addition of the solar panels, the International Space Station can be as bright as magnitude -3.8, which it will on March 18, making it brighter than all the stars other than the Sun and all the planets other than Venus, although magnitude -2 to -3 is more likely. The Hubble Space Telescope can get up to magnitude 1.5, which is brighter than the stars in the Big Dipper, although, since it is lower in the sky, it is more difficult to see. China's Tiangong 1 space station can get up to magnitude -0.6, which is brighter than all the night stars except Sirius and Canopus. With this issue, I'm also including data for Tiangong 2, which can get up to magnitude 0.4 at least.

Missions to and from the International Space Station or Tiangong-2 may change its orbit. The next manned launch to the ISS will be March 21, and there will be a SpaceX cargo mission at the beginning of April. I know of no scheduled manned flights to Tiangong-2. Tiangong-1 has been abandoned and will reenter the Earth's atmosphere sometime in the next six months.

Tiangong 2, March 12, 2018

Time            Position    Elevation

Appears from Earth's Shadow		
6:43 a.m.	240°	24°
6:45	152	86
6:48	64	10

#### Tiangong 1, March 12, 2018

Time	Position	Elevation
8:21 p.m.	309°	10°
8:23:14	22	40
8:24:14	80	23

Vanishes into Earth's Shadow

#### Tiangong 1, March 12, 2018

Time	Position	Elevation
8:09 p.m.	302°	10°
8:12	24	63
8:13	107	14

Vanishes into Earth's Shadow

#### Hubble Telescope March 14, 2018

Time	Position	Elevation
8:38 p.m.	222°	20°
8:39	203	26
8:40	176	30
8:41	150	27
8:42	131	20

#### Hubble Telescope March 15, 2018

Time	Position	Elevation
8:28 p.m.	225°	20°
8:29	206	27
8:30	179	31
8:31	151	27
8:32	133	20

#### Hubble Telescope March 16, 2018

Time	Position	Elevation
8:18 p.m.	227°	20°
8:19	209	27
8:20	181	31
8:21	154	27
8:22	136	20

#### Hubble Telescope March 17, 2018

Time	Position	Elevation
8:07 p.m.	229°	20°
8:08	211	26
8:09	184	30
8:10	157	26
8:11	139	20

#### Space Station March 18, 2018

Time	Position	Elevation
6:51 a.m.	312°	22°
6:52	313	42
6:53	51	89
6:54	132	42
6:55	133	21

#### Space Station March 19, 2018

Time	Position	Elevation
Appears from Earth's shadow		
6:00 a.m.	353°	31°
6:01	38	42
6:02	83	31
6:03	102	19

#### Space Station March 23, 2018

Time	Position	Elevation
8:44 p.m.	197°	19°
8:45	178	31
8:46	133	42
8:46:30	88	31
8:47:08	75	23

Vanishes into Earth's Shadow

#### Space Station March 25, 2018

Time	Position	Elevation
8:35 p.m.	241°	21°
8:36	252	39
8:37	318	65
8:38	26	40
8:39	38	21

#### Tiangong 1, March 30, 2018

Time	Position	Elevation
Appears from Earth's Shadow		
6:25 a.m.	246°	29°
6:27	333	85
6:29	62	10

#### Tiangong 2, April 1, 2018

Time	Position	Elevation
9:16 p.m.	245°	10°
9:18	332	83
9:19:16	52	58

Vanishes into Earth's Shadow

#### Tiangong 2, April 2, 2018

Time	Position	Elevation
8:16 p.m.	225°	10°
8:19	149	50
8:23	72	10

#### Space Station April 10, 2018

Time	Position	Elevation
9:08 p.m.	327°	20°
9:09	343	36
9:10	38	54
9:11	96	37

Vanishes into Earth's Shadow

#### Space Station April 12, 2018

Time	Position	Elevation
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8:59 p.m.	295°	20°	Time	Position	Elevation
9:00	279	35	8:42 p.m.	301°	10°
9:01	225	51	8:45	25	67
9:02	172	35	8:48	107	15
9:03	156	20	Vanishes into Earth's Shadow		

Tiangong 2, April 13, 2018

Key: Position is measured in degrees clockwise from north. That is, 0° is due north, 90° is due east, 180° is due south, and 270° is due west. Your fist held at arm's length is about ten degrees wide. "Elevation" is elevation above the horizon in degrees. Thus, to see the International Space Station at 9:01 p.m. on April 12, measure four-and-a-half fist-widths west of due south (in other words, look due southwest), then five fist-widths above the horizon.

All times are rounded off to the nearest minute except for times when the satellite enters or leaves the shadow of the Earth. The highest elevation shown for each viewing opportunity is the actual maximum elevation for that appearance.

### Space Related Articles

"The First Galaxies," by James Geach, *Sky & Telescope*, April 2018, pp. 14 – 21. The first known galaxies are tiny, ill-formed and red-shifted to the point where we need an infrared telescope to find them. They are low in elements heavier than helium since they haven't had much time to create stars to turn into supernovae. One thing I hadn't realized is that the best way to distinguish these galaxies is that neutral hydrogen blocks light with wavelengths below 91.2 nanometers, which is well into the ultraviolet part of the spectrum. This is called the Lyman break. However, the light of the earliest galaxies is redshifted into the visible or even infrared regions, and the Lyman break moves accordingly, so all you have to do is use a set of filters that only lets light through below a certain wavelength. If the Lyman break for a given galaxy has been redshifted to a wavelength longer than that which a certain filter lets through, the galaxy will appear to vanish and alerts you that it requires more investigation.

"A Beacon at the Dawn of the Universe," by Eilat Glikman, *Nature*, 25 January 2018, pp 410 – 411: Here we have a quasar with a red shift of 7.54, which makes it the farthest ever detected, only 690 million years after the Big Bang. This presents a mystery, because at the center of this quasar is a black hole with a mass 800 million times that of the Sun, and it is surprising that such a massive black hole could have formed when the Universe was so young. It may have started off as a thousand solar-mass black 600 million years earlier, but even then, it would have had to accumulate mass steadily somehow over that long a period of time.

### Chapter Bylaws – National Space Society Oklahoma Space Alliance Chapter

NAME The name of this organization shall be the National Space Society Oklahoma Space Alliance Chapter. This may be abbreviated to "NSS Oklahoma Space Alliance" or "OSA" after a first reference, where appropriate.

#### PURPOSE AND GENERAL REQUIREMENTS

The purpose of the Chapter shall be the same as that of the National Space Society (NSS). No funds or assets of this Chapter may be used for any other purpose. The Chapter shall operate under the rules of the NSS Bylaws and Chapter Rules, and the Chapter Fiscal Year shall be the same as that of the NSS. Upon dissolution, all remaining chapter assets shall become property of the National Space Society.

#### MEMBERSHIP

The membership in the Chapter consists of those persons who have agreed to become members and have paid the current chapter dues. At least three chapter officers must be current NSS members who have paid their National Space Society dues. The Chapter may collect chapter membership dues in amounts determined from time to time by majority vote of the Chapter members present, provided the proposal was placed on the agenda at least one regular monthly meeting in ad-

vance of the vote. The Chapter members may deny or withdraw a person's membership in the chapter only for stated actions which interfere with the purposes of the chapter, and only by a two-thirds vote of the chapter members voting in person or live communication (such as Skype) or by proxy at two successive general membership meetings, during the presence of a quorum.

All chapter members shall be encouraged to become members of the National Space Society.

## MEETINGS

There shall be at least one general membership meeting every year, but one meeting each month is preferred. All members shall receive a one week notice of the meeting in writing, by email, in person, or by phone, of the time and place of the meeting if the meeting is not at the usual time and place. However, if the meeting is in the afternoon of the second Saturday of the month in the previous usual location, only three days' notice is required. A general membership meeting may be called at any time by the President, or any other two officers, or by a petition signed by one-half of the paid OSA membership. A quorum for purposes of voting on chapter business at a general membership meeting shall be two officers and one-third the paid chapter membership.

Meetings of groups appointed for specific purposes (such as planning an event) may include persons who have not paid OSA dues, and may be held without notifying the general membership.

The first general meeting of the NSS Oklahoma Space Alliance chapter followed the last meeting of Oklahoma Space Alliance L5, and occurred during the first year after the National Space Society was formed on 28 March 1987.

## OFFICERS

The principal Chapter officers shall be the President, Vice President, Secretary, and Treasurer, but up to two of these may be the same person if so designated by vote of the membership. All principal chapter officers must be, or immediately become, members of NSS and paid members of OSA. Officers shall be nominated annually at a general membership meeting in November and elected by a majority of the paid membership voting at the general meeting in December, and shall serve until their successors are elected. No candidate may be nominated without consent of that candidate. In addition to the votes of members present, ballots received by mail prior to the December meeting and proxy votes (proxy given in writing) shall be considered valid votes. Write-in candidates are allowed. The chapter is encouraged to nominate more than one person for each office if several are interested.

An officer may be removed from office by a majority vote of Chapter members present and voting, in person or by proxy, as long as a quorum exists, at a meeting for which members were given at least one month advance written notice of such proposed removal. If an office becomes vacant, the remaining officers may propose a replacement from among the regular members of the Chapter to serve until confirmed or replaced at the next regular membership meeting.

### Duties of the Officers

The President shall: preside at meetings of the membership; administer all affairs of the Chapter, in accordance with the rules of NSS and any relevant votes of the membership; act as the official representative of the Chapter; sign all agreements to which the Chapter is a party (but the Treasurer must also approve expenditures which exceed an amount set by majority vote of the members); act as liaison between the Chapter and the Society; and delegate those responsibilities and powers to other members of the Chapter as may be appropriate. The President may also appoint appropriate Chapter members to perform duties such as newsletter editor, meeting representative, event coordinator, etc. as needed. The President shall also ensure that at least two people not in the same household have the passwords for any OSA website(s) and have been taught how to use them.

However, formal delegates to the Chapters Assembly at ISDC (or at any other regular Chapters Assembly meeting) should be approved by a majority vote of those chapter members voting in person or by email.

The Vice-President shall preside at chapter meetings when requested by the President, and perform such other duties as the President requests and the VP accepts.

The Secretary shall: maintain records of resolutions passed at all meetings of the membership and of the Executive Committee; keep the membership roll with member contact information and provide a copy to any officer or to the NSS if requested to do so; and provide notice of meetings to the membership. Also the Secretary shall, in cooperation with the newsletter editor(s), see that any amended bylaws, and names and addresses of subscribers to any chapter newsletters, are promptly provided to the NSS Chapters Coordinator, the NSS staff member who deals with chapter matters at the principal NSS office, and the Chapters Coordinator for OSA's chapter coordinator district.

The Treasurer shall: receive, record, and safeguard all monies paid into the Chapter; provide immediate paper or email receipts for all dues and other income received, keep full and accurate books of account for all financial transactions of the Chapter; pay all duly approved bills of the Chapter; see that financial reports required by the IRS and NSS are timely filed; and render a financial report or open the books for inspection when called upon by Executive Committee. If possible, the treasurer shall keep all OSA monies in a dedicated account without account-maintenance fees. Immediately after elections, one other Chapter officer shall be designated by majority vote of the membership to write checks at such times as the Treasurer may be incapacitated, and the Treasurer shall make the necessary arrangement(s).

Both the Secretary and the Treasurer shall maintain current, dated copies of these bylaws, and promptly provide a copy to the NSS, to relevant government officials, or to any Chapter member when requested.

Officers shall collaborate to ensure that the chapter's annual report to the NSS is complete and timely filed.

Other chapter officers may be appointed by the President or the Executive Committee for other duties, such as newsletter editors, website managers, package recipients, event coordinators, etc. These officers may or may not be the same person as a Principal Officer; if not, they do not have votes on the Executive Committee.

All officers shall collaborate to recruit, engage and retain Chapter membership and promote community awareness of the Chapter and its goals.

## EXECUTIVE COMMITTEE

The Executive Committee shall consist of the duly elected OSA principal officers. The power to conduct the affairs of the chapter, when required between regular chapter meetings, shall rest with the Executive Committee except as explicitly provided in these Bylaws. Executive Committee meetings may be held by mail, by phone, or in person, and a majority of the officers shall constitute a quorum for the transaction of business. However, actions taken by the Executive Committee must be reported to the membership in the next newsletter and at the next general meeting. In-person meetings of the Executive Committee shall be open to other OSA members, unless personnel matters are involved.

## RATIFICATION AND AMENDMENT

These Bylaws may be ratified or amended by a two-thirds vote of those paid-up chapter members present and voting at a duly called general membership meeting, provided the text of proposed changes is available to all paid members at least one week in advance. The complete text of amended Bylaws shall be published in the next OSA newsletter and provided to the NSS Vice President for Chapters, the NSS Chapters Coordinator, the NSS staff member who deals with chapter matters at the principal NSS office, and the Chapters Coordinator for chapters in OSA's coordinator district.

These OSA Bylaws were Ratified on: January 13, 2018

Certified by Syd Henderson, OSA Secretary  
(print name) (signature)

Amendment ratification date(s): \_\_\_\_\_

## Programming Notice: NASA TV on the Web

Watch NASA TV (Public, Media and Education Channels) on your computer using Flash, Windows or QuickTime at <http://www.nasa.gov/multimedia/nasatv/index.html>.

NASA TV Schedules are available at <http://www.nasa.gov/multimedia/nasatv/schedule.html>

### Highlights:

March 21, 11:30 a.m.: Launch coverage of Expedition 55-6 crew to the Space Station (actual launch is 12:44 p.m.)

March 23, 2:00 p.m.: Coverage of the docking of the Expedition 55-6 crew with the Space Station (docking is 2:41 p.m.) 3:30 p.m.: Coverage of hatch opening and welcoming ceremony. (Hatch opening is approximately 4:20 p.m.)

### Calendar of Events

Sometime in 2018: Launch of Japan's *SELENE-2* spacecraft to the Moon. This mission includes an orbiter, lander and rover. For more information, visit <https://en.wikipedia.org/wiki/SELENE-2>

March 10: Oklahoma Space Alliance meeting, 2:00 p.m., Earl's Rib Palace in Moore, Oklahoma.

March 14: [tentative] Oklahoma Space Industry Development Authority [OSIDA] meets at 1:30 p.m. the Oklahoma Department of Transportation Building in Oklahoma. Call 580-562-3500 to verify.

March 15: Mercury is at greatest eastern elongation, 18 degrees east of the Sun, and is visible after sunset in Pisces.

March 21: Expedition 55 launch to the Space Station.

April: [Moved from September 2017.] Launch of the Green Propellant Infusion Mission (GPIM) by a SpaceX Falcon Heavy rocket. This mission is "green" because the fuel it uses, hydroxylammonium nitrate produces nontoxic gases when it burns, unlike hydrazine

April: India launches *Chandrayaan-2* to the Moon. The mission consists of an orbiter, lander and rover. The lander and rover will land south of 70 degrees south on the lunar surface, making them the first to land in the lunar polar regions.

April 1: Mercury is in inferior conjunction to the Sun.

April 11: [tentative] Oklahoma Space Industry Development Authority [OSIDA] meets at 1:30 p.m. the Oklahoma Department of Transportation Building in Oklahoma. Call 580-562-3500 to verify.

April 12: Yuri's Night. 57<sup>th</sup> anniversary of the first man in space.

April 14: [Tentative] Oklahoma Space Alliance meeting, 2:00 p.m., Earl's Rib Palace in Moore, Oklahoma.

April 16: Launch of TESS, the Transiting Exoplanet Survey Satellite. Unlike *Kepler*, TESS will conduct a full sky search for exoplanets. For information, visit [space.mit.edu/TESS](http://space.mit.edu/TESS).

April 18: Uranus is in conjunction with the Sun.

April 29: Mercury is at greatest western elongation, 27 degrees west of the Sun, and is visible before sunrise in the constellation Cetus.

April 30: Air Force EELV Certification launch for SpaceX's Falcon Heavy with a variety of secondary payloads.

May 5: Launch of *InSight*, a lander that will probe the interior of Mars. For information, see <http://insight.jpl.nasa.gov/>.

May 9: Jupiter is at opposition, 409 million miles from Earth.

May 9: [tentative] Oklahoma Space Industry Development Authority [OSIDA] meets at 1:30 p.m. the Oklahoma Department of Transportation Building in Oklahoma. Call 580-562-3500 to verify.

May 11: [Tentative] Oklahoma Space Alliance meeting, 2:00 p.m., Earl's Rib Palace in Moore, Oklahoma.

June 3: Expedition 55 returns from the Space Station.

June 6: Mercury is in superior conjunction with the Sun.

June 6: Expedition 56 is launched to the Space Station.

June 13: [tentative] Oklahoma Space Industry Development Authority [OSIDA] meets at 1:30 p.m. the Oklahoma Department of Transportation Building in Oklahoma. Call 580-562-3500 to verify.

June 9: [Tentative] Oklahoma Space Alliance meeting, 2:00 p.m., Earl's Rib Palace in Moore, Oklahoma.

June 27: Saturn is at opposition, 840 million miles from Earth.

July 11: Mercury is at greatest eastern elongation, 26 degrees east of the Sun, and is visible after sunset in Cancer.

July 14: [Tentative] Oklahoma Space Alliance meeting, 2:00 p.m., Earl's Rib Palace in Moore, Oklahoma.

July 27: Mars is at opposition. This will be the closest Mars opposition since 2003, and until the 2030s although Mars is closest to Earth on July 31. Mars will be 36 million miles from Earth.

July 31 – August 19: Launch date range for *Parker Solar Probe* (formerly *Solar Probe Plus*), which will study the corona of the Sun from within four million miles. For information, see [en.wikipedia.org/wiki/Parker\\_Solar\\_Probe](http://en.wikipedia.org/wiki/Parker_Solar_Probe) or <http://parkersolarprobe.jhuapl.edu/>. (This spacecraft will fly by Venus seven times to refine its orbit.)

August: Boeing's CST-Starliner makes its first automated test flight. See [https://en.wikipedia.org/wiki/CST-100\\_Starliner](https://en.wikipedia.org/wiki/CST-100_Starliner) for details.

August 8: Mercury is in inferior conjunction with the Sun.

August 11: [Tentative] Oklahoma Space Alliance meeting, 2:00 p.m., Earl's Rib Palace in Moore, Oklahoma.

August 17: Venus is at greatest eastern elongation, 46 degrees east of the Sun, and is visible after sunset in Virgo

August 26: Mercury is at greatest western elongation, 28 degrees west of the Sun, and is visible before sunrise in the constellation Cancer.

August 26: Mission 56 returns from the Space Station.

September 7: Neptune is at opposition.

September 8: [Tentative] Oklahoma Space Alliance meeting, 2:00 p.m., Earl's Rib Palace in Moore, Oklahoma.

September 20: Mercury is in superior conjunction with the Sun.

October: The European Space Agency/JAXA *BepiColombo* Mercury Orbiter is launched. On its way to Mercury, *BepiColombo* will make two flybys of Venus and one of Earth, and six flybys of Mercury before settling into orbit. Home page is <http://sci.esa.int/bepicolombo>.

October 13: [Tentative] Oklahoma Space Alliance meeting, 2:00 p.m., Earl's Rib Palace in Moore, Oklahoma.

October 24: Uranus is at opposition.

October 26: Venus is in inferior conjunction with the Sun.

November: Boeing's CST-Starliner makes its first crewed flight. This will be the first American spacecraft to carry astronauts to orbit since 2011. See [https://en.wikipedia.org/wiki/CST-100\\_Starliner](https://en.wikipedia.org/wiki/CST-100_Starliner) for details.

November 6: Mercury is at greatest eastern elongation, 23 degrees east of the Sun, and is visible after sunset in Scorpius

November 10: [Tentative] Oklahoma Space Alliance meeting, 2:00 p.m., Earl's Rib Palace in Moore, Oklahoma.

November 26: Jupiter in in conjunction with the Sun.

November 27: Mercury is in inferior conjunction with the sun.

December: SpaceX will launch its first manned Dragon-2 capsule to the International Space Station.

December 7. Mars is only two seconds of arc south of Neptune at 8:55 p.m. CST. In other words, this is the best possible time to find Neptune.

December 15: Mercury is at greatest western elongation, 21 degrees west of the Sun (hence is visible before sunrise), in the constellation Libra.

Late in 2018: Launch of the European Space Agency's CHEOPS space telescope, which will study exoplanets, which transit their star's disc. Project website is <http://sci.esa.int/cheops>.

Sometime in 2019: Maiden flight of the Space Launch System.

Spring 2019: [Moved from October 2018]: Launch of the James Webb Space Telescope.

Sometime in 2019: China launches the *Chang'e 5* lunar sample return mission. This will be the first spacecraft to return material from the Moon since 1976 (the Soviet Union's *Luna 24*.)

January 1, 2019: *New Horizons* flies by Kuiper Belt object 2014 MU<sub>69</sub>.

January 2, 2019: Saturn is in conjunction with the Sun.

February 2019: Launch from Cape Canaveral of the European Space Agency/NASA Solar Orbiter (SolO), which will orbit the Sun at a distance closer than Mercury. Web site is [sci.esa.int/solarorbiter](http://sci.esa.int/solarorbiter)

September 2019: Arrival of *OSIRIS-REx* at the near-earth asteroid 101955 Bennu to return samples. For more information, visit <http://en.wikipedia.org/wiki/OSIRIS-REx> or <http://science.nasa.gov/missions/osiris-rex/>.

November 11, 2019: Mercury transits the Sun.

Sometime in 2020: Launch of the European Space Agency's Euclid space telescope. This will map the distribution of dark matter and search for evidence of dark energy. The Euclid website is <http://sci.esa.int/euclid>.

Sometime in 2020: Launch of ESA's *ExoMars Mars Rover*. For more information, visit [en.wikipedia.org/wiki/Exo-mars](http://en.wikipedia.org/wiki/Exo-mars).

July 2020: United Arab Emirates launch the Mars probe *Hope*.

July 2020: ESA launches the *ExoMars Mars Rover*. [Postponed from May 2018.] For more information, visit [en.wikipedia.org/wiki/Exomars](http://en.wikipedia.org/wiki/Exomars).

July 2020: Launch of the *Mars 2020* space rover, which will arrive on Mars at the beginning of 2021.

October 13, 2020: Mars is at opposition, 39 million miles from Earth.

Sometime in 2021: India hopes to launch its first manned spaceflight, but 2024 is more likely.

Sometime in 2022: SpaceX plans to launch a human crew around the Moon. [This is speculative, reflected by this mission being postponed from 2018.]

Sometime in 2022: Proposed launch date of JUICE, the Jupiter Icy Moon Explorer, by the European Space Agency. The JUICE web site is <http://sci.esa.int/juice>.

Sometime in 2023: *OSIRIS-REx* returns with samples from the Asteroid Bennu.

April 8, 2024: Next total eclipse of the Sun visible in the United States. This one will be visible on a path through northern Mexico (making landfall opposite the tip of Baja California), passes through Texas (including Dallas, Arlington and Waco), touches the southeastern corner of Oklahoma, then crosses Arkansas, eastern Missouri, Illinois, western Kentucky, Indiana, Ohio (including Cleveland), Erie in Pennsylvania, upper New York (including Buffalo and Niagara Falls), Burlington in Vermont, New Hampshire, and Maine, then into Canada.

December 19, 2024: *Parker Solar Probe* (formerly *Solar Probe Plus*) makes its first pass through the outer corona of the Sun. For more information, see <http://parkersolarprobe.jhuapl.edu>.

December 2025: *BepiColombo* arrives at Mercury orbit.

Sometime in 2030: JUICE achieves Jupiter orbit. [See 2022.]

Sometime in 2033: JUICE achieves Ganymede orbit. [See 2022.]

August 12, 2045: The next total solar eclipse visible in Oklahoma City. This one is also visible in Salt Lake City, Denver, Little Rock (again), Tampa Bay and New Orleans.

### **Oklahoma Space Alliance Officers, 2018 (Area Code 405)**

Dave Sheely, President & <i>Update</i> Editor	821-9077 (C)
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Syd Henderson, Secretary & <i>Outreach</i> Editor	321-4027 (H) 365-8983 (C)
Tim Scott, Treasurer	740-7549 (H)
Claire McMurray, Communications	329-4326 (H) 863-6173 (C)

### **OSA E-mail Addresses and Web Site:**

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cliffclaire at hotmail.com (Claire & Clifford McMurray)

sydh at ou.edu (Syd Henderson)

sswift42 at aol.com (Steve Swift)

ctscott at mac.com (Tim Scott)

t\_koszoru01 at cox.net (Heidi and Tom Koszoru, new address)

john.d.northcutt1 at tds.net (John Northcutt)

lensman13 at aol.com (Steve Galpin)

E-mail for OSA should be sent to [sydh@ou.edu](mailto:sydh@ou.edu). Members who wish their e-mail addresses printed in *Outreach*, and people wishing space-related materials e-mailed to them should contact Syd. Oklahoma Space Alliance website is [chapters.nss.org/ok/osanss.html](http://chapters.nss.org/ok/osanss.html). Webmaster is Syd Henderson.

### **Other Information**

Oklahoma Space Industrial Development Authority (OSIDA), 401 Sooner Drive/PO Box 689, Burns Flat, OK 73624, 580-562-3500. Website is <http://airspaceportok.com/#home>,

Science Museum Oklahoma (former Omniplex) website is [www.sciencemuseumok.org](http://www.sciencemuseumok.org). Main number is 602-6664.

Tulsa Air and Space Museum, 7130 E. Apache, Tulsa, OK 74115.

Web Site is [www.tulsaairandspacemuseum.com](http://www.tulsaairandspacemuseum.com). Phone (918) 834-9900.

The Mars Society address is Mars Society, Box 273, Indian Hills CO 80454. Their web address is [www.marsociety.org](http://www.marsociety.org).

The National Space Society's Headquarters phone is 202-429-1600. Executive Director e-mail [nsshq@nss.org](mailto:nsshq@nss.org). The Chapters Coordinator is Bennett Rutledge 720-641-7987, [rutledges@chapters.nss.org](mailto:rutledges@chapters.nss.org). The address is: National Space Society, PO Box 98106, Washington DC 20090-1600 Web page is [www.nss.org](http://www.nss.org).

The Planetary Society phone 626-793-5100. The address is 65 North Catalina, Avenue, Pasadena, California, 91106-2301 and the website is [www.planetary.org](http://www.planetary.org). E-mail is [tps@planetary.org](mailto:tps@planetary.org).

NASA Spacelink BBS 205-895-0028. Or try [www.nasa.gov](http://www.nasa.gov).  
Congressional Switchboard 202/224-3121.

Write to any U. S. Senator or Representative at [name]/ Washington DC, 20510 (Senate) or 20515 [House]

**OKLAHOMA SPACE ALLIANCE**  
A Chapter of the National Space Society  
**MEMBERSHIP ORDER FORM**

Please enroll me as a member of Oklahoma Space Alliance. Enclosed is:

\_\_\_\_\_ \$10.00 for Membership. (This allows full voting privileges, but covers only your own newsletter expense.)

\_\_\_\_\_ \$15.00 for family membership

\_\_\_\_\_ TOTAL amount enclosed

National Space Society has a special \$20 introductory rate for new members. Regular membership rates are \$52, Student memberships are \$36, Senior \$42. Part of the cost is for the magazine, *Ad Astra*. If you choose to receive the magazine digitally, memberships are \$40 for regular, \$24 for students and \$30 for seniors. Mail to: National Space Society, PO Box 98106, Washington, DC 20090, or join at [www.nss.org/membership](http://www.nss.org/membership). (Brochures are at the bottom with the special rate.) Be sure to ask them to credit your membership to Oklahoma Space Alliance.

To join the Mars Society, visit [www.marssociety.org](http://www.marssociety.org). One-year memberships are \$50.00; student and senior memberships are \$25, and Family memberships are \$100.00. Their address is Mars Society, 11111 W. 8<sup>th</sup> Ave, Unit A, Lakewood, CO 80215.

Do you want to be on the Political Action Network?

\_\_\_\_\_ Yes\_\_\_\_\_ No. [See brochure for information.]

Name\_\_\_\_\_

Address\_\_\_\_\_

City\_\_\_\_\_ State\_\_\_ ZIP\_\_\_\_\_

Phone (optional or if on phone tree)\_\_\_\_\_

E-mail address (optional)\_\_\_\_\_

OSA Memberships are for 1 year, and include a subscription to our monthly newsletters, *Outreach* and *Update*. Send check & form to **Oklahoma Space Alliance, 102 W. Linn, #1, Norman, OK 73071.**