Space News Update
— May 22, 2020 —

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1. NASA Invites Public to Be Its Guests to Celebrate Historic ‘Launch America’

NASA is inviting the public to help celebrate a historic milestone in human spaceflight as it prepares for #LaunchAmerica – the first flight into orbit of American astronauts on American rockets from American soil since the end of the space shuttle era in 2011.

Known as NASA’s SpaceX Demo-2 test flight, which is targeted for lift off at 4:33 p.m. EDT Wednesday, May 27, this mission will send NASA astronauts Robert Behnken and Douglas Hurley to the International Space Station as part of the agency’s Commercial Crew Program. Members of the public can attend the launch virtually, receiving mission updates and opportunities normally received by on-site guests.

“Through NASA’s virtual launch experience, we make it possible for more people than ever to watch the beginning of this new era in human spaceflight,” said Bettina Inclán, NASA’s associate administrator for Communications. “We’re already seeing people participate online with the #LaunchAmerica hashtag and helping build the excitement for this historic moment.”

To participate, members of the public can register to find a calendar of mission information, mission highlights, and virtual tours. To find out more, visit:

https://www.nasa.gov/beourguest

Demo-2 will be SpaceX’s second spaceflight test of its Crew Dragon craft and its first test with astronauts aboard. This final test flight prior to NASA certification and will provide data on the performance of the Falcon 9 rocket, the Crew Dragon and ground systems, as well as in-orbit, docking, and landing operations.
The Falcon 9 rocket will launch from historic Launch Complex 39A at NASA’s Kennedy Space Center in Florida. But, the excitement will be felt across the country and around the world, with virtual launch parties and other events to help usher in this new era of spaceflight as NASA and its commercial partners take the next bold step toward to send the first woman and the next man to the Moon by 2024 as part of the agency’s Artemis program.

Live video coverage and countdown commentary begins at 12:15 p.m. May 27. Watch the launch and all prelaunch activities on NASA TV, YouTube, Twitter, Facebook, and Linkedin. You also can share reasons you are excited for the launch on Instagram, Twitter or Facebook with the hashtag #LaunchAmerica for a chance to be shared on our social media channels.

But, before then, there are a lot of other ways people can get involved with this historic mission now. The virtual events taking place include:

**Virtual NASA Social**

For the first time ever, NASA is hosting a global “NASA Social,” an opportunity for social media users to get a behind the scenes view of the launch – virtually – and a unique way the public can celebrate the return of human spaceflight to American soil.

The #LaunchAmerica NASA Social is taking the form of a Facebook group that any social media user can request permission to join by answering a few simple questions and agreeing to adhere to the guidelines of the group. In addition to connecting virtually with a community of people excited about the #LaunchAmerica mission, participants will be able to virtually tour NASA facilities at Kennedy and interact with NASA representatives in real time, as well as virtually view a launch of the SpaceX Falcon 9 rocket. For more information and to register, visit:

https://www.nasa.gov/social/launchamerica

**NASA STEM Engagement**

No matter where you are, you can celebrate this historic milestone with other members of the Artemis Generation. Students can share their excitement with webinars, virtual reality experiences and activities specifically designed for grades K-4 and grades 5-12. These and other exciting resources are available at:

https://go.nasa.gov/CCPLaunchKit

**NASA Television Coverage**

In addition to social media coverage, NASA Television will air a number of events leading up to, including, and following the historic launch. Continuous coverage of the mission on all NASA TV channels begins at 12:15 p.m. Wednesday, May 27 and continue through Crew Dragon’s arrival at the International Space Station on Thursday, May 28, including the subsequent hatch opening and welcoming ceremony.

Please check the NASA TV schedule for the latest updates on coverage.

Source: NASA
2. Air Deliveries Bring NASA's Perseverance Mars Rover Closer to Launch

Progress continues to speed along as NASA’s Perseverance rover readies for its launch this summer. On May 11, the rover team at the agency’s Kennedy Space Center in Florida received the tubes tasked with **holding the first samples collected at Mars for eventual return to Earth**. A week later, the Atlas V launch vehicle that will hurl Perseverance to the Red Planet arrived at the launch site. Working together, personnel from NASA’s Jet Propulsion Laboratory in Southern California and United Launch Alliance in Centennial, Colorado, were also able to extend the rover's launch period by six days, from Jul. 17-Aug. 5 to Jul. 17-Aug. 11.

The sample tubes will be filled with Martian rock and sediment and deposited on the planet for a future mission to return to Earth to be studied. They’re part of the rover’s **Sample Caching System**, the most complex and capable mechanism of its kind to be sent into space to address the question of potential life beyond Earth.

The tubes and their seals were among the nearly 5,000 pounds (2,270 kilograms) of mission flight hardware, test gear and equipment that traveled from JPL to NASA’s Armstrong Flight Research Center in Palmdale, California. On May 10, the equipment was loaded onto a C-130 cargo plane from NASA’s Wallops Flight Facility in Virginia. The following day, the crew set out for Florida, touching down on Kennedy Space Center’s Launch and Landing Facility a little before 3 p.m. local time. They were back at Wallops that evening.

A week later, on May 18, a giant Antonov cargo plane delivered the first stage of the mission's Atlas V **launch** vehicle, arriving at Kennedy Space Center just after 4 p.m. local time. The following day the booster was transported to the Atlas Spaceflight Operations Center at Cape Canaveral Air Force Station.

Once final testing is complete, the Atlas will be moved to the Vertical Integration Facility at Space Launch Complex 41, where preparations for the launch of Perseverance have begun following the successful Atlas V launch of the USSF-7 mission on May 17. Next, the Centaur upper stage and the payload fairing, which protects the spacecraft during launch, will be stacked on top of it.
Perseverance's Launch Period

Along with welcoming these key deliveries, Perseverance's team recently extended the mission's launch period—the range of days they can launch in order to reach Mars. Navigators calculated the original launch period, July 17-Aug. 5, over four years ago—long before the final weight of the spacecraft (the rover, the protective aeroshell in which it will travel to Mars, the descent stage, and the cruise stage that will take them there) could be well defined. With the new spacecraft data in hand, as well as an update on Atlas V performance margins from United Launch Alliance, the navigation team has expanded the period to Aug. 11.

"Vehicle design maturity is the space navigator’s friend," said Fernando Abilleira, design and navigation manager for the mission. "We now have a 26-day launch period to get Perseverance on its way."

No matter what day Perseverance lifts off during its launch period, it will land in Mars' Jezero Crater on Feb. 18, 2021. Targeting landing for one specific date and time helps mission planners better understand lighting and temperature at the landing site, as well as the location of Mars-orbiting satellites tasked with recording and relaying spacecraft data during its descent and landing.

Explore further

NASA's Perseverance rover spacecraft put in launch configuration

Source: Phys.org
3. New Gravitational-wave Model Can Bring Neutron Stars into Even Sharper Focus

Gravitational-wave researchers at the University of Birmingham have developed a new model that promises to yield fresh insights into the structure and composition of neutron stars.

The model shows that vibrations, or oscillations, inside the stars can be directly measured from the gravitational-wave signal alone. This is because neutron stars will become deformed under the influence of tidal forces, causing them to oscillate at characteristic frequencies, and these encode unique information about the star in the gravitational-wave signal.

This makes asteroseismology -- the study of stellar oscillations -- with gravitational waves from colliding neutron stars a promising new tool to probe the elusive nature of extremely dense nuclear matter.

Neutron stars are the ultradense remnants of collapsed massive stars. They have been observed in the thousands in the electromagnetic spectrum and yet little is known about their nature. Unique information can be gleaned through measuring the gravitational waves emitted when two neutron stars meet and form a binary system. First predicted by Albert Einstein, these ripples in spacetime were first detected by the Advanced Laser Interferometer Gravitational Wave Observatory (LIGO) in 2015.

By utilising the gravitational wave signal to measure the oscillations of the neutron stars, researchers will be able to discover new insights into the interior of these stars. The study is published in Nature Communications.
Dr Geraint Pratten, of the University of Birmingham's Gravitational Wave Institute, is lead author of the study. He explained: "As the two stars spiral around each other, their shapes become distorted by the gravitational force exerted by their companion. This becomes more and more pronounced and leaves a unique imprint in the gravitational wave signal.

"The tidal forces acting on the neutron stars excite oscillations inside the star giving us insight into their internal structure. By measuring these oscillations from the gravitational-wave signal, we can extract information about the fundamental nature and composition of these mysterious objects that would otherwise be inaccessible."

The model developed by the team enables the frequency of these oscillations to be determined directly from gravitational-wave measurements for the first time. The researchers used their model on the first observed gravitational-wave signal from a binary neutron star merger - GW170817.

Co-lead author, Dr Patricia Schmidt, added: "Almost three years after the first gravitational-waves from a binary neutron star were observed, we are still finding new ways to extract more information about them from the signals. The more information we can gather by developing ever more sophisticated theoretical models, the closer we will get to revealing the true nature of neutron stars."

Next generation gravitational wave observatories planned for the 2030s, will be capable of detecting far more binary neutron stars and observing them in much greater detail than is currently possible. The model produced by the Birmingham team will make a significant contribution to this science.

"The information from this initial event was limited as there was quite a lot of background noise that made the signal difficult to isolate," says Dr Pratten. "With more sophisticated instruments we can measure the frequencies of these oscillations much more precisely and this should start to yield some really interesting insights."

Source: Spaceref.com
The Night Sky

Comet SWAN: Yet another fizzler. Comet SWAN (C/2020 F8) has unexpectedly faded down to 6th magnitude or dimmer, instead of brightening to 3rd magnitude as was predicted for its approach to its May 27th perihelion. It's a tiny, faint thing low in the northwest right at the end of evening twilight this week; you'll need a telescope, patience, and an adequately detailed chart.

But you'll already be setting up your scope earlier for Mercury and Venus on the same side of the sky, as described below, so why not?

FRIDAY, MAY 22

■ The Venus-Mercury pairup. Showy Venus and demure little Mercury are still close together low in the west-northwest in twilight, as shown below, following their conjunction yesterday. This evening they're 1.7° apart.

How fast they move! Venus is heading down toward the lower right day by day, while Mercury is ascending to the upper left. (The visibility of objects in bright twilight is exaggerated here.)

■ Venus is a super-thin crescent as it plunges down to the sunset horizon this week. Bring out the telescope and/or binoculars. Mercury in contrast, is a tiny "half Moon" with a much lower surface brightness.

The early days of this week are your last and perhaps best chance to try to resolve the crescent with your unaided eyes. Having mere 20/20 vision isn't good enough; this is for the more eagle-eyed. Start trying at or even before sunset, as soon as you can detect the planet low in the west-northwest. Try during different stages of twilight, before the glare of the tiny, bright planet on a too-dark background turns it into a mess. Look long and carefully and report your results to Sky & Telescope's Bob King, nightsky55@gmail.com, as urged in the May issue, page 49.

You may improve your chances by sighting through a clean, round hole in a stiff piece of paper 1 mm or 2 mm in diameter (try both). This will mask out optical aberrations that are common away from the center of your eye's cornea and lens.

■ New Moon (exact at 1:39 p.m. Eastern Daylight Time).

SATURDAY, MAY 23

■ A twilight challenge: As soon as you can see Venus this evening, start looking lower left of it for the very thin crescent Moon hardly more than a day old (see the date and time of new Moon just above). The Moon and Venus are 4° or 5° apart during twilight for North America. Here's the arrangement as seen from the middle of the continent, and it will vary only a little for the rest of the US and Canada:
SUNDAY, MAY 24

- Now the thicker crescent Moon hangs upper left of Mercury and Venus. It aims its sunlit edge almost straight at them, as shown.

MONDAY, MAY 25

- Look west for the crescent Moon after dusk. About a fist at arm's length above it are Pollux and Castor, the Gemini "twins." They're not identical twins. Pollux, on the left, is slightly brighter and tinted pale orange.

- Vega is the brightest star in the east-northeast after dark. Look upper left of it by 14° (about a fist and a half at arm's length) for Eltanin, the nose of Draco the Dragon. Closer above and upper left of Eltanin are the three fainter stars of Draco's stick-figure head, also called the Lozenge. Draco always points his nose to Vega, no matter the season or how they're oriented. He seems curious about it. Dragons are supposed to have a thing for jewels . . . .

The faintest star of Draco's head, opposite Eltanin, is Nu Draconis. It's a fine, equal-brightness double star for binoculars: separation 61 arcseconds, both magnitude 4.9. This is definitely a true binary; Nu-1 and Nu-2 are both 99 light-years away, and they share a common proper motion against the more distant starry background. Both are hot, chemically peculiar type-Am stars somewhat larger, hotter, and more massive than the Sun. They await your attention higher and higher overhead as the night progresses.

Source: Sky & Telescope
ISS Sighting Opportunities

For Denver:

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Sighting information for other cities can be found at NASA’s [Satellite Sighting Information](https://www.nasa.gov/centers/goddard/home/index.html).

**NASA-TV Highlights**

*(all times Eastern Daylight Time)*

**May 22, Friday**

2:15 p.m. – SpaceX Demo-2 Virtual Crew Engagement (All Channels)
2:45 p.m. – SpaceX Demo-2 Flight Readiness Review Briefing (All Channels)

**May 25, Monday**

6:45 a.m. - Coverage of the Rendezvous and Capture of the JAXA/HTV-9 Cargo Ship at the International Space Station (Capture scheduled at 8:15 a.m. EDT) - Johnson Space Center (All Channels)
9:30 a.m. - Coverage of the Installation of the JAXA/HTV-9 Cargo Ship to the International Space Station - Johnson Space Center (All Channels)
*6 p.m. – SpaceX Demonstration Mission 2 pre-launch briefing (All Channels) *or one hour after launch readiness review

**May 26, Tuesday**

10 a.m. – SpaceX Demonstration Mission 2 Administrator Countdown Clock Briefing (All Channels)

Watch NASA TV on the Net by going to the [NASA website](https://www.nasa.gov/).
Space Calendar

- May 22 - **Mercury** Passes 0.9 Degrees From **Venus**
- May 22 - **Comet 193P/LINEAR-NEAT** Closest Approach To Earth (2.604 AU)
- May 22 - [May 20] **Apollo Asteroid 2020 KD1** Near-Earth Flyby (0.003 AU)
- May 22 - [May 22] **Apollo Asteroid 2020 KW1** Near-Earth Flyby (0.004 AU)
- May 22 - [May 17] **Apollo Asteroid 2020 JY1** Near-Earth Flyby (0.008 AU)
- May 22 - [May 18] **Apollo Asteroid 2020 JH2** Near-Earth Flyby (0.028 AU)
- May 22 - [May 15] **Apollo Asteroid 2020 JE1** Near-Earth Flyby (0.037 AU)
- May 22 - [May 22] **Amor Asteroid 2020 KF2** Near-Earth Flyby (0.043 AU)
- May 22 - **Asteroid 4536 Drewpinsky** Closest Approach To Earth (1.066 AU)
- May 22 - **Asteroid 1002 Olbersia** Closest Approach To Earth (1.835 AU)
- May 22 - **Asteroid 9661 Hohmann** Closest Approach To Earth (3.058 AU)
- May 23 - **Comet C/2019 Y4 (ATLAS)** Closest Approach To Earth (0.781 AU)
- May 23 - **Comet 231P/LINEAR-NEAT** At Opposition (2.442 AU)
- May 23 - **Comet P/2019 GG21 (PANSTARRS)** At Opposition (3.508 AU)
- May 23 - **Comet P/2005 JD108 (Catalina-NEAT)** At Opposition (3.988 AU)
- May 23 - **Comet P/2010 TO20 (LINEAR-Grauer)** Closest Approach To Earth (4.691 AU)
- May 23 - [May 20] **Apollo Asteroid 2020 KU** Near-Earth Flyby (0.003 AU)
- May 23 - [May 16] **Apollo Asteroid 2020 JR1** Near-Earth Flyby (0.010 AU)
- May 23 - [May 18] **Apollo Asteroid 2020 KJ** Near-Earth Flyby (0.023 AU)
- May 23 - **Amor Asteroid 2020 JX** Near-Earth Flyby (0.050 AU)
- May 23 - **Asteroid 50 Virginia** Closest Approach To Earth (2.084 AU)
- May 23 - 70th Anniversary (1950), Madhipura Meteorite Fall (Hit Shed in India)
- May 23 - **Jim Chamberlin**'s 105th Birthday (1915)
- May 24 - [May 22] **MiniCarb (CNGB)/ PAN A & B LauncherOne Launch**
- May 24 - **Moon Occults Asteroid 4 Vesta**
- May 24 - **Comet 196P/Tichy** At Opposition (3.979 AU)
- May 24 - [May 18] **Apollo Asteroid 2020 JZ1** Near-Earth Flyby (0.030 AU)
- May 24 - [May 20] **Amor Asteroid 2020 KX** Near-Earth Flyby (0.032 AU)
- May 24 - **Asteroid 9617 Grahamchapman** Closest Approach To Earth (1.449 AU)
- May 24 - **Asteroid 19620 Auckland** Closest Approach To Earth (2.000 AU)
- May 24 - **Asteroid 18235 Lynden-Bell** Closest Approach To Earth (2.309 AU)
- May 24 - **Asteroid 1282 Utopia** Closest Approach To Earth (2.536 AU)
- May 24 - 60th Anniversary (1960), **Midas 2** Launch (1st Experimental Infrared Surveillance Satellite)
- May 25 - [May 18] **Cygnus NG-13** Reenters Earth's Atmosphere (International Space Station)
- May 25 - [May 18] **Towel Day - Annual Tribute to Douglas Adams**
- May 25 - **Comet P/2007 S1 (Zhao)** At Opposition (3.635 AU)
- May 25 - [May 22] **Comet C/2020 H7 (Lemmon)** At Opposition (3.750 AU)
- May 25 - **Asteroid 12284 Pohl** Closest Approach To Earth (1.627 AU)
- May 25 - **Asteroid 10378 Inqmarbergman** Closest Approach To Earth (1.883 AU)
- May 25 - **Asteroid 451 Patientia** Closest Approach To Earth (2.286 AU)
- May 25 - **Online Lecture: Characteristics of Localized Lunar Pyroclastic Deposits**
- May 25 - 75th Anniversary (1945), **Arthur C Clarke Proposes Communication Satellites in Geosynchronous Orbit**
- May 25 - 95th Anniversary (1925), R. Watson's Discovery of **Nova Pictoris 1925**
- May 25 - **Pieter Zeeman**'s 155th Birthday (1865)
- May 25 - **Daniel Barringer**'s 160th Birthday (1860)
- May 26 - **Comet 239P/LINEAR** At Opposition (3.383 AU)
- May 26 - [NEW] [May 22] Comet C/2020 H7 (Lemmon) Closest Approach To Earth (3.750 AU)
- May 26 - Comet 45P/Honda-Mrkos-Pajdusakova At Opposition (4.238 AU)
- May 26 - Asteroid 342843 Davidbowie Closest Approach To Earth (1.841 AU)

Source: JPL Space Calendar
Food for Thought

Jupiter Is So Big that Our Solar System Almost Had Two Suns

About half of all the star systems in the galaxy are made of pairs or triplets of stars. Our solar system features just one star, the Sun, and a host of (relatively) small planets. But it was almost not the case, and Jupiter got right on the edge of becoming the Sun’s smaller sibling.

Jupiter, the biggest planet in the solar system, is by far the largest. If you added up the masses of all the other planets, it wouldn’t even come to half of the mass of Jupiter. You could eliminate every single planet in the solar system except Jupiter, and you would basically still have...the solar system.

I’m not trying to make you feel insignificant, but the mass of the Earth is just a rounding error when adding up all the stuff orbiting the Sun.

Jupiter is so immensely big that it’s right on the cusp of becoming a star in its own right. If it were about 20 times bigger than it is, it would be heavy enough that the pressures and temperatures in the core would be high enough to ignite nuclear fusion and start Jupiter on the path to stardom (albeit as a small, barely-there red dwarf, but it would still count).

Now I get that “20 times” sounds like a big deal. If you were 20 times bigger than you are now, that would be a slightly concerning medical issue. But in the astronomy world that’s peanuts.

The material that formed our solar system coalesced to form the planets, and most of that material ended up on Jupiter through runaway exponential growth. A small clump of rocks and ices – probably about 5-10 times the mass of the Earth – formed a core which hoovered down all the surrounding hydrogen and helium as fast
as it possibly could. And when it comes to exponential growth, 20 times bigger isn’t all that much – if you want an analogy, just see how quickly the recent novel coronavirus outbreak spread in a matter of days.

If our solar system was just a little bit different, Jupiter would have ended up igniting and lighting up as a second sun. This doesn’t rule out the formation of other planets – we know of planets orbiting binary stars – but it would make life on Earth much more unlikely, as planets that orbit in binary systems almost never get that sweet spot of temperatures needed to prevent water from either evaporating from heat or freezing from cold.

So we’ll take Jupiter exactly as it is, thank you.

Source: Universe Today

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Moon, Mars, Saturn, Jupiter, Milky Way

Explanation  It is not a coincidence that planets line up. That's because all of the planets orbit the Sun in (nearly) a single sheet called the plane of the ecliptic. When viewed from inside that plane -- as Earth dwellers are likely to do -- the planets all appear confined to a single band. It is a coincidence, though, when three of the brightest planets all appear in nearly the same direction. Such a coincidence was captured about a month ago. Featured above, Earth's Moon, Mars, Saturn, and Jupiter were all imaged together, just before sunrise, from the Black Sea coast of Bulgaria. A second band is visible diagonally across this image -- the central band of our Milky Way Galaxy. If you wake up early, you will find that these same planets remain visible in the morning sky this month, too.

Image Credit & Copyright: Mihail Minkov

Source: APOD