

"If you wish to make an apple pie from scratch, you must first invent the universe." Carl Sagan



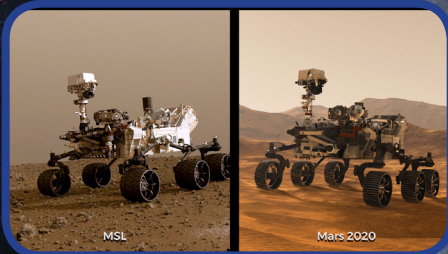
# Astro

Volume 12, Issue 19

December 17, 2019

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## Two Rovers to Toll on Mars Again in 2020

Curiosity won't be NASA's only active Mars rover for much longer. Next summer, Mars 2020 will be headed for the Red Planet. While the newest rover borrows from Curiosity's design, they aren't twins: Built and managed by NASA's Jet Propulsion Laboratory in Pasadena, California, each has its own role in the ongoing exploration of Mars and the search for ancient life.

Landing in 2004 to "follow the water," the twin rovers Spirit and Opportunity discovered evidence that the planet once hosted running water before becoming a frozen desert.

MarsDaily.com

## How Does Our Milky Way Galaxy Get Its Spiral Form?

A question that has long puzzled scientists is how our Milky Way galaxy which has an elegant spiral shape with long arms, took this form. Universities Space Research Association today announced that new observations of another galaxy are shedding light on how spiral-shaped galaxies like our own get their iconic shape. According to research from the Stratospheric Observatory for Infrared Astronomy (SOFIA), magnetic fields play a strong role in shaping these galaxies.

"Magnetic fields are invisible, but they may influence the evolution of a galaxy," said Dr. Enrique Lopez-Rodriguez, a Universities Space Research Association scientist at the SOFIA Science Center at NASA's Ames Research Center in California's Silicon Valley.

Phys.org



## Blue Origin Has Now Flown the Same Rocket Six Times



### Blue Origin Has Now Flown the Same Rocket Six Times

Blue Origin successfully launched their New Shepard rocket on December 11. The launch from Amazon founder Jeff Bezos' aerospace company took place in West Texas, and it brought over 1,000 postcards and art projects from students into space.

The launch marked the 100th commercial payload mission for the company as well as the 12th time they have launched a New Shepard rocket, and the 6th launch of the specific booster used in the launch.

New Shepard combines a reusable booster rocket with a capsule that can carry cargo — and someday crew. The rocket is named after Alan Shepard, the first American in space. New Shepard launches take it on an 11-minute flight that just crosses the boundary of space. Then, as it returns, the rocket booster lands vertically on Earth's surface. The capsule comes back with a parachute system.

In the near future, Blue Origin hopes to transform their capsule from a payload bearing vehicle into one that can bring humans into space. Crewed missions would allow researchers, students, and space tourists to experience microgravity.



### Moon FARSIDE: Lunar Astronomy Proposal Takes Aim at Cosmic Dark Ages and Exoplanets

The far side of the moon is an attention grabber for many reasons. A new mission idea capitalizes on those reasons in a project dubbed the Farside Array for Radio Science Investigations of the Dark ages and Exoplanets, shortened to this enlightened abbreviation: FARSIDE.

The concept would place a low-radio-frequency interferometric array on the far side of the moon. Jack Burns of the University of Colorado Boulder and Gregg Hallinan of the California Institute of Technology have sketched out a way to execute the mission in a NASA-funded report published last month.

But those are just the highlights. The team explained that FARSIDE could also conduct a range of other tasks. Those applications might include sounding the lunar subsurface and characterizing the interstellar medium in the solar system neighborhood.

The FARSIDE idea encompasses the instrument itself, a deployment rover, the lander and a base station. FARSIDE relies on 128 dipole antennas deployed across 6 miles (10 kilometers) of the lunar landscape by a rover. Tethers

connect the antennas to a base station for central processing, power and data transmission to the proposed NASA Lunar Gateway or an alternative relay satellite.

FARSIDE would require transportation to the lunar surface, likely on board a commercial lunar lander. The study report uses the Blue Origin Blue Moon lander as a reference for the design.

All told, the team estimated that the budget for FARSIDE, after applying NASA and JPL standard cost reserves of 30% during development and 15% during operations, would be roughly \$1.3 billion.

"In the past decade, significant investments have been made by commercial companies to develop the capability to deliver payloads to the surface of the moon, with some companies now on the horizon of success" the team wrote in the report. "NASA shows strong support of these companies through the Commercial Lunar Payload Services Program (CLPS), which recently awarded the first contract to three companies for payload delivery with a launch target in 2021."



## Celebrating 10 Years of the WISE Spacecraft

Just before sunrise on Dec. 14, 2009, a Delta-II rocket lifted off from California's Vandenberg Air Force Base and brought NASA's Wide-field Infrared Survey Explorer (WISE) to low-Earth orbit. Its mission: to study galaxies, stars, asteroids and comets by imaging the entire sky in infrared light.

WISE was placed in hibernation in February 2011 after completing its primary astrophysics mission, but in late 2013, the spacecraft was reactivated, renamed NEOWISE and assigned a second mission dedicated to identifying and characterizing the population of near-Earth objects while also providing information about the size and composition of more distant asteroids and comets. Over the last decade, data from WISE and NEOWISE have been cited in more than 3,000 peer-reviewed publications and been used to study distant galaxies, cool stars, exploding white dwarfs, outgassing comets, near-Earth asteroids and everything in between.

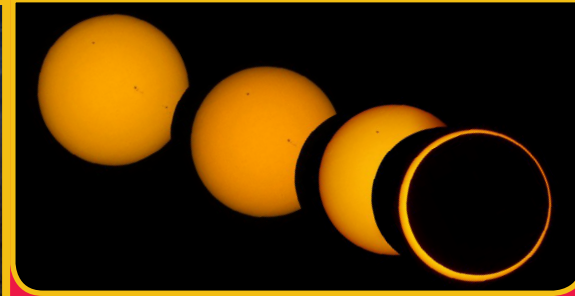
To celebrate the 10th anniversary of the spacecraft's launch, the mission team has gathered their

top 10 images and graphics based on WISE and NEOWISE data.

### The Sky as Seen by WISE

The fundamental objective of the WISE mission was to map the entire sky in infrared light with hundreds to hundreds of thousands of times greater sensitivity than previous surveys. WISE completed this objective in 2010. This image shows the entire sky as seen by WISE with its four infrared detectors (3.4- and 4.6-micron light is colored blue; 12-micron light is green; and 22-micron light is red), with the plane of our Milky Way galaxy running across the center.

Trojan asteroids share an orbit with a planet, orbiting the Sun ahead of or behind the planet. While Trojan asteroids associated with Jupiter, Neptune and Mars are known, NEOWISE discovered the first (and so far only) Trojan asteroid in Earth's orbit, known as 2010 TK7. In this artist's conception, the asteroid is shown in gray and its orbit, which oscillates above and below Earth's every four centuries, is shown in green. Earth's orbit around the Sun is indicated by blue dots.



## Middle of Eclipse Season December 30

The annular solar eclipse on December 26, 2019, happens some 4 days before the middle of the eclipse season, which falls on December 30, 2019.

The upcoming annual solar eclipse on December 26, 2019, happens some 4 days before the middle of the eclipse season, which falls on December 30, 2019. An eclipse season lasts for about 35 days, and any new moon or full moon occurring within this time period will undergo an eclipse. Given that the lunar month (period of time between successive new moons or successive full moons) is about 29.5 days long, a minimum of 2 eclipses (one solar and one lunar, in either order), or a maximum of 3 eclipses (either lunar/solar/lunar, or solar/lunar/solar) can take place in one eclipse season.

Most often, there are only two eclipses in one eclipse season. For three eclipses to occur, the first one has to come quite early in the eclipse season to allow for a third eclipse near the end. This time around, there are 2 eclipses in one eclipse season. The solar eclipse on December 26, 2019, happens about 4 days before the middle of the eclipse season, whereas the lunar eclipse on January 10, 2020, comes a solid 11 days after the midpoint of the eclipse season. Because this lunar eclipse happens rather late in the eclipse season, the upcoming new moon on January 10, 2020, won't even meet up with the Earth's dark umbral shadow.



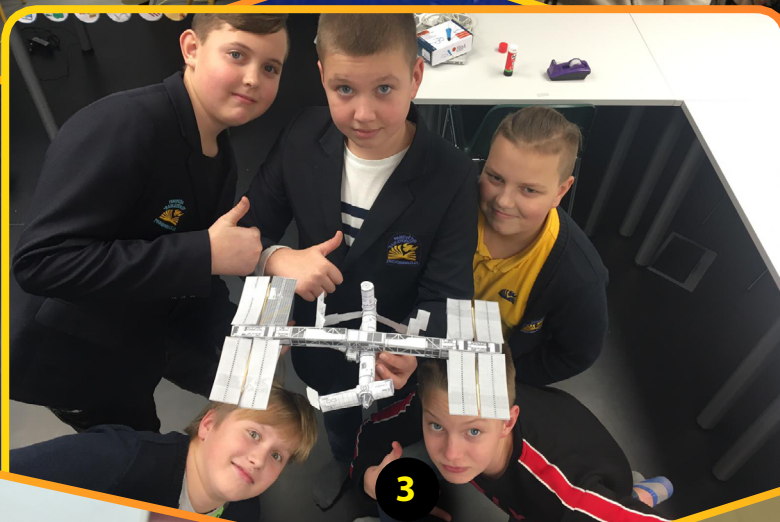


Global Friendship Through Space Education

# SCHOOLS In ACTION!

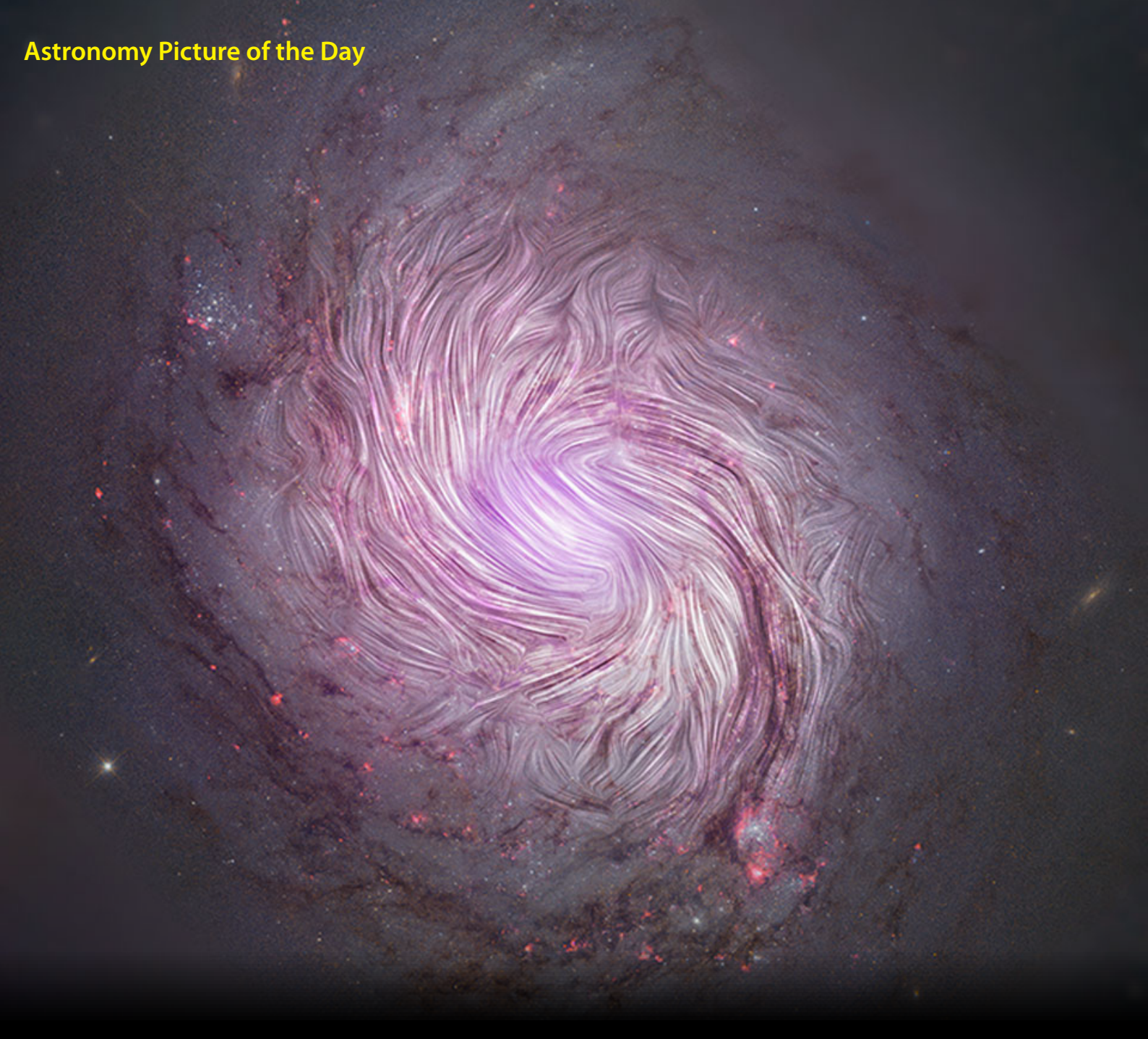
Dear followers,

The photographs, which you can see below, are the ones that were taken during the projects and presentations of the students that participated in PSSP (Partner School Science Program) and FEP (Future Explorers Program). We are happy and proud to share the projects that were created with brilliant ideas.



1- Hristo Botev Secondary School (FEP), BULGARIA 2- Gymnasium No:3 of Volgograd (FEP), RUSSIA 3- RoboLabas (FEP), LITHUANIA  
4- Yane Sandanski School (PSSP), BULGARIA 5- Little Prince Private School (FEP), BULGARIA





## Astronomy Picture of the Day

### *The Magnetic Fields of Spiral Galaxy M77*

**Image Credit & Copyright:** NASA, SOFIA, HAWC+; JPL-Caltech, Roma Tre. U.; ESA, Hubble, NuSTAR, SDSS

Can magnetic fields help tell us how spiral galaxies form and evolve? To find out, the HAWC+ instrument on NASA's airborne (747) SOFIA observatory observed nearby spiral galaxy M77. HAWC+ maps magnetism by observing polarized infrared light emitted by elongated dust grains rotating in alignment with the local magnetic field. The HAWC+ image shows that magnetic fields do appear to trace the spiral arms in the inner regions of M77, arms that likely highlight density waves in the inflowing gas, dust and stars caused by the gravity of the galaxy's oval shape. The featured picture superposes the HAWC+ image over diffuse X-ray emission mapped by NASA's NuSTAR satellite and visible light images taken by Hubble and the SDSS. M77 is located about 47 million light years away toward the constellation of the Sea Monster (Cetus).

[apod.nasa.gov](http://apod.nasa.gov)



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