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The cataclysm that killed the dinosaurs

The Chicxulub impactor, as it's known, left behind a crater off the coast of Mexico that spans 93 miles and goes 12 miles deep. Its devastating impact brought the reign of the dinosaurs to an abrupt and calamitous end by triggering their sudden mass extinction, along with the end of almost three-quarters of the plant and animal species then living on Earth.

In a study published in *Scientific Reports*, Avi Loeb, Frank B. Baird Jr. Professor of Science at Harvard, and Amir Siraj '21, concentrating in astrophysics, put forth a new theory that could explain the origin and journey of this catastrophic object and others like it.

Using statistical analysis and gravitational simulations, Loeb and Siraj show that a significant fraction of a type of comet originating from the Oort cloud, a sphere of debris at the edge of the solar system, was bumped off-course by Jupiter's gravitational field during its orbit and sent close to the sun, whose tidal force broke apart pieces of the rock. That increases the rate of comets like Chicxulub (pronounced Chicks-uh-lub) because these fragments cross the Earth's orbit and hit the planet once every 250 to 730 million years or so.

The calculations from Loeb and Siraj's theory increase the chances of long-period comets impacting Earth by a factor of about 10, and show that about 20 percent of long-period comets become sun grazers. That finding falls in line with research from other astronomers.

(Source: sciencedaily.com)

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WHAT'S UP(COMING)!

March 13 – New Moon
March 19 – Conjunction of Moon and Mars ⊗
March 28 – Full Moon
April 6 – Conjunction of Moon and Saturn ⊗
April 7 – Conjunction of Moon and Jupiter ⊗
April 11 – New Moon
April 17 – Conjunction of Moon and Mars
April 22 – Lyrid meteor shower peak
April 26 – Full Moon
May 3 – Conjunction of Moon and Saturn ⊗
May 4 – Conjunction of Moon and Jupiter ⊗
May 6 – η-Aquariid meteor shower peak
May 8 – η-Lyrid meteor shower peak
May 11 – New Moon
May 13 – Conjunction of Moon and Mercury ⊗
May 15 – Conjunction of Moon and Mars ⊗
May 26 – Total lunar eclipse/full Moon

⊗ not within field of view of a telescope

Success! NASA safely lands Perseverance on Mars

Perseverance captured video of its entire landing stage. This still image shows the rover being lowered down to Mars' surface via its Skycrane maneuver.

Within the next few months, Perseverance is expected to drop off its tag-along experimental helicopter, Ingenuity, before rolling away to a safe distance while the rotor-craft carries out a series of tests.

From there, Perseverance will continue with its primary mission: investigating areas of interest throughout Jezero Crater in an attempt to both characterize the site's past geology, as well as search for signs of ancient martian life.

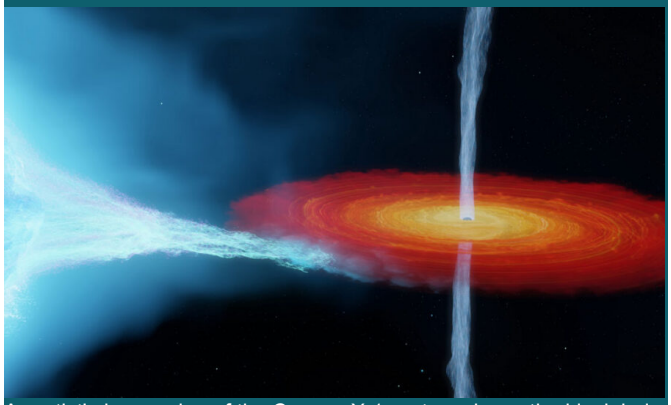
To do this, Perseverance comes equipped with a number of high-tech instruments. There's PIXL and SHERLOC, which are mounted to the end of the rover's arm and will create detailed spatial maps of both the elemental and molecular compositions of notable rock outcroppings.

And if Perseverance finds a particularly intriguing target, the rover will then use its coring drill to collect and store a sample from the site, which it will later deposit at designated cache depots until a future sample-return mission can bring the samples back to Earth.

Lori Glaze, Director of NASA's Planetary Science Division, put it best during the press conference: "Now that we're on the ground, now the fun really starts."

(Source: Astronomy.com)

First-detected Black Hole is More Massive Than We Thought



An artist's impression of the Cygnus X-1 system shows the black hole feeding off its giant stellar companion. Credit: International Centre for Radio Astronomy Research

Cygnus X-1 is part of a binary system, first discovered in 1964 by its powerful X-rays. Closer inspection showed a supergiant star orbiting an unseen companion every 5.6 days. The black hole is siphoning material away from the star, releasing X-rays and radio jets in the process. The stellar-mass black hole is the most massive ever detected without the use of gravitational waves.

About a decade ago, scientists were able to make the first precise calculations of the system's distance and mass using the Very Long Baseline Array (VLBA), a network of radio telescopes spread across the U.S.

"As the Earth moves around the Sun, we see Cygnus X-1 from different vantage points," explains study lead James Miller-Jones (International Centre for Radio Astronomy Research-Curtin University, Australia). As a result, Cygnus X-1 — and the radio jet it emits — appears to move back and forth against the backdrop of far more distant galaxies. Measuring this shift enables scientists to work out the distance to the black hole and its star companion, which affects the calculation of their masses. The 2011 observations were taken over the course of a year and suggested that Cygnus X-1 is about 6,000 light-years away and 15 times the mass of the Sun.

For the current study, Miller-Jones and colleagues used the VLBA to observe the system over six days to watch how the radio emission changes over the course of a single orbit. They used this information to correct for the supergiant's stellar wind, which absorb radio emission passing through it and can thus shift the apparent position of the black hole's radio jet base. Combining this understanding with archival observations taken over more than seven years, the team obtained improved radio measurements.

The new results show that Cygnus X-1 is more than 7,000 light-years away and thus more massive than originally thought. The new calculations show the black hole has the mass of 21 Suns; the giant star companion is around 40 solar masses. The results put the radio measurements in agreement with visible-light measurements of parallax from the European Space Agency's Gaia satellite.

(Source: skyandtelescope.com)

We have decided to publish the newsletter on a bimonthly schedule. Please send any comments, suggestions, topics, or questions to:

newsletter @bpastro.org

Rare blast's remains discovered in Milky Way's center

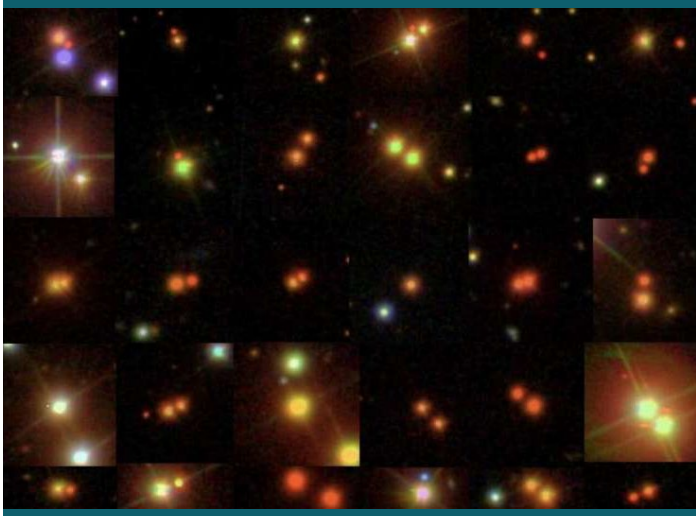
Astronomers may have found our galaxy's first example of an unusual kind of stellar explosion. This discovery, made with NASA's Chandra X-ray Observatory, adds to the understanding of how some stars shatter and seed the universe with elements critical for life on Earth.

This intriguing object, located near the center of the Milky Way, is a supernova remnant called Sagittarius A East, or Sgr A East for short. Based on Chandra data, astronomers previously classified the object as the remains of a massive star that exploded as a supernova, one of many kinds of exploded stars that scientists have catalogued.

Using longer Chandra observations, a team of astronomers has now instead concluded that the object is left over from a different type of supernova. It is the explosion of a white dwarf, a shrunken stellar ember from a fuel-depleted star like our Sun. When a white dwarf pulls too much material from a companion star or merges with another white dwarf, the white dwarf is destroyed, accompanied by a stunning flash of light.

(Source: Sciencedaily.com)

Binary stars are all around us



A colorful collage of binary star pairs near Earth, courtesy of the Gaia survey. Credit: ESA/Gaia/DPAC

The latest star data from the Gaia space observatory has for the first time allowed astronomers to generate a massive 3-D atlas of widely separated binary stars within about 3,000 light years of Earth—1.3 million of them.

The one-of-a-kind atlas, created by Kareem El-Badry, an astrophysics Ph.D. student from the University of California, Berkeley, should be a boon for those who study binary stars—which make up at least half of all sunlike stars—and white dwarfs, exoplanets and stellar evolution, in general. Before Gaia, the last compilation of nearby binary stars, assembled using data from the now-defunct Hipparcos satellite, included about 200 likely pairs.

"This is just a massive increase in sample size," said El-Badry. "And it is an increase in what kinds of evolutionary phases we find the binaries in. In our sample, we have 17,000 white dwarfs alone. This is a much bigger census."

One takeaway, he said, is that the new analysis confirms something hinted at in the 2018 data: Many binary star pairs are very similar in mass.

The implication, he said, is that they formed much closer together in a process that tended to equalize their masses and then migrated apart, perhaps because of interactions with other nearby stars.

(Source: skyandtelescope.com)