FEB' 24

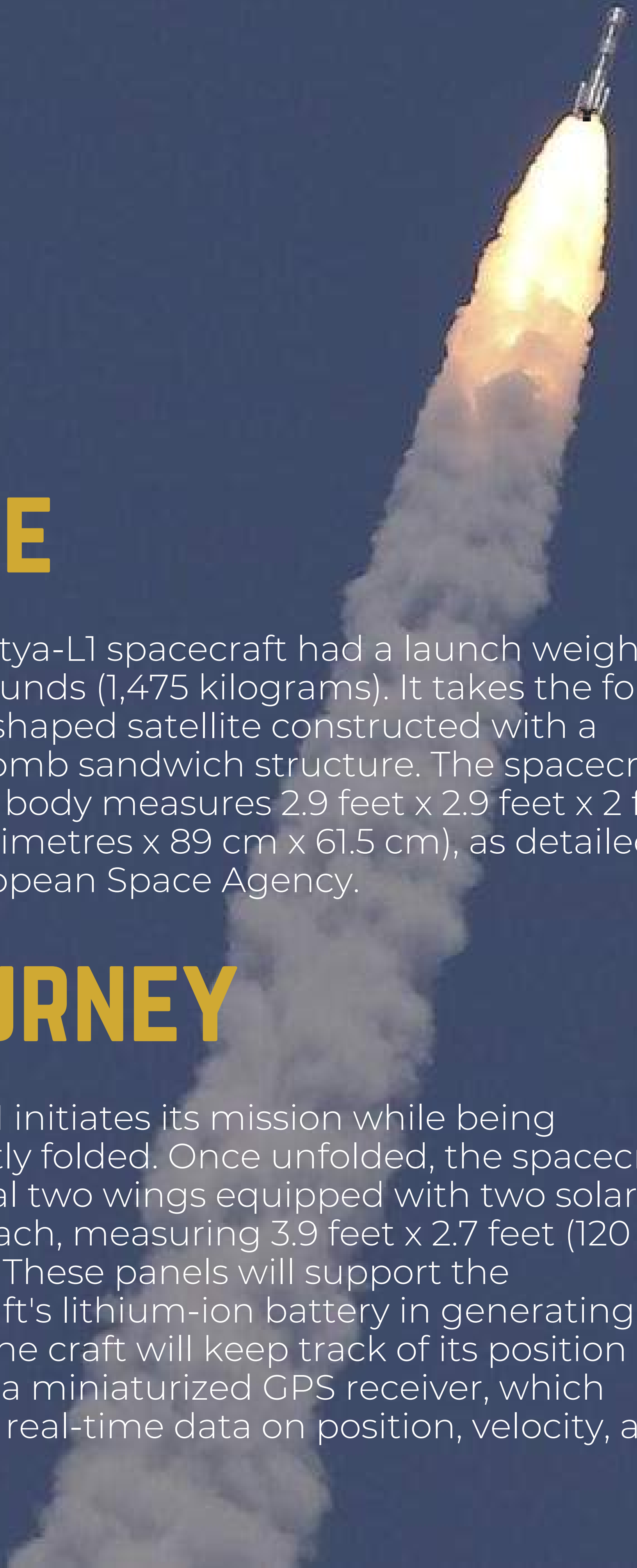
SKYLAB NEWSLETTER

ADITYA L1

Skylab Newsletter

ABOUT ADITYA L1

The Aditya L1 is a risky endeavour initiated by ISRO (Indian Space Research Organisation) to take another step-in space research. After the phenomenal success of the Chandrayaan-3 mission, India has another resolve to keep the first-ever mission to study the Sun a success. Its objectives include solar observation and the design of Aditya L1 to study the Sun's patterns and dynamics closely; this will provide us with information on the Sun's various aspects, such as its surface, corona, and solar wind. It also aims to monitor solar activity. Understanding the corona is also an objective of the mission and is one of the top mysteries; its point is to explain the intense heat of the corona, which is much hotter than the Sun's surface. Aditya-L1 serves as a space weather station; it monitors and collects data on the space weather conditions near the Earth, and this is crucial to find out how solar variability impacts the Earth's climate and space weather, which can affect communication systems, power grids, and satellite operations .



Size

The Aditya-L1 spacecraft had a launch weight of 3,252 pounds (1,475 kilograms). It takes the form of a cube-shaped satellite constructed with a honeycomb sandwich structure. The spacecraft's primary body measures 2.9 feet x 2.9 feet x 2 feet (89 centimetres x 89 cm x 61.5 cm), as detailed by the European Space Agency.

Journey

Aditya-L1 initiates its mission while being compactly folded. Once unfolded, the spacecraft will reveal two wings equipped with two solar panels each, measuring 3.9 feet x 2.7 feet (120 cm x 81 cm). These panels will support the spacecraft's lithium-ion battery in generating power. The craft will keep track of its position through a miniaturized GPS receiver, which provides real-time data on position, velocity, and time.

CONTENTS OF ADITYA L1

HEL 1OS

(High Energy L1 Orbiting X-ray Spectrometer)HEL1OS will focus on solar flares, investigating both thermal and non-thermal emissions as flares develop. It will also study X-ray pulsations during solar flares to understand how these high-energy emissions relate to the acceleration of particles like electrons around the sun.

SUIT

Developed by the Inter University for Astronomy and Astrophysics, SUIT(Solar Ultraviolet Imaging Telescope) is an ultraviolet telescope designed to image the solar disk. It aims to comprehend the energy transfer from the photosphere to the corona, explore the wavelengths at which solar flares emit the most energy, and observe how different flare phases appear at various layers of the sun's atmosphere.

PAPA

Plasma Analyser Package for Aditya PAPA's two sensors will also study the solar wind, investigating its composition and the distribution of energy within it. The instrument will examine the speed of electrons in the solar wind and the temperature differences between electrons and protons at various points in the stream of solar plasma.


WHAT
IF.....?

What if the Sun suddenly disappeared?

After 8 minutes, your world will go dark! Small plants would eventually die; your lights may work or sometime unless they are powered by solar electricity. Within two seconds, the moon would go dark. No more moon. The Earth all the other objects in our solar system would march their way in a straight line off to space instead of following a circular orbit. Larger trees will die in a few decades, animals will start to die. Sometime into it, you will freeze as the Earth's temperature begins to decrease. Earth would head off towards stars about at about 30km/s, floating around space. If earth was lucky enough to avoid getting caught up in these collisions and did not just fly off into space, it might start revolving around a new centre.

What if we spent 5 seconds on Venus?

Spending just five seconds on Venus is considered a mission completion, highlighting the extreme and inhospitable nature of the planet. The atmospheric pressure on Venus is 90 times that of Earth, which, combined with the lack of oxygen, would be fatal to humans without proper protective gear.

What if a white hole and black hole collided?

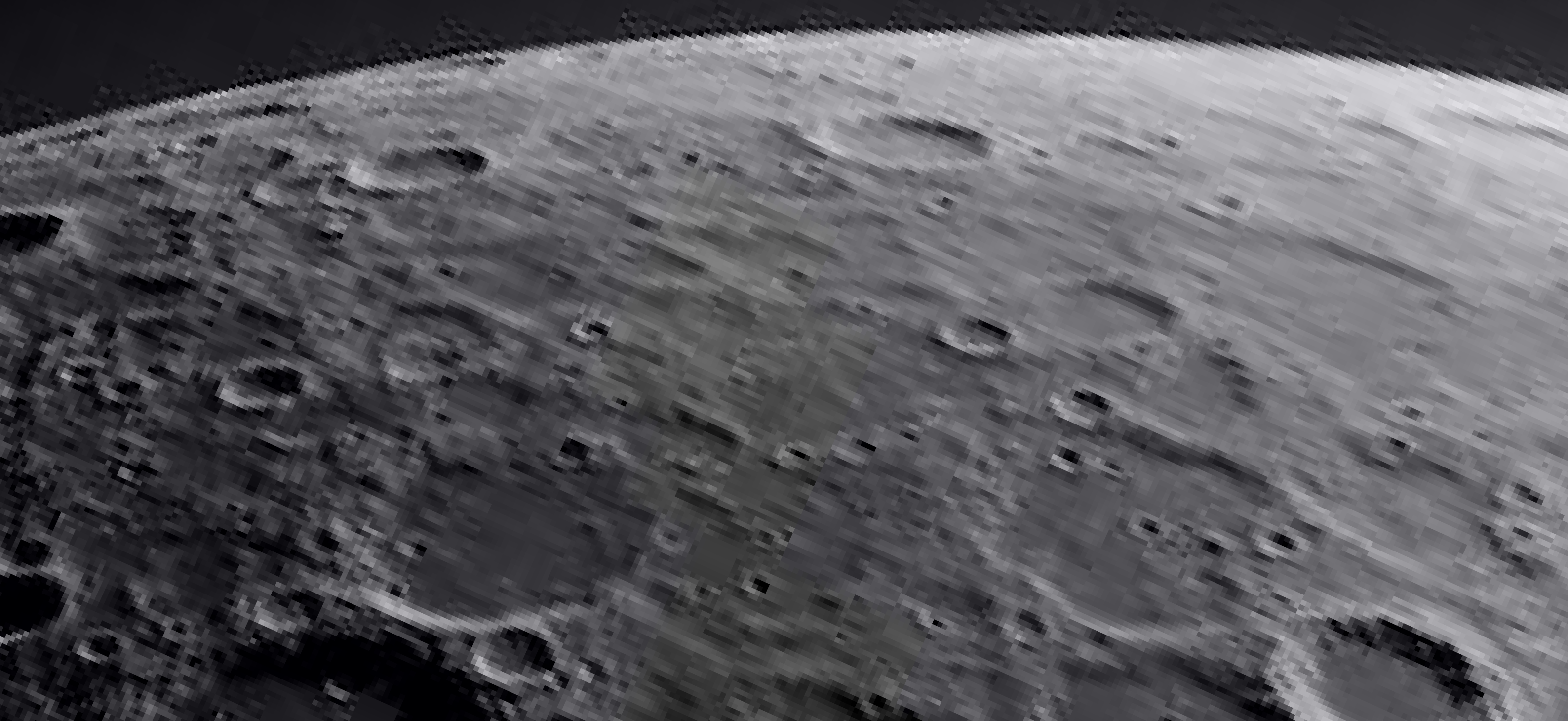
This means that in a hypothetical universe where there is a black and a white hole, in a short time after their first interaction the white hole will become another black hole so that the system will end up with two black holes.

CHANDRAYAAN

India's first moon-exploration excursion took its first leap, all the way back in October 2008. Since then, India as a country and its interests and knowledge on the moon has developed vastly.

CHANDRAYAAN - 1

Chandrayan was first launched on 22nd October 2008. The spacecraft was orbiting the Moon at a height of 100 kilometers above the lunar surface to map the Moon's chemical, mineralogical and photo-geologic composition. It was made up of two parts: a lunar orbiter and an impactor. Chandrayaan-1 discovered water molecules on the Moon's surface, particularly in the polar regions, indicating the presence of water ice. This discovery was an exceptionally proud moment for the country, but this was only achieved after facing several challenges in the process prior to launching. The creators had to produce ways to establish deep-space communication, and to get the spacecraft to stably orbit around the moon without getting significantly affected by the vacuum conditions and extreme temperatures of space.

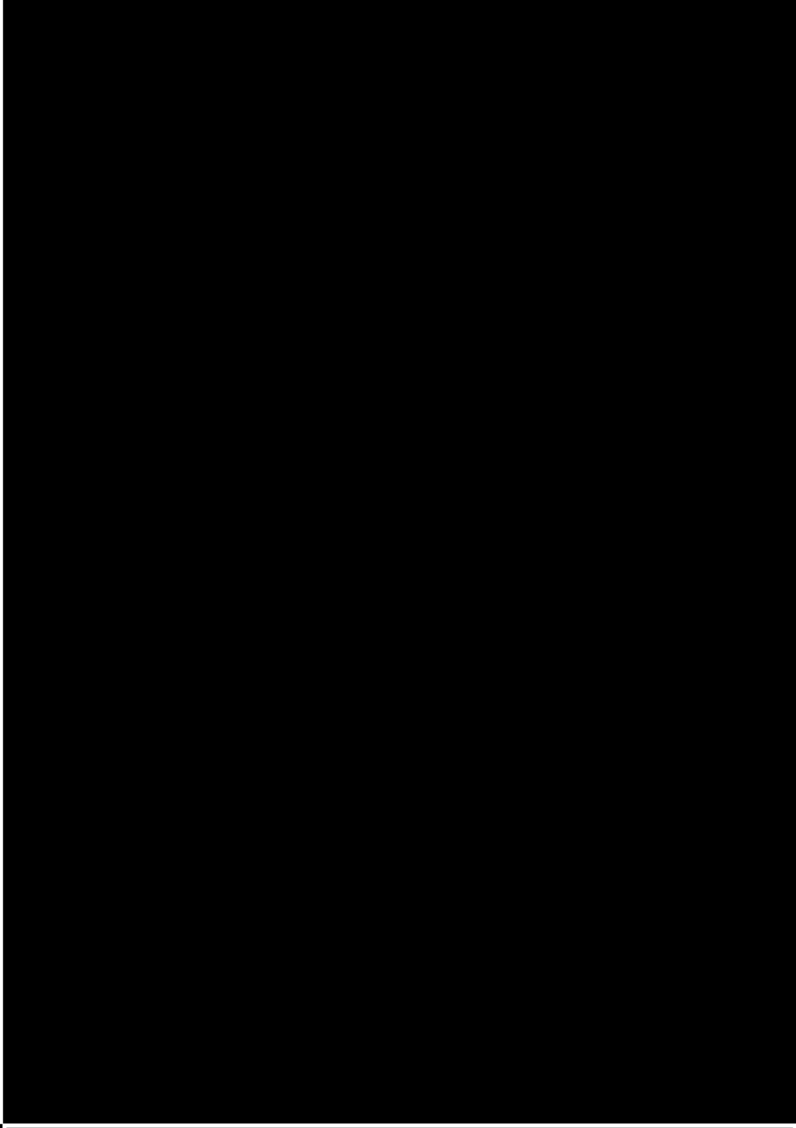


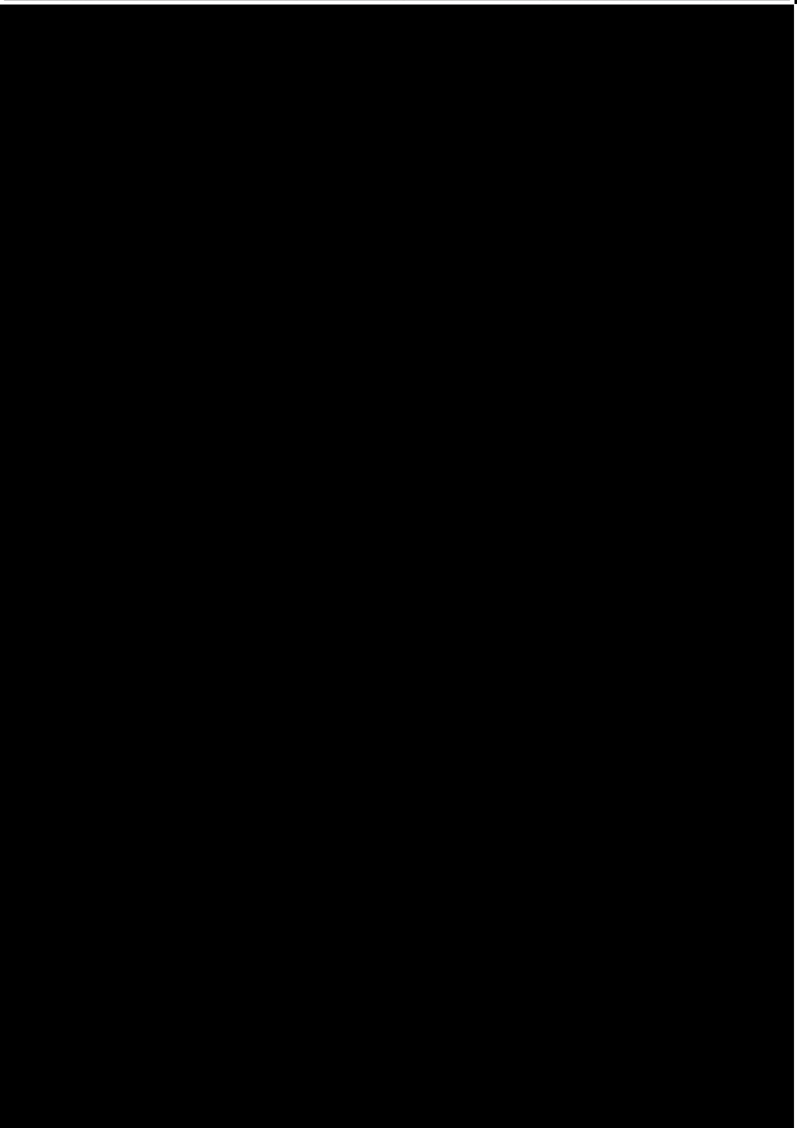
CHANDRAYAAN - 2

The second expedition aimed to expand India's lunar scientific knowledge through detailed study of the topography, surface chemical composition, the thermo-physical characteristics of the topsoil and a lot more. It was the most complex mission India aimed to achieve by far. It comprised an Orbiter, Lander, and Rover to explore the unexplored South Pole of the Moon. Unfortunately, Chandrayan 2 was not completely successful. While the Orbiter successfully entered lunar orbit and is still sending back useful data, the Vikram lander lost contact during its descent to the lunar surface. As a result, the Pragyan rover was not properly deployed.

ISRO faced a lot more challenges while crafting Chandrayan 2 than it did the first Chandrayan. The Chandrayaan-2 mission required accurate predictions of the Moon's orbit and its intersection with Chandrayaan-2. The lunar surface is covered with craters, rocks, and dust, disrupting deployment mechanisms, the performance of solar panels and of NGC sensors. The mission required a combination of hard and good braking, local variations in gravity, and automated navigation and control systems.

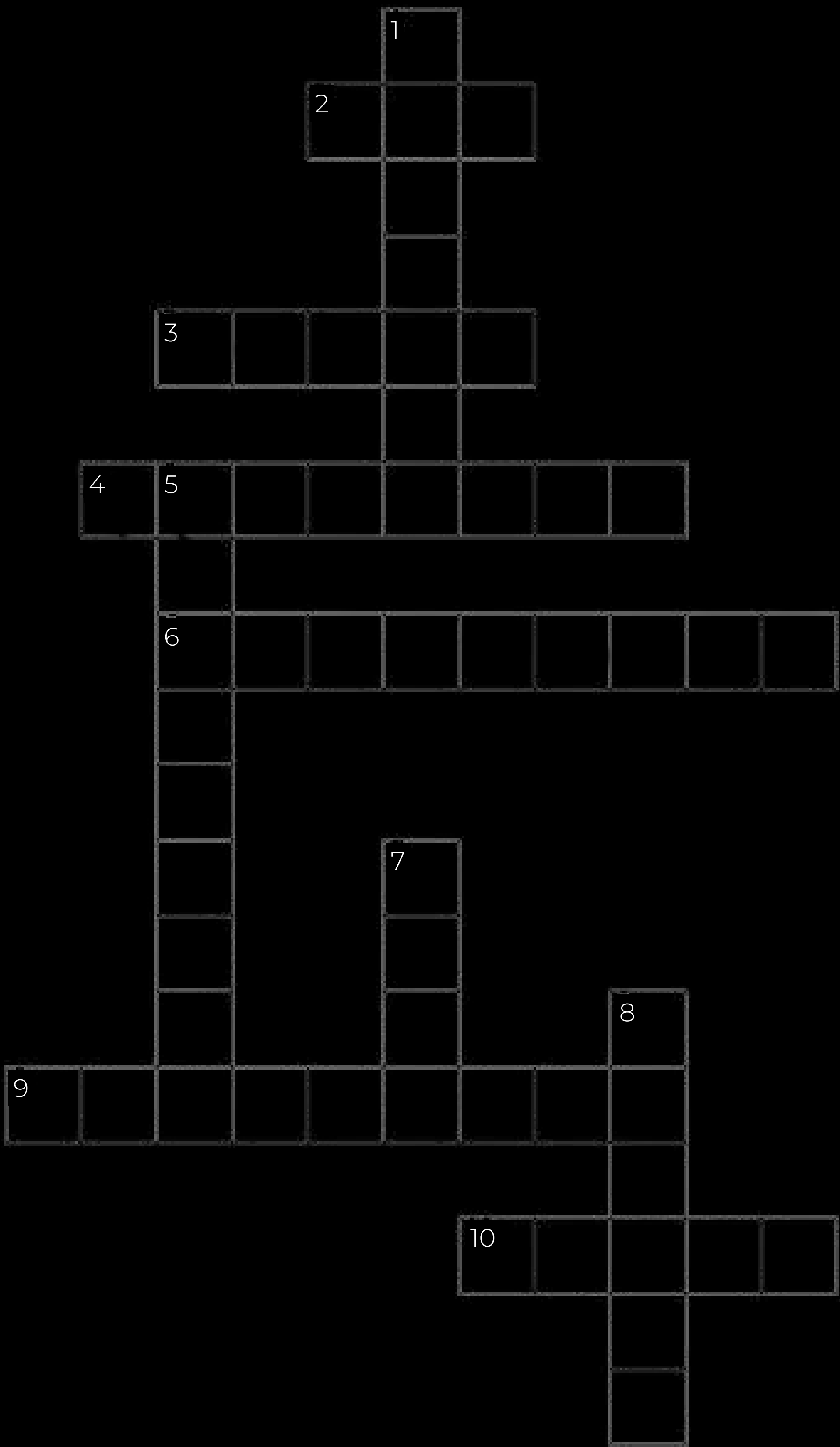

SKYLAB GALLERY





GAMES CORNER

CROSSWORD



ACROSS
2. The closest star to the earth
3. The third planet from the sun
4. A rocky or metallic object in space
6 . The study of stars and othe celestial bodies
9. A massive explosion in spac
10. hole A region of space having gravitational pull so strong that nothing, not even light, can escape

DOWN
1. The largest planet in our solar system
5. A spacecraft designed to carry humans into space
7. The celestial body that orbits a planet
8. A large group of stars held together by gravity

GAMES CORNER

WORD SEARCH

H	D	E	A	R	T	H	M
S	T	A	R	M	O	O	N
I	O	U	L	F	L	L	G
G	A	L	A	X	Y	V	I
S	U	N	W	V	U	C	T
U	P	L	A	N	E	T	F
S	K	Y	R	X	H	F	O
M	I	U	W	R	H	V	K

Key:

EARTH GALAXY MOON
PLANET SKY STAR SUN

WARP SPEED AHEAD

How Our Galaxy's Black Hole Bends Spacetime

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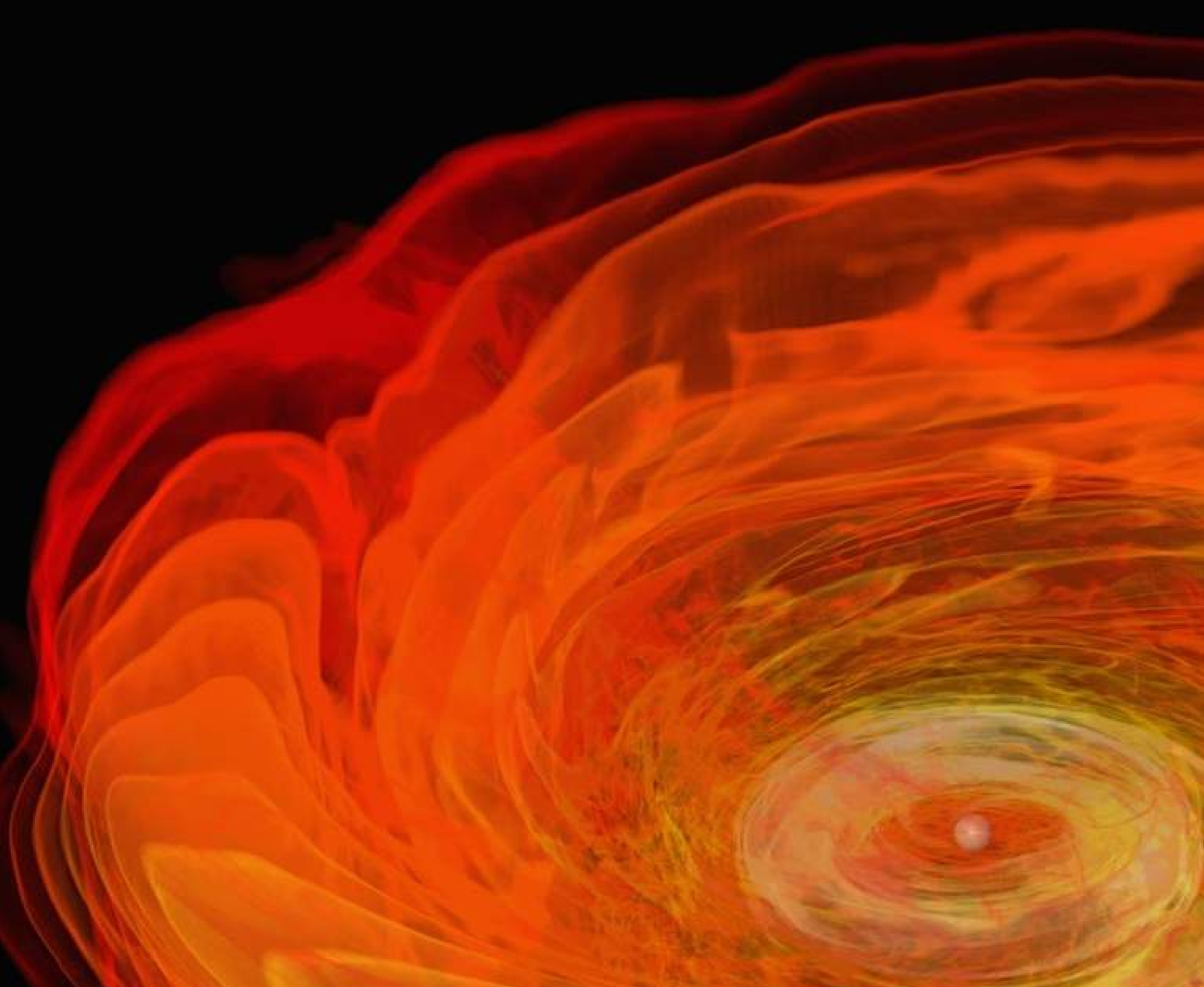
SAGITTARIUS A*,

the supermassive black hole situated at the heart of the Milky Way, exhibits a rotation so rapid that it distorts the spacetime encompassing it, exerting influence on the dynamics of the galaxy and potentially impacting future celestial formations.

The supermassive black hole residing at the core of the Milky Way is spinning at such a high velocity that it warps the spacetime in its vicinity into a shape resembling that of a football, as revealed by a recent investigation utilising data from NASA's Chandra X-ray Observatory and the National Science Foundation's Karl G. Jansky Very Large Array (VLA).
Referred to by astronomers as Sagittarius A* (Sgr A*), this colossal black hole is positioned approximately 26,000 light-years away from Earth within the centre of our galaxy.
Black holes possess two intrinsic characteristics: their mass, representing their weight, and their spin, denoting their rotational speed. Determining either of these attributes provides scientists with valuable insights into the nature and behaviour of any given black hole.



Spin Measure Technique

A novel methodology utilizing X-ray and radio data has been employed by a research team to ascertain the rotational speed of Sgr A*, based on the directional flow of surrounding material towards and away from the black hole. Their findings reveal that Sgr A* exhibits an angular velocity equivalent to approximately 60% of the theoretical maximum, a constraint imposed by the universal limit of the speed of light. Previous assessments by various astronomers using disparate techniques have yielded a spectrum of estimates regarding Sgr A*'s rotation rate, ranging from a state of immobility to near-maximal spin. Ruth Daly, the principal investigator of the recent study from Penn State University, suggests that their findings hold promise in resolving the longstanding debate regarding the rotational dynamics of our galaxy's supermassive black hole. The results imply a significant level of rapid rotation in Sgr A*, a discovery that bears significant implications for astrophysical understanding.

THE IMPLICATION OF A RAPID SPIN

The rapid rotation of a black hole affects the surrounding spacetime, causing it to distort and compress as the black hole spins. When viewed from above, the spacetime around the rotating black hole takes on a circular shape along the axis of any emitted jets, while from a side perspective, it resembles a flattened football shape, with the degree of flattening increasing with the speed of rotation. The spin of a black hole serves as a significant source of energy. In particular, supermassive black holes that rotate rapidly have the capability to generate focused outflows, such as narrow streams of matter known as jets, as they extract energy from their spin. This process, however, necessitates the presence of nearby matter. Despite the relatively limited availability of fuel in the vicinity of Sgr A*, the black hole has exhibited a subdued activity level in recent millennia, characterized by relatively weak jets. The findings of this study suggest that this situation could potentially change if the amount of material in the vicinity of Sgr A* were to increase.

The Future of Sagittarius A*

Describing a spinning black hole as akin to a rocket poised for launch, Biny Sebastian, a collaborator from the University of Manitoba in Winnipeg, Canada, illustrates how once matter approaches sufficiently close, it ignites a surge of energy comparable to the ignition of a rocket.
This implies that in forthcoming epochs, alterations in the characteristics of nearby matter and the strength of magnetic fields surrounding the black hole could amplify the immense energy derived from its rotation, potentially leading to more forceful outflows. Such material could originate from gas or from remnants of stars disrupted by the gravitational pull of Sgr A* if they stray too close.
Co-author Megan Donahue from Michigan State University underscores the profound impact of jets, powered and focused by the central rotating black hole of a galaxy, on the gas reservoir of the entire galaxy, thereby influencing the pace and even the possibility of star formation. She notes the presence of "Fermi bubbles," observable in X-rays and gamma rays around the Milky Way's black hole, suggesting past activity. Assessing the spin of our black hole becomes crucial in validating this hypothesis.
To ascertain the spin of Sgr A*, the researchers employed an empirical theoretical approach known as the "outflow method." This method delineates the interplay between the black hole's spin, its mass, properties of nearby matter, and outflow characteristics. The collimated outflow gives rise to radio emissions, while the gas disk encircling the black hole generates X-ray emissions. By amalgamating data from Chandra and the VLA alongside an independent mass estimate from other telescopes, the researchers were able to narrow down the spin of the black hole.
Co-author Anan Lu from McGill University in Montreal, Canada, highlights the unique perspective offered by Sgr A*, being the closest supermassive black hole to Earth. While currently tranquil, their study forecasts a potential future scenario where it imparts a significant impetus to surrounding matter. This eventuality, whether in millennia, millions of years, or within our lifetimes, remains a compelling prospect.

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Dark Matter

DARK MATTER

is one of the greatest mysteries of the universe. It is thought to make up about 85% of the matter in the universe, but we have never been able to directly observe it. This is because dark matter does not interact with light or other forms of electromagnetic radiation. However, scientists are now using new techniques to try to learn more about dark matter. One promising technique is to study the cosmic microwave background radiation (CMB). The CMB is a faint afterglow of light that was emitted shortly after the Big Bang. By studying the CMB, scientists can learn about the conditions in the early universe, which can help them to understand the nature of dark matter.

Insights from the Atacama Cosmology Telescope

In a recent study, scientists used data from the Atacama Cosmology Telescope (ACT) to study the CMB. The ACT is a telescope located in the Atacama Desert of Chile. The scientists found that the data was consistent with the existence of dark matter. This is an important finding, as it helps to confirm the existence of dark matter. It also provides new clues about the properties of dark matter. For example, the data suggests that dark matter is cold, meaning that it is moving slowly relative to the speed of light. The findings from the ACT study are just the latest in a long line of research into dark matter. Scientists have been studying dark matter for decades, and they have made significant progress in our understanding of this mysterious substance.

GRAVITATIONAL LENSING

One of the most important tools that scientists have used to study dark matter is gravitational lensing. Gravitational lensing is a phenomenon that occurs when gravity bends light. When light from a distant object passes by a massive object, such as a galaxy, the light is bent by the gravity of the object. This can cause the distant object to appear distorted or magnified. Scientists can use gravitational lensing to study dark matter by looking for distortions in the light from distant galaxies. If there is dark matter between the galaxy and the observer, the gravity of the dark matter will bend the light from the galaxy, causing it to appear distorted. By studying the distortions in the light from distant galaxies, scientists have been able to learn about the distribution of dark matter in the universe. They have found that dark matter is not evenly distributed throughout the universe, but is instead clumped together in large structures called halos.

The existence of dark matter halos is another important piece of evidence for the existence of dark matter. Dark matter halos are thought to be the invisible matter that surrounds galaxies and holds them together. In addition to gravitational lensing, scientists are also using other techniques to study dark matter. These techniques include:

Direct detection

Indirect detection

Astrophysical observations

Scientists are studying the motions of stars and galaxies to learn about the distribution of dark matter.

As we delve deeper into the enigma of dark matter, the recent findings from the South Pole Telescope paint a fascinating, yet incomplete, picture. While they bolster the case for its existence and offer glimpses into its properties, numerous questions remain. Could dark matter be composed of entirely new and unexpected particles? What role did it play in the formation of galaxies and the evolution of the universe? Does it interact with ordinary matter in unforeseen ways?

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