

ISSUE 1 | VOL. 1 | FEB 2024

COSMO CAFE

A MINIMAL MAGAZINE FOR ADVENTURERS

CHAOS IN CALM

SOMEWHERE, SOMETHING INCREDIBLE
IS WAITING TO BE KNOWN.

THE OFFICIAL MAGAZINE OF DJS NOVA

INDIA'S LUNAR ODYSSEY THE CHANDRAYAAN PROGRAM

India etched its presence on the lunar landscape with the Chandrayaan program, marked by visionary leadership and groundbreaking technology. Launched on October 22, 2008, Chandrayaan-1, under ISRO's helm, aimed to explore the Moon uniquely.

BIRTH OF INNOVATION:

Conceptualized by G Madhavan Nair, Chandrayaan-1 pioneered with the Moon Impact Probe (MIP), signaling India's departure from traditional lunar data provision.

HISTORIC LAUNCH

Successfully launched from Satish Dhawan Space Centre, Sriharikota, using PSLV C-11 rocket, Chandrayaan-1 made ISRO the fifth space agency to reach the lunar surface. On 14 November 2008, the probe hit near the crater and the location of impact was named Jawahar Point. Costing ₹386 crore, it orbited the Moon for two years.

SCIENTIFIC OBJECTIVES

Chandrayaan-1's goals encompassed lunar orbit insertion, mineralogical imaging, water-ice detection, and understanding lunar highland rocks along with Moon Impact Probe (MIP) testing.

ACHIEVEMENTS

While the main mission being remote sensing and planetary science observation, the spacecraft carried 11 scientific instruments as payload. On 18 November 2008, the Moon Impact Probe was released from Chandrayaan-1 at a height of 100 km. Among its many achievements was the discovery of widespread presence of water molecules in lunar soil.

TRIUMPHS AND CHALLENGES:

While achieving 95% of its primary objectives, Chandrayaan-1 faced a setback in 2009 due to power supply failure. Despite the challenge, the mission succeeded, showcasing India's prowess in international space endeavors.

CHANDRAYAAN - 2 UNVEILED:

Post-Chandrayaan-1, Chandrayaan-2 emerged, featuring a lunar lander, Vikram, and the Pragyaan rover. Launched on July 22, 2019, its goal was to explore the Moon's south pole, expanding scientific frontiers.

WHAT LIES AHEAD:

The Chandrayaan program demonstrates India's commitment to lunar exploration, overcoming challenges, and contributing significantly to global lunar research.

In our next edition, delve into the Chandrayaan-2 landing, explore the aftermath, and discover ongoing lunar mysteries.

~ BY SHRUSHTI JAIN

INDIAN ASTRONOMY

• DISCOVERY OF GRAVITY

What would your answer be if someone asks you who discovered gravity? Most of the people would say 'Newton'. But what if there exists an Indian Literature that says otherwise? That is exactly the case.

The Rig Veda written in the year 1150 AD has clearly discussed the idea of gravitational force . The text specifies the gravitational force of not only the earth but also other celestial bodies .

This is the Sanskrit quote :

“ AKRSTISAKTISCA MAHI TAYA YAT KHASTHARN GURU SVABHIMUKHARN SVASAKTYA I
AKRSYATE TATPATATIVA BHATI SAME SARNANTAT KVA PATATVIYARN KHE II ”

Translation - The attracting (gravitational) force (is) the earth. That (earth) with the gravitational force of hers attracts towards herself the large objects in the sky. It seems as though she is falling. In space, with matching forces where will she (earth) fall.

• THE SPEED OF LIGHT AND THE DISTANCE BETWEEN SUN AND EARTH

The speed of light discovered in 1676 by Danish astronomer Ole Roemer. The distance between the sun and earth is said to be discovered between 230 to 310 BC . All this was already mentioned in the ancient Indian text the Rig Veda which was written in 1500 BC .

The Sanskrit quote is as follows :

“ TARANIRVISVADARSATO JYOTISKRDASI SURYA I VISVAMABHASI ROCANAM I ”

Meaning - Oh Sun! (You) overwhelm all in speed, visible to all, source of light. (You) shine pervading the Universe.

“ TATHA CA SMARYATE YOJANANARN SAHASRARN DVE DVE
SATE DVE CA YOJANE I EKENA NIMISARDHENĀ KRAMAMANA NAMOSSTU TE II ”

Meaning - It is remembered (that) Salutations to Thee (sun), the traveler of 2,202 yojanas in half a nimisha.

• THE HELIOCENTRIC THEORY

Nicolaus Copernicus in 1453 AD had proved that the Sun was in the centre of the solar system and the planets revolved around it . This was a historical breakthrough in science but the Vedas had texts about the Heliocentric theory way before Copernicus put this theory in front the world .

“ NAIVASTAMANAMARKASYA NODAYAH SARVADA SATAH I
UDAYASTAMANAKHYARN HI DARSANADARSANARN RAVEH II ”

Meaning - There is, in truth, neither rising nor setting for the sun, for it is always there, and these terms (of rising and setting) merely imply his presence and disappearance.

“ DADHARTHA PRTHIVIMABHITO MAYUKHAIH I ”

Meaning - (The sun) holds the earth from all sides with (his) rays.

“ MITRO DADHARA PRTHIVIMUTADYAM I MITRAH KRSTLH II ”

Meaning - The sun holds the earth and the celestial region. The sun is the attracting power.

~ BY SHLOK PETE



The world was unaware of such advanced astronomy during the time . 500 years after the Rig Veda was written in the year 1666 Sir Issac Newton discovered gravity when he formulated the Universal law of Gravitation .

CHASING SHADOWS : OF DARK

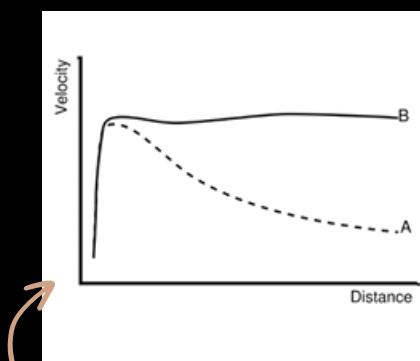
Dark Matter, an elusive cosmic puzzle, perplexes the scientific community, urging them to decipher its secrets.

It all starts with the Rotation Curve Law. The Rotation Curve Law states that inside a galaxy, the rotational velocity of objects (stars, nebulae, etc.) is directly proportional to the distance of the object from the centre of the galaxy.

$$V_{\text{circular}} \propto R$$

Meanwhile the rotational velocity of objects outside the galaxy or far away from the centre of the galaxy is inversely proportional to the square root of the distance of the object from the centre of the galaxy.

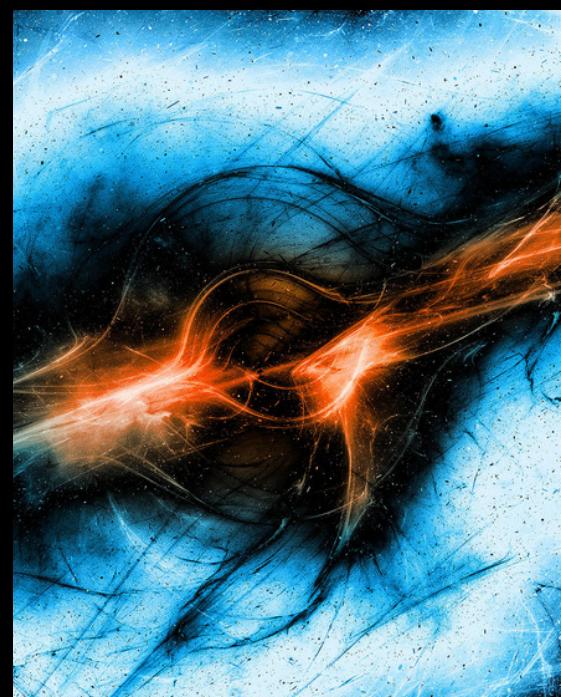
$$V_{\text{circular}} \propto 1/\sqrt{R}$$



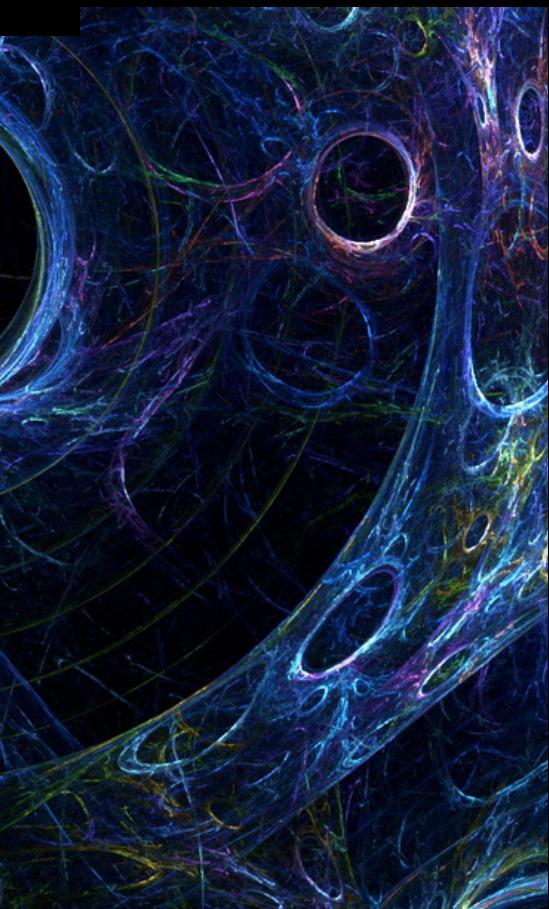
This implies that the plot should fall as we move outside the disk of the galaxy, since there is no luminous matter present there (curve A), but that is not the case! The curve appears to be dead flat as we move outside the galaxy (curve B).

The above graph shows the rotational velocity of objects in a galaxy versus the distance of the same from the centre of the galaxy. Curve A is the expected plot while curve B is the observed plot.

Either Newton's laws were wrong or there is something more bizarre at work. To explain the puzzle of the flat rotation curve, dark matter was introduced. So, dark matter is a substance that is invisible, but has its own gravitational force and therefore must have mass unlike photons and other fundamental particles. Why is it invisible? Because, unlike normal matter it does not interact with electromagnetic force. It does not emit, absorb and/or radiate light, which makes it near impossible to detect.



THE COSMIC MYSTERY MATTER



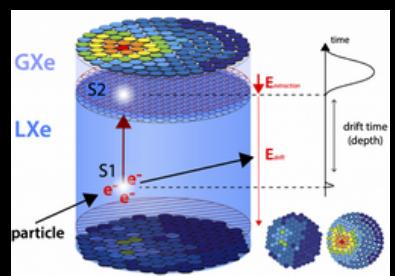
But what exactly is Dark matter? What is it made up of? This question is one of the most significant unsolved mysteries in both astrophysics as well as particle physics. So far, the front-runner candidates of this race are Weakly Interacting Massive Particles aka. WIMPs, and Axions. WIMPs are extremely heavy particles with masses up to 1000 GeV. As the name suggests these particles interact weakly with normal matter and are massive particles which explains the fact that Dark matter makes up to 27% of the observable universe, while dark energy makes up to 68% and normal matter makes about 5% of the observable universe. Axions are particles with an individual mass of 10-11 times the mass of an electron. To compensate for this ridiculously low mass, these particles are said to be in a dizzying abundance in the universe.

There are numerous studies and experiments going on to find out what dark matter is made of. The most popular ones are the Super Cryogenic Dark Matter Search (CDMS), XENON Dark Matter Experiment, The Axion Dark Matter Experiment (ADMX), and many more....

The XENON Dark Matter Experiment, based at the INFN Gran Sasso National Laboratory, aims to detect WIMPs, or dark matter particles, using its latest model, XENONnT.

Located deep underground to eliminate cosmic background radiation, XENONnT features a Time Projection Chamber (TPC) filled with 8.5 tonnes of liquid Xenon and Xenon gas. Photomultiplier tubes (PMTs) on the top and bottom detect scintillation signals (S1 and S2) from electron recoils (ER) and nuclear recoils (NR) caused by gamma/beta particles and heavy particles like WIMPs respectively. The ratio of S1 to S2 signals helps identify particles, while external veto devices reject neutron recoils, muon recoils and other background events.

So far, WIMPs were the frontrunners of the race, although the experiments haven't shown any promising results. Axions and other exotic particles like MACHOs have also intrigued scientists and there are ongoing experiments dedicated to the same.



So, hold onto your seats and place your bets, the results to, this race may come out any day! There might be a breakthrough any day!

UNVEILING THE RIPPLES OF THE COSMOS

Among the countless secrets of our universe, humanity discovered gravitational waves - a new melody venturing in the vast symphony of the cosmos.

Einstein changed the way we look at the universe with the theory of special relativity and then general relativity. He challenged the long-held assumption that empty space is flat - proposing the spacetime fabric. Mass or energy-distorts and curves space and time or spacetime around it. This led to the visualization of gravity as not a force-suggested by Newton, but the consequence of the spacetime curvature, leading to the prediction of gravitational waves-the perturbations in the spacetime fabric due to accelerating or colliding objects. Detecting these waves proved to be a formidable challenge due to their weak nature.

THE
EINSTEINIAN
PRELUDE

THE FIRST SYMPHONY: LIGO'S TRIUMPH

On September 14, 2015, LIGO made history by capturing the unmistakable signal of two black holes colliding over 1.3 billion light-years away. This event was called GW150914. Detailed statistical analysis and over 16 days of data, identified it as a real event. Analysis of the signal with the inferred redshift indicated that the perturbations were produced by merging of two black holes that took place about 1.3 billion years ago-the time it took the waves traveling at the speed of light to reach us! This groundbreaking observation not only validated Einstein's predictions but also marked the birth of gravitational wave astronomy.

Since the historic event, gravitational wave detections have become routine, unveiling cosmic mysteries to humanity. The observations made on binary systems provide significant information on their dynamics, including their orbital evolution, inspiral, merger and the loss of energy of these systems over their life. Colliding black holes, merging neutron stars and even the echoes of the universe's birth-the Big Bang have all been discerned through the delicate presence of gravitational waves.

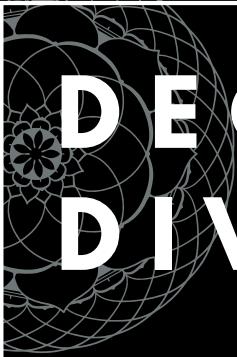
EXPANDING
OUR COSMIC
SYMPHONY

THE FUTURE OF COSMIC LISTENING

With advancements in our technology, the capacity to detect the cosmic symphony also advances. These advancements are already being made for the existing observatories like LIGO and Virgo. The development of new ground-based detectors, coupled with a global network approach, aims to enhance the precision of source localization and overall sensitivity. Furthermore, other international collaborations like the Laser Interferometer Space Antenna (LISA) are already gearing up to launch space-based detectors-further expanding our ability to catch these faint signals and explore the universe inaccessible to us by providing low frequency wave observations. As the field matures, gravitational wave astronomy is poised to provide invaluable insights into the dynamics of binary systems, the properties of celestial objects, and the fundamental nature of gravity itself, ushering in a new era of discovery at the intersection of physics and astronomy.

~ BY LAXMI PRAJAPATI

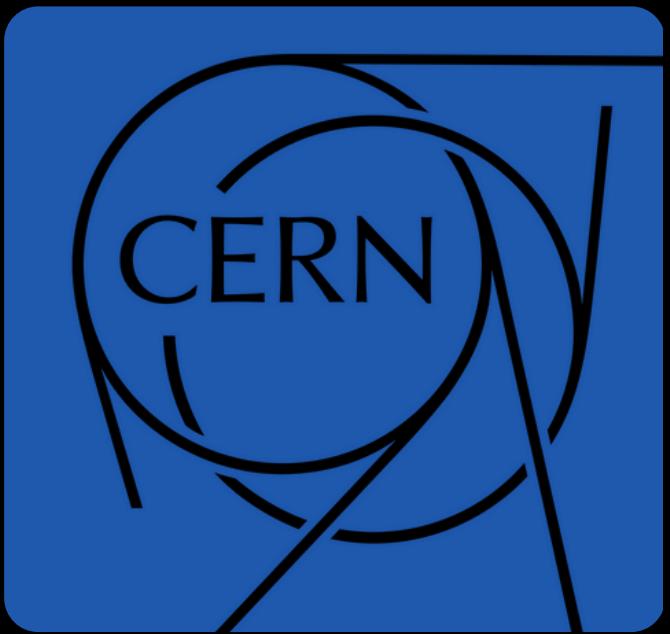
DECIPHERING THE DIVINE DANCE



Now the science has come to the conclusion that perpetual creating and destruction of the universe is like the cosmic dance of Lord Shiva"

~Fritjof Capra

At the world's largest physics laboratory CERN, home to cutting-edge particle research, stands a mesmerizing statue of the Hindu god Shiva depicted as Natraj, the divine cosmic dancer. With his four arms outstretched, he twirls within a flaming halo, captivating spiritual mystics and quantum scientists alike for centuries. What secrets lie encoded within this exotic bronze sculpture? According to Hindu scripts, Natraj's dance signifies the endless rhythms of creation and destruction in the universe. An ancient legend describes Natraj manifesting to enlighten revered sages about cosmic existence - conveying through sublime movement the perpetual interplay between life and death.



Intriguingly, the metaphorical dance closely mirrors the frenzied dance of particles now witnessed at the quantum realm. For today's physicists, Natraj eloquently reflects the ceaseless dance of subatomic matter flashing into and out of the void. The sculpture's rich iconography further unveils Natraj's mystical import. The small drum in his upper hand symbolizes the primal sounds of creation, while the coiled snake represents cosmic preservation. The circle of flames around Natraj signifies the cyclic progression of time. Beneath Natraj's foot lies a demon, indicating the ignorance that obscures our essential unity with all existence. Altogether the statue presents a powerfully integrated vision of reality's manifold appearances blossoming from and dissolving back into a single divine source - uniting spiritual insight with modern science's revelations. What timeless teachings might unfold as we decipher this sublime metaphor bridging mystical vision and quantum truths.

~ BY SHAURYA CHATURVEDI

INFORMATIONAL VISIT, HOW, WHEN AND WHERE?



The Astronomy and Astrophysics Club of DJSCE, DJS NOVA, undertook a fascinating informational visit to Horizon Astronomical Society, Vangani on October 20th and 21st, 2023. Facilitated by DJS NOVA's core members and our esteemed faculty advisor, the journey commenced with a train ride from CSMT station to Vangani, followed by a short drive to the society's campus.

Upon arrival, the group rested briefly and enjoyed snacks before embarking on an enlightening campus tour. The expansive grounds featured numerous greenhouses housing rare plant species and a quaint lake with a somewhat shaky bridge leading to a central house. The atmosphere set the stage for an engaging astronomy session conducted by Mihir Sir.



The astronomy session covered a wide array of topics, from the history and types of telescopes to their workings and the advantages and disadvantages of various designs. Participants gained insights into telescope components, magnification calculations, and stellar positioning systems such as Alt-Azimuth and RA/Dec. As darkness fell, the group ventured outdoors for captivating night sky observations, including the Summer Triangle, Albireo's binary star system, the Pleiades star cluster, Jupiter with its Galilean moons, Saturn with its rings, the Moon, and the Orion Nebula.

Following the celestial spectacle, the group enjoyed dinner and delved into an informative theory session on cosmology. The night continued with light photography, an astronomy quiz, and an entertaining round of astronomy Antakshari. As dawn approached, participants took a serene walk to a nearby river, concluding the visit with a hearty breakfast and a wealth of cherished memories.

~ BY MOHIT SHAH

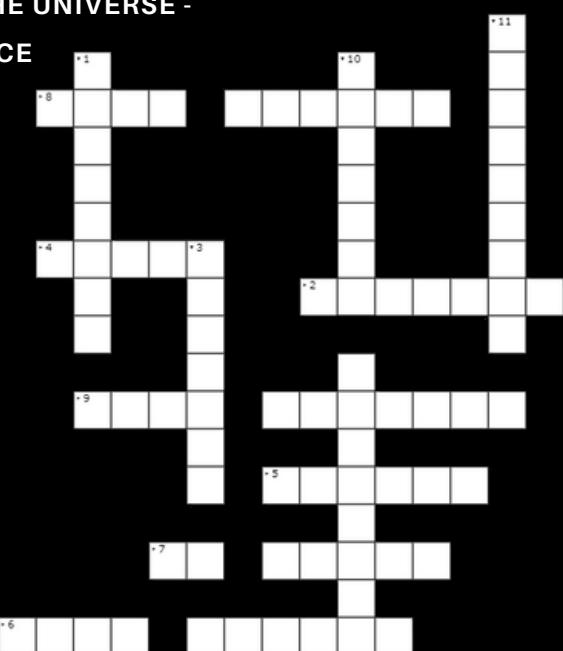
WORD SEARCH ?

- FIRST PERSON IN SPACE
- WHO WROTE THE CODE PROGRAM FOR REQUIRED APOLLO 11
- WHO PROPOSED EARTH AS SPHERE FIRST
- FIRST PERSON OF COLOR IN SPACE
- WHO PROPOSED THAT THE UNIVERSE IS EXPANDING
- FIRST INDIAN WHO WENT TO SPACE
- WHO IS KNOWN AS FATHER OF MODERN PHYSICS
- WHO FORMULATED THE THREE LAWS OF PLANETARY MOTION

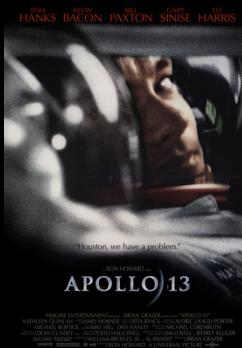
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K	Z	P	V	I	X	H	Y	T	Y	O	N	M	J	A	C	F	N	N	T
K	Y	I	F	E	Y	U	R	I	G	A	G	A	R	I	N	O	K	B	B
D	R	K	W	A	S	X	A	V	Z	B	O	P	S	Q	T	N	H	I	C
B	A	G	U	I	O	N	B	L	U	F	O	R	D	L	I	O	Z	T	Q
R	P	M	Z	N	O	B	R	Y	X	A	K	K	I	X	U	T	V	S	H
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R	J	K	K	V	A	V	Y	Q	L	E	M	O	K	Z	J	K	F	X	L
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CROSSWORD ?

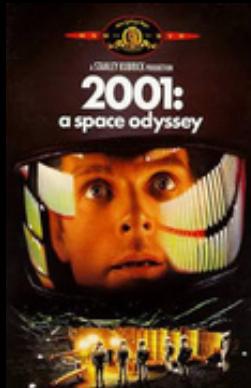
- 1) LARGEST MOON IN THE SOLAR SYSTEM
- 2) PHENOMENON WHICH CAUSE DEATH OF BLACK HOLE IS CALLED _____ RADIATION
- 3) FIRST ARTIFICIAL SATELLITE IN SPACE
- 4) WHICH PLANET IS KNOWN AS EARTH'S SISTER
- 5) WHICH PLANET HAS DENSITY LESS THAN WATER
- 6) SECOND PERSON TO STEP ON THE MOON
- 7) BIGGEST STAR FOUND IN THE UNIVERSE DISCOVERED TILL NOW
- 8) WHAT CAUSES THE ACCELERATED EXPANSION OF THE UNIVERSE -
- 9) NAME OF THE FIRST LIVING ORGANISM SENT TO SPACE
- 10) WHO TERMED THE NAME BLACK HOLE
- 11) NEAREST STAR TO OUR SOLAR SYSTEM
- 12) FIRST WOMEN IN SPACE



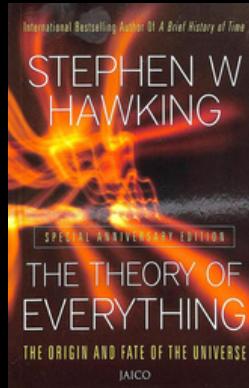
MOVIES & BOOKS



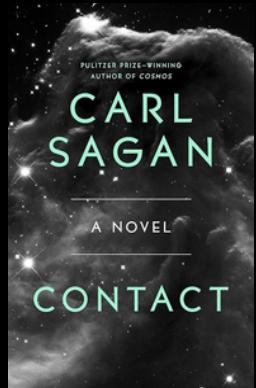
APOLLO 13



2001: A SPACE ODYSSEY



THEORY OF EVERYTHING



CONTACT

ASTRONOMICAL EVENTS

UPCOMING EVENTS :

1.) 28TH FEBRUARY : NATIONAL SCIENCE DAY

28TH FEBRUARY IS CELEBRATED AS NATIONAL SCIENCE DAY IN INDIA TO COMMEMORATE THE DISCOVERY OF THE 'RAMAN EFFECT', WHICH LED TO SIR C.V. RAMAN WINNING THE NOBLE PRIZE. IT WAS DONE WITH A VIEW TO HONOUR NOT JUST THE ACHIEVEMENTS OF SIR C.V. RAMAN BUT ALSO OF OTHER SCIENTISTS FOR THEIR ACHIEVEMENTS IN THE SCIENTIFIC FIELD AND TO SPREAD THE MESSAGE ABOUT THE SIGNIFICANCE OF SCIENCE.

2.) 29TH FEBRUARY : SATURN IN CONJUNCTION WITH SUN

SATURN WILL PASS CLOSE TO THE SUN IN THE SKY AS ITS ORBIT CARRIES IT AROUND THE FAR SIDE OF THE SOLAR SYSTEM FROM THE EARTH, MAKING IT TOTALLY UNOBSERVABLE FOR SEVERAL WEEKS WHILE IT IS LOST IN THE SUN'S GLARE. SATURN WILL ALSO BE AT ITS MOST DISTANT FROM THE EARTH. OVER FOLLOWING 6 MONTHS, SATURN WILL RE-EMERGE TO THE WEST OF THE SUN, GRADUALLY BECOMING VISIBLE FOR EVER-LONGER PERIODS IN THE PRE-DAWN SKY.

3.) 14TH MARCH : γ-NORMID METEOR SHOWER 2024

THE γ-NORMID METEOR SHOWER WILL BE ACTIVE FROM 25 FEBRUARY TO 28 MARCH, PRODUCING ITS PEAK RATE OF METEORS AROUND 14 MARCH. OVER THIS PERIOD, THERE WILL BE A CHANCE OF SEEING γ-NORMID METEORS WHENEVER THE SHOWER'S RADIANT POINT – IN THE CONSTELLATION NORMA – IS ABOVE THE HORIZON, WITH THE NUMBER OF VISIBLE METEORS INCREASING THE HIGHER THE RADIANT POINT IS IN THE SKY.

~ BY SOHAM NAGVEKAR

OUR SOCIALS