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MK Yadav Sir

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Team led by PRL Ahmedabad finds ozone on Jupiter's moon

Scientists are currently analysing various celestial bodies in the solar system that show signs of ozone, suggesting the existence of stable atmospheric conditions and by extension the possibility of them being able to host life.

By Anand Gopal

A team of international scientists, including from India, has discovered strong evidence indicating the presence of ozone on Jupiter's moon, Callisto, shedding light on the complex chemical processes taking place on icy celestial bodies in the Solar System.

The study was published in the March 2024 issue of the journal *Nature*. It was the first time that scientists have used the observational evidence of the atmospheric composition of Callisto to identify the presence of atmospheric conditions.

This shed light on the chemical processes and composition of the UV absorption spectra of the irradiated ice samples, the team was able to identify a distinct signature indicating the formation of ozone.

They corroborated their findings by comparing them with data from the Hubble Space Telescope to understand Callisto's environment and the potential habitability of icy moons in the Solar System.

The importance of ozone: The earth has life not just because it has a way to generate energy, but also because it has the resources to filter, buffer, and diversify. These resources include sunlight containing the "right" frequency of radiation, water, a stable atmosphere providing a stable supply of the reactive gases at the right temperatures, and various compounds required for the life-form's biochemical processes.

This said, not all elements from the sun are good for organisms on earth. Ultraviolet radiation is particularly harmful to many species that also suffer from water-related issues. One of the compounds called ultraviolet B and ultraviolet C, of wavelengths 280-320 nanometres, and ultraviolet C, of wavelengths 100-280 nanometres, can damage DNA, trigger mutations, and increase the risk of cancer and other diseases in humans.

However, the sun also has been known to inhibit plant growth and has detrimental effects on various organisms. This is why the ozone layer is a critical part of the earth's atmosphere. It completely absorbs ultraviolet B and ultraviolet C radiation, thus protecting life on earth.

These ozone atoms bonded together. The ozone layer, located in the lower part of the earth's stratosphere, around 10-15 km above ground, serves as a shield. Without the ozone layer, ultraviolet radiation levels would be much higher on the planet's surface, rendering it inhospitable to most species and disrupting entire ecosystems.

Scientists are currently studying Callisto's environment in the Solar System that show signs of ozone, suggesting the existence of stable atmospheric conditions and, by extension, the possibility of them being able to host life.

Callisto and its unique environment: After Saturn, Jupiter has the most moons in the Solar System. Callisto is one of Jupiter's largest moons and is the only one that has not been visited by a spacecraft. It is the only moon in the Solar System after Ganymede and Titan, Callisto, despite its impressive size, is



Surface of Callisto imaged by the Hubble Space Telescope by Hubble 2 photos in July 2016.

disproportionately big in composition. Despite being as big as the planet Mercury, it has less than half as much mass. Callisto is primarily composed of water ice, rocky materials, sulphur dioxide, and water-organic compounds. These substances make for a more potential candidate for supporting life in the solar system beyond the earth.

Callisto's surface is heavily crusted, indicating a long history of bombardment by planetary debris. It may have the oldest surface in the Solar System, in fact. It often lacks the volcanic resurfacing activity seen on other of Jupiter's outer moons, such as Io and Europa.

The presence of relatively low geological features suggests Callisto's surface is geologically inactive. In other words, the surface has likely been relatively stable for a long time. This stability could be vital to preserve any subsurface oceans or potential habitats beneath the icy crust.

The detection of sulphur dioxide on Callisto's surface has encouraged the team of scientists to conduct spectroscopic observations to gain a better understanding of the moon's surface composition and formation.

Recreating conditions on the earth: Scientists led by Dr. Ramesh Narayan, of the Atomic, Molecular, and Optical Physics Division, Physical Research Laboratory, Ahmedabad, set out to investigate the chemical evolution of sulphur dioxide ice under irradiation, leading to the formation of ozone.

Scientists have previously demonstrated this process in laboratory experiments. The current team was able to recreate the conditions on the earth's surface on Callisto, where sulphur dioxide is found. To do this, the researchers used vacuum ultraviolet



The ozone molecule is composed of three oxygen atoms bonded together. The ozone layer, found in the lower part of the earth's stratosphere, around 10-15 km above ground, serves as a shield against ultraviolet radiation

phenomena, which mimic the solar radiation that reaches the moon's surface.

The experiments were conducted at the National Institute for Interdisciplinary Research (NIIR) in Ahmedabad, which provided access to high-energy radiation sources required to recreate the conditions on the moon.

To reach the surface of Callisto, the researchers placed a substrate of lithium fluoride in a chamber with very low pressure. This environment recreated conditions similar to those found in outer space.

The sulphur dioxide ice samples were deposited onto the substrate, setting the stage for the final step: observing the absorption spectra.

The absorption spectrum is the unique fingerprint of a substance. It shows the wavelengths of light it absorbs, providing insights into its composition and properties.

The team carefully controlled the temperature of the sulphur dioxide ice samples throughout the experiment.

The samples were initially kept at a low temperature of around 4 K (-269.15 °C). In line with the conditions on Callisto's surface, they then slowly warmed it up to 100 K to simulate different environmental scenarios.

In this process, they irradiated the ice with vacuum ultraviolet photons of wavelength 102.7 nanometres and

recorded its ultraviolet absorption spectrum during and after the irradiation using a photodiode array detector. This device measures low levels of electromagnetic radiation by converting photons into electrical signals.

Ozone and potential habitability: The ultraviolet absorption spectra revealed the formation of ozone after the sulphur dioxide ice samples were irradiated. This was evidenced by a distinct signature in the absorption spectrum.

The researchers also compared their experimental data with data collected by the Hubble Space Telescope, which had also suggested the presence of sulphur dioxide and ozone on the surface of Callisto in 1992.

The discovery of ozone on Callisto suggests the presence of oxygen, which in turn is a fundamental ingredient required for the formation of complex molecules required for life (as we know it), such as amino acids, raising questions about the moon's habitability. This extends to other icy moons in our solar system, potentially informing our understanding of habitable environments beyond Earth.

In addition to the ozone, the researchers observed an unidentified feature in the absorption spectrum, similar to that observed on Ganymede in 1996, hinting at a common molecular source in their surface compositions or chemical processes.

This finding could provide valuable insights into geological and atmospheric processes on these moons. In particular, it could help us to understand the precise mechanisms that led to the formation of Jupiter and its moons, and the various types of active moons.

Further research in planetary science and astrobiology is needed to explore the implications of these findings for the search for life beyond Earth.

Context: An international team of scientists, including from India, has discovered strong evidence indicating the presence of ozone on Jupiter's moon, Callisto, shedding light on the complex chemical processes taking place on icy celestial bodies in the Solar System.

Callisto

- **Abundance of Moons:** Jupiter possesses the most moons in the Solar System.
- **Callisto's Stature:** Callisto, among Jupiter's largest moons, ranks third in size across the Solar System, following Ganymede and Titan.
- **Composition:** Despite its substantial size comparable to Mercury, Callisto holds less than half the mass, primarily composed of water ice, rocky materials, sulphur dioxide, and organic compounds.
- **Potential for Life:** Callisto's diverse composition raises the possibility of supporting life beyond Earth within the solar system.
- **Surface Characteristics:** Callisto's surface exhibits heavy cratering, potentially indicating the oldest surface in the Solar System, with limited seismic activity compared to other Jupiter moons.
- **Geological Inactivity:** Callisto's relatively few geological features suggest geological inactivity, implying surface stability crucial for preserving potential subsurface oceans or habitats.
- **Scientific Investigation:** The detection of sulphur dioxide on Callisto's surface prompts further spectroscopic observations to unravel its surface composition and formation.

Ozone Layer

- **About:** It is a **natural gas**, an allotrope of oxygen consisting of 3 atoms of oxygen bound together in non-linear fashion.
- **It is found in two different layers of the atmosphere:** one in the **troposphere** (bad ozone leads to the formation of smog) and the other in the **stratosphere** (good ozone that protects from harmful UV radiations).
- **Protective shield:** in the Earth's stratosphere.
- **Filters out:** harmful ultraviolet (UV) radiation from the Sun.
- **Role:** is vital in safeguarding human health and the environment.
- **Prevention:** It helps prevent health conditions such as skin cancer, cataracts, and immune system suppression.

RBI@90: snapshots from history

The central bank's story of the last 90 years has generally been one of stellar achievement. Its relationship with the government has been testy at times, but the bank has been steadfast in defending its turf

GEORGE MATHEW
MUMBAI, APRIL 1

THE RESERVE Bank of India (RBI), which was established on April 1, 1935, is responsible for monetary stability, currency management, inflation targeting, regulating the banking system, and setting interest rates. The central bank's story of the last 90 years includes ups and downs, but has generally been one of stellar achievement.

Early years of RBI

Legislation to set up the Reserve Bank of India was enacted in March 1934, and the provisions relating to the constitution of the bank, issue of share capital, and establishment of central and local boards became operative from January 1, 1935.

The first Governor of the RBI was the Australian Sir Osborne Adell Smith, one of the two managing governors of the Imperial Bank of India. Sir C.D. Deshmukh was the first Indian to become Governor.

Following Partition, it was agreed that the RBI would remain to be the currency authority for Pakistan, and Indian notes would cease to be legal tenders in Pakistan.

The RBI's relationship with the government has been testy at times. But the bank has been steadfast in defending its turf whenever the government has tried to interfere.

The reforms of 1991

A sharp increase in oil prices in August 1990 led to an acute economic crisis, making the balance of payments situation unmanageable, depleting foreign exchange reserves along with massive capital outflows, and pushing India close to default.

The RBI transferred more than 46 tonnes of gold from its reserves to the Bank of England and borrowed loans to manage immediate liquidity problems. The rupee was devalued twice, by 9% and 10%, in three days.

Full convertibility of the rupee on trade account was allowed, giving more flexibility to trade. Banking reforms were announced, the setting of interest rates by lenders was deregulated, and new private bank licences issued between 1991 and 1995.

Mamohan and Pranab

In 1982, Prime Minister Indira Gandhi brought Mamohan Singh, then Member



Prime Minister Narendra Modi and RBI Governor Shaktikanta Das at a ceremony marking 90 years of the RBI in Mumbai on Monday. Maharashtra Governor Ranesh Raut and Chief Minister Udaykumar Shinde are also seen.

Secretary of the Planning Commission, to the RBI to succeed I.G. Patel as Governor. Singh, who held office till January 14, 1985, prepared the groundwork for strengthening monetary policy actions, and banking reforms got a boost.

Singh acknowledged in the book 'Strictly Personal' that his daughter, Damini Singh, who was then Finance Minister Pranab Mukherjee, Singh advised the government against granting approval to Bank of Credit and Commerce International (BCCI), a foreign bank promoted a decade earlier by the Pakistani businessman Aga Khan IV, to open branches in India. However, the government wanted the RBI to grant BCCI a licence, and directed it to approve the application.

After the RBI led by Singh opposed it, the government took to the Cabinet a proposal to strip the RBI of its power to license foreign banks. Singh sent his resignation to Mukherjee and the Prime Minister. However, he was persuaded to stay on as Governor.

Singh and Mukherjee reportedly had differences of opinion on the hostile takeover plan of Escorts and DCM by the Soviet industrialist Suren Paul. However, Mukherjee wrote in his book 'The Turbulent Years' that the decision to move Singh from the RBI to the Planning Commission in 1985 was taken by then Prime Minister Rajiv Gandhi.

Subbarao, Patel vs Govt
D. Subbarao, who was Governor between September 5, 2008 and September 4, 2013, mentioned his disagreements with then Finance Minister P. Chidambaram. 'The Prime Minister (Singh) never asked me (about it). He would ask, whether the Finance Minister was persuaded. I would say yes or no. He would leave it at that. He never pressed a point of view. You can say he was supporting me for he remained above this conflict between the Finance Minister and the Governor,' Subbarao told the Indian Express in an interview.

Governor Ujjay Patel had a running feud with the Finance Ministry when the government asked for more surplus (dividend income) from the RBI. Patel resigned after serving for two years in the post.

2008 crisis and after
India escaped the 2008-09 global financial crisis through a combination of management, structure, and luck. Pre-crisis, the policies of Governor V.B. Reddy against capital inflows, especially to the real estate sector, and against rapid foreign bank expansion, were timely. Post-crisis, management was excellent, and appropriately measured.

Under Subbarao, the RBI opted for a liberal accommodative policy to salvage economic growth.

Raghuram Rajan announced plans to internationalise the rupee. Inflation bonds

linked to the consumer price index, steps to boost exports and increase inflows, and plans to review the monetary policy process, and gave banks freedom to open branches without having to approach the RBI for licences.

Demonetisation of 2016

On November 8, 2016, the government announced the demonetisation of Rs 500 and Rs 1000 notes of the Mahatma Gandhi Series. It also announced the issuance of new Rs 500 and Rs 2,000 notes in exchange for the demonetised notes.

The sudden withdrawal of notes created a liquidity shortage in the country. There were long queues outside banks, and people faced immense hardships across the country. It also caused the economy — demand fell, businesses faced a crisis, and GDP growth declined close to 1.5 per cent. Many small units reported huge losses even after nine months. The pace of demonetisation was slow.

Managing the situation was one of the biggest challenges faced by RBI. At stake was the credibility of the bank and Governor Patel.

MPC, asset quality review

The Monetary Policy Committee (MPC), which decides on interest rates started during the early phase of Patel's tenure; he chaired the first meeting of the MPC on October 1 and 2, 2016.

Despite calls from corporate India to go easy on the asset quality review led out by Rajan, Patel continued the exercise. The RBI has utilised the Insolvency and Bankruptcy Code (IBC) to address the huge debt pile of some of the largest defaulters. It has also approved loans of 40 corporates with debt of around Rs 4 lakh crore which are in various stages of resolution in National Company Law Tribunal.

Covid-19 pandemic

As demand crashed, there were production cuts and job losses, and growth declined. Shaktikanta Das, the current Governor, and his team opted for an accommodative monetary policy. Repo rate, the main policy rate, was brought down to 4% to kickstart growth. However, the liberal policy led to a spike in inflation, forcing the RBI to raise rates by 250 basis points to 6.5% now.

However, the pandemic added the RBI in boosting digitalisation of payments. The launch of UPI revolutionised payments in the banking system.

RESERVE BANK OF INDIA (Syllabus GS Paper 3 – Economy)

Context: The Indian central bank, which turns 90 on April 1, joins the ranks of other nonagenarian central banks, including the Central Bank of Argentina and the Bank of Canada, both recently celebrating their 90th anniversaries, having been established in 1935.

Reserve Bank of India

- **Formation:** Established in 1934 through the Reserve Bank of India Act, based on Hilton Young Commission recommendations.
- **Centralization:** Initially in Kolkata, permanently shifted to Mumbai in 1937.
- **Nationalization:** Privately owned at inception, nationalized in 1949 under complete Government ownership.
- **Regional Role:** Acted as central bank for Burma (Myanmar) and Pakistan until respective independence.
- **Central Board Composition:** Comprises a 21-member board including Governor, Deputy Governors, Finance Ministry reps, government-nominated directors, and representatives from local boards.
- **Objectives of RBI:**
 - **Currency Regulation:** Control, issuance, and maintenance of currency supply.
 - **Monetary Stability:** Ensuring stability by maintaining reserves.
 - **Financial Integrity:** Issuance of bank notes and maintaining financial stability independent of political influences.
 - **Economic Growth:** Supporting planned economic advancement.
 - **Banking Roles:** Acting as Banker's bank, Banker to government, and note-issuing authority.
- **Functions of RBI**
 - **Money Supply Regulation:** Controls and maintains the supply of the Indian rupee.
 - **Payment Systems Management:** Manages the main payment system and promotes economic development.
 - **Financial Supervision:** Conducts consolidated supervision of the financial sector.
 - **Banker to Government:** Manages government accounts and transactions.
 - **Foreign Exchange Management:** Facilitates external trade and maintains the foreign exchange market.

Behind Hume's conversational AI with emotional intelligence

Context: Recently, the New York-based startup Hume AI unveiled the first voice AI with emotional intelligence, capable of generating conversations to support the emotional well-being of its users.

Hume AI

- **About:** It is an advanced conversational AI system that incorporates empathic large language models (eLLMs) to enhance user interactions.
- **Empathic Voice Interface:** Hume's voice interface utilizes its empathic large language model (eLLM) to focus on the tones of voice behind words, enabling it to discern various emotions.
- **Emotion Emulation:** Hume AI can emulate tones associated with 23 different emotions, including admiration, adoration, frustration, and more, enabling it to engage in human-like conversations.
- **Training on Human Conversations:** The conversational AI chatbot is trained on vast datasets comprising millions of human conversations worldwide, encompassing voice tonality, human reflexes, and emotional responses.
- **Real-time Optimization:** Responses generated by Hume AI are continuously optimized in real-time based on the emotional state of the user, ensuring a personalized and empathetic interaction experience.

How is it useful?

- **AI Assistants Enhanced with eLLM:** Early predictions suggest that Hume's eLLM-powered AI assistants could excel not only in conversation but also in assisting with daily tasks.
- **Integration with Existing Models:** Hume's product demonstrates the ability to seamlessly integrate with other prominent large language models like GPT and Claude, enhancing its adaptability for various enterprise applications.
- **Multifunctional Capabilities:** Beyond its empathetic features, the voice assistant boasts additional functionalities including transcription and text-to-speech capabilities, broadening its utility beyond simple conversation.

Large Language Model

- **About:** It is an artificial intelligence (AI) program designed for text recognition and generation, among other functions.
- **Data Training:** LLMs undergo training on massive datasets, hence their designation as "large", to enhance their capabilities.
- **Machine Learning Foundation:** LLMs are constructed using machine learning techniques, primarily based on transformer models, a type of neural network.

Severe environmental harm equal to genocide, crime against humanity: Experts write to International Criminal Court

Context: Recently, a group of universities has penned a joint note urging the International Criminal Court (ICC) to intervene, highlighting the close connection between environmental degradation and human suffering.

International Criminal Court (ICC)

- **Establishment:** In 2002 pursuant to the multilateral Rome Statute.
- **Headquarter:** The Hague, Netherlands.
- **About:** It is the first and only permanent international court with jurisdiction to prosecute individuals for the international crimes like - genocide, crimes against humanity, war crimes and the crime of aggression.
- **Members:** 123 countries. Countries like – India, China and Pakistan have not signed the treaty and not a party.
- **Jurisdiction:** The ICC's jurisdiction is limited only to natural persons (unlike the International Court of Justice, which hears disputes between states) with minimum age of the alleged perpetrator should be 18 years at the time of the commission of the crime.
- **Relation with UN:** The ICC is not part of the UN. The Rome Statute was negotiated within the UN; however, it created an independent judicial body distinct from the UN.

Right to a Healthy Environment (R2hE)

- **About:** The right to a healthy environment, advocated by human rights and environmental organizations, aims to safeguard ecological systems crucial for human health.
- **Acknowledged by:** United Nations Human Rights Council in October 2021 and the United Nations General Assembly on July 28, 2022, this right gained significant international recognition.
- **Interconnection with Health Rights:** This right is intricately linked with other health-focused human rights, such as the right to water and sanitation, the right to food, and the right to health.

How India's first solar observatory was set up in Kodaikanal 125 yrs ago

ANJALI MARAR
BENGALURU, APRIL 1

SINCE ANCIENT times, seafarers, mathematicians, astronomers, and physicists have studied the Sun. In 1792, the British East India Company established the Madras Observatory, a first-of-its-kind facility in this part of the world, where early solar and other astronomical observations in India began.

On April 1, 1889, it was merged with Kodaikanal's Solar Physics Observatory and it then became the Kodaikanal Solar Observatory (KoSO), which has been operational for 125 years.

Roots in Great Drought

Scanty rainfall over South India in 1875 triggered a terrible drought that led to the deaths of many millions of people across the Madras and Mysore Provinces between 1875 and 1877. Countries such as China, Egypt, and Morocco also suffered multi-

year droughts during this period, and an associated global famine is estimated to have killed nearly 50 million people.

The Great Drought was due to multiple factors — solar activity, cool Pacific Ocean conditions followed by a record-breaking El Niño (1877-1878), strong Indian Ocean Dipole, and warm North Atlantic Ocean conditions.

Why Kodaikanal was chosen

Based on evidence that sunspot periodicity (a solar cycle of 11 years, when the Sun's activity can be at maxima or minima) was linked to the seasonal rainfall distribution over India, the Famine Inquiry Commission recommended that the Government of India undertake regular solar observations and establish a dedicated solar observatory in southern India. Thus, the idea for an Indian solar observatory was born.

Scotland-born Charles Michie Smith, who had briefly served as the Government Astronomer at the Madras Observatory, was

asked to locate a site. Leh, Mussoorie, and Shimla in North India were rejected for being dusty and cloudy, with an unstable atmosphere. Regular solar observations from southern Indian hilltops were found to be better.

Smith surveyed Kodaikanal in the Palani hills and Kotagiri in the Nilgiris on parameters like rainfall, cloud cover, sky transparency, haze, atmospheric stability, humidity, fog, and mist. Kodaikanal was finally chosen as the ideal location.

In August 1893, the government of the Raj sanctioned the Solar Physics Observatory under the meteorological budget. In 1895, Lord Wenlock, then Governor of Madras, laid its foundation stone.

Under Smith, who later became the first director of the renamed KoSO, construction of the observatory picked up pace. By the end of 1900, the main observatory building and two adjacent domes had been built.

Why study the Sun

Being the primary source of energy, the Sun supports life on Earth. Any change on the solar surface or its periphery significantly im-



The Kodaikanal Solar Observatory.
Wikimedia commons

pacts the Earth's atmosphere. Powerful solar storms and solar flares can potentially harm satellite-based operations, power grids, and navigation networks.

Expanding scope of study

Following the reorganisation of all Indian observatories, implemented by the Government of India on April 1, 1899, the

Madras Observatory was merged with KoSO. Systematic solar observations commenced here on March 14, 1901.

The Bhavnagar Telescope, named after Maharaja of Bhavnagar, operated at KoSO during its nascent years. This 16-inch Newtonian (later Cassegrain) mobile telescope was imported from Dublin, Ireland, and first established at the Maharaja Talpadasingh Observatory in Poona (now Pune) around 1888. However, when the Poona observatory closed down, it was sent to KoSO in 1912.

Initial KoSO solar observations included tracing bright lines from the Sun's atmospheric layers, measuring solar radiations, and the direct photography of the Sun in monochromatic lights of calcium and hydrogen (done to show specific features clearly).

Until the end of World War II in 1945, KoSO was dedicated to solar physics. Thereafter, it expanded its ambit to study cosmic rays, radio astronomy, ionospheric physics, etc. The continuous recording of the solar radio noise flux (an indicator of solar activity) commenced in 1952 and is considered India's earliest solar radio observations.

KoSO at age 125

After astrophysics was separated from the India Meteorological Department (IMD), KoSO was reconstituted into an autonomous institution named the Indian Institute of Astrophysics (IIA) on April 1, 1971.

From solar data recorded on basic photographic plates or films, KoSO boasts a huge digital repository containing 148 lakh digitised solar images. These include 33,500 white-light images (showing sunspots) and thousands of other images of the Sun recorded every day since the start of the 20th century. It is the only observatory offering high-resolution digitised images for such a long period.

Currently, it houses a spectrum of advanced instruments like a White Light Active Region Monitor (WAARM), with calcium and sodium filters to make full disc simultaneous observations of the photosphere and chromosphere layers of the Sun.

The KoSO's rich data repository could help reconstruct the Sun's past and link its behavioural changes to understand and predict its future impact.

Context: Recently, the 125th anniversary of the Kodaikanal Solar Observatory commemorated how the establishment of this institution was influenced by the Great Drought of 1876.

Kodaikanal Solar Observatory

- **Location:** The KSO is nestled amidst the scenic Palani range of hills in Southern India.
- **Establishment and Purpose:** Established in 1899, the KSO initially served as a Solar Physics Observatory, dedicated to studying the Sun's phenomena.
- **Consolidation of Activities:** All functions of the Madras Observatory were relocated to Kodaikanal, consolidating its scientific endeavors and expanding its research scope.
- **Discovery of the Evershed Effect:** In January 1909, the Evershed effect, a crucial phenomenon in solar physics, was first detected at this observatory, marking a significant contribution to the field.
- **Oldest Continuous:** Solar data collected by the observatory constitutes the oldest continuous series of its kind in India, offering valuable insights into the long-term behavior of the Sun.
- **Foundational Years:** The Madras Observatory, initiated in 1786 through the private efforts of a British East India Company official, laid the groundwork for the establishment of the solar observatory.
- **Selection of Kodaikanal:** In 1893, a decision was made to establish a solar observatory, with Kodaikanal in present-day Tamil Nadu being chosen for its high altitude and pristine environment.
- **Notable Instruments:** The Bhavnagar Telescope, named after the Maharaja of Bhavnagar, emerged as one of the prominent instruments at KoSO during its initial years, facilitating significant observations.
- **Pioneering Techniques:** Utilizing a 15cm telescope, solar images were captured onto photographic film or plates, enabling the recording of solar magnetic plagues and prominences since 1911.

SC does not stay survey at Bhojshala

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NEW DELHI: The Supreme Court on Monday restrained the Archaeological Survey of India (ASI) from carrying out any physical excavation during its scientific survey of Bhojshala, a protected 11th-century monument in Madhya Pradesh's Dhar district, but declined to stay the process.

Stressing that the structure was in dispute — Hindus claim it is a temple and Muslims claim it is the Kamal Maulla mosque — the top court said that no action should be taken on the ASI report (once it is completed) without the permission of the court. It also sought responses of the state government, ASI and the Hindu petitioners within four weeks on a plea filed by the mosque committee.

The bench, headed by justice Hrishikesh Roy, said, "In the interim, we direct that no action should be taken on the outcome of the impugned survey (by ASI) without the leave of this court." The appeal was filed by the Mau-

**THE TOP COURT
SAID NO ACTION
SHOULD BE TAKEN
ON THE ASI REPORT
(ONCE COMPLETED)
WITHOUT COURT'S
PERMISSION**

lana Kamaluddin welfare society, challenging the order of the Madhya Pradesh high court on March 11 that allowed the survey.

The society, represented by senior advocate Salman Khurshid, told the bench that the survey was ordered without hearing the Muslim side and that there are serious apprehensions about permanent damage to the monument.

The state, represented by additional solicitor general (ASG) KM Nataraj, said that the survey has been going on since March 22. Since no details of the survey were forthcoming, the bench, also comprising justice PK Mishra said, "It is made clear that no physical excavation is to be done which will change the character of the prem-

ises in question."

The Hindu petitioners before the high court opposed any kind of stay on the ongoing ASI survey. Senior advocate Ardhendu Mauli Kumar Prasad, representing the Hindu side, cited Section 16 of the Ancient Monuments and Archaeological Sites and Remains Act, 1958 which provides for protection of any protected monument or any part of it which is a place of worship. Prasad said the survey is only meant to determine the religious character of the monument.

Bhojshala is a protected 11th-century monument, which Hindus consider to be a temple dedicated to Vagdevi (Goddess Saraswati) and claim it was built by the 11th century ruler of Malwa, Bhoja Paramara, also known as Raja Bhoj. Muslims, on the other hand, call it Kamal Maulla Mosque and claim that prayers have been offered at the mosque since 1910.

In April 1995, a voluntary agreement was reached between the two communities, allowing Hindus to offer prayers on Tuesdays, besides on annual festivals of Bas-

ant Panchmi and Bhoj Utsav. This arrangement, however, was suspended in 1997. The ASI in April 2003 allowed Hindus to perform puja at Bhojshala every Tuesday. Muslims were permitted to offer namaz in the complex on Fridays.

The Dhar land dispute between the two communities is the only one outside the legal battles fought in Uttar Pradesh over the Ram-janmabhoomi-Babri Masjid at Ayodhya, Krishnanjanmabhoomi and Shahi Idgah at Mathura and Kashi Vishwanath temple-Gyanvapi mosque dispute in Varanasi.

The HC was approached in May 2022 by Hindu petitioners led by Ranjana Agnihotri seeking right to pray and worship at the Bhojshala. They sought an ASI survey on a claim that the mosque situated in the property had Sanskrit shlokas written on its pillars and walls.

The Muslim side, in its appeal before the top court, said the appeal by Hindu petitioners is not maintainable as a challenge to the ASI's 2003 order has already been dismissed by the Madhya Pradesh high court in September 2003.

BHOJSHALA DISPUTE

(Syllabus: GS Paper 1 – History)

Context: Recently, the Supreme Court issued a restraining order against the Archaeological Survey of India (ASI) from conducting excavations while conducting its scientific survey of Bhojshala, a protected 11th-century monument in Madhya Pradesh's Dhar.

ASI Survey of Bhojshala

- **About:** An historic building located in Dhar, Madhya Pradesh.
- **History:**
 - **The name is derived from:** The celebrated king Bhoja of the Paramara dynasty of central India.
 - **Built by:** Paramara dynasty in the 10th century.
 - **Capital:** The medieval circular city of Dhar, a capital of Malwa.
 - **Maratha capital:** Later served as the Maratha capital of the Powers in the 18th century.
- **Legal Status:** Designated as a Monument of National Importance under the Archaeological Sites and Remains Act, 1958 (AMASR Act).
 - Protected by the Archaeological Survey of India (ASI).
- **Religious Practices:** Hindus are permitted to worship inside the Bhojshala complex every Tuesday, whereas Muslims are allowed to offer namaz at the site every Friday, as per an ASI order from April 7, 2003.
- **Function:**
 - **Prominent centre:** Functioned as a prominent centre for education, manuscript compilation, exchange, and cattle trading.
 - **Centre of metallurgy:** Suggested to be a centre of metallurgy, indicated by the name Dharanagara (city of swords) and the presence of an iron pillar.

Paramara Dynasty

- **Origins and Rise:** The Paramaras established dominance in the Malwa region of central India, supplanting the Pratihara empire of Kanauj.
- **Capital:** Dharanagar
- **Clan Origins:** Legend holds that the Paramara or Pawar clan emerged from the Agnikund of Mount Abu, adding mystique to their lineage.
- **Raja Bhoj's Reign (1018-1060):** Raja Bhoj, one of the most renowned rulers of the dynasty, reigned from 1018 to 1060.
- **Notable Works:** Raja Bhoj authored several significant works, including "Ayurveda Sangraha," "Yukti Kalpataru," and "Samranga Suthradhara," focusing on various subjects like medicine, principles, and architecture respectively.

India all Set to Make Penicillin G After 3 Decades on PLI Push

LESS OF CHINA Aurobindo to begin trial production of PenG in April, Kinva to make clavulanic acid

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New Delhi: Two domestic drug-makers are set to start production of penicillin G and clavulanic acid this year, supported by the government's production-linked-incentive (PLI) scheme, a development seen boosting India's efforts to cut dependence on China for crucial drugs.

Industry executives told ET that the decks have been cleared for Hyderabad-based Aurobindo Pharma and Mumbai-headquartered Kinva to begin production of the key starting materials (KSMs) penicillin G and clavulanic acid, respectively, and that their first batches will come this year. Penicillin G is used in making several antibiotics while clavulanic acid is used for manufacturing Amoxycilav, a combination drug whose most popular brand is Augmentin.

India stopped producing the two input drugs about three decades ago and since then it has relied on China for their supplies. "As of now, we are largely dependent on China. With the initiative of the production-linked incentive scheme, companies like Aurobindo are coming up with fermentation-based products like PenG," said Ravi Uday Bhaskar, director general, Pharmaceutical Export Promotion Council (Pharmexcil). "We will be in a better position in the coming few months."

Aurobindo's PenG plant is expected to start trial production this month and move into commercial production in a few months, the people cited earlier said.

The ₹2,400-crore plant has been commissioned in Andhra Pradesh. It has a production capacity of 15,000 tonnes per annum.

The government initiated the PLI scheme which is aimed at boosting domestic manufacturing of active pharmaceutical ingredients (APIs/ KSMs), widening its scope to encourage export of these raw materials.

India's pharmaceuticals industry is the third largest in the world, but is dependent on Chi-

Work in Progress

India stopped producing penicillin G 3 decades ago

Penicillin G
Used in manufacturing several common antibiotics

30,000
metric tons of penicillin said to be imported from China

Clavulanic Acid
Used for manufacturing Amoxycilav (combination of 2 medicines) its most popular brand is Augmentin

China ensured closure of production on account of huge govt support in terms of subsidies, etc.

na for crucial raw materials. The PLI scheme seeks to reduce this dependency and ensure adequate domestic supply of bulk drugs and APIs. The focus on self-reliance became sharper following the disruptions in global supply due to Covid-19.

Dinesh Dua, former chairman of Pharmexcil, said that China is a major player in penicillin G and the initiative of starting its production in India will be a major victory for India.

"About 30,000 metric tonnes of penicillin is imported from China. China ensured closure of production in the entire world, including India, on account of huge government support in terms of subsidies, infrastructure support, ease of doing business (EODB) in regulatory landscape, cheap labour, etc.," Dua said.

"This new initiative by India, however, is a major victory for India as it is going to compress demand from China."

The PLI scheme was announced in 2021 for crucial fermentation products, including penicillin G, amino cephalosporanic acid 7-aca (used for making antimicrobial drugs), clavulanic acid (to treat bacterial infections), and erythromycin thio-cyanate (anti-infectives).

Context: Recently, two domestic drug-makers have been poised to commence production of penicillin G and clavulanic acid this year, aided by the government's production-linked incentive (PLI) scheme.

Penicillin G

- **About:** Benzylpenicillin, also known as penicillin G or BENPEN, is an antibiotic used to treat a number of bacterial infections.
- **The first penicillin discovered:** It was effective against Gram-positive bacteria.
- **Use for disease:** This includes pneumonia, strep throat, syphilis, necrotizing enterocolitis, diphtheria, gas gangrene, leptospirosis, cellulitis, and tetanus.
- **Production:** The production of Penicillin G in India ceased due to the influx of cheaper Chinese alternatives.
- **Administration and Absorption of Penicillin G:** Due to poor oral absorption, Penicillin G is commonly administered intravenously or intramuscularly.
- **Side effects:** diarrhea, seizures, and allergic reactions including anaphylaxis.
- **Reason for closures of industry in 1990's:** Approximately five Indian companies, including Torrent, were manufacturing Penicillin G in the 90s.
 - Low prices of Chinese products forced Indian manufacturers out of business, leading to plant closures.

Clavulanic Acid

- **About:** It is indicated for use alongside amoxicillin to combat bacterial infections, particularly those caused by beta-lactamase-producing bacteria.
- **Mechanism of Action:** As a beta-lactamase inhibitor, clavulanic acid works by preventing bacterial enzymes from degrading amoxicillin, thus extending its antibacterial activity against beta-lactamase-producing pathogens.

IICA and HP India launch HP Future Impact Leaders – IICA Certified Environmental-Social-Governance (ESG) Professional Programme

Context: The Indian Institute of Corporate Affairs (IICA), has joined hands with HP India to introduce 'HP Future Impact Leaders - IICA Certified **Environmental – Social - Governance (ESG) Professional Programme**'.

ESG Professional Programme

- **About:** The initiative targets promoting sustainability and empowering CSR professionals to become leaders in navigating ESG frameworks.
- **Scholarship Offerings:** HP India and IICA offer full scholarships to 75 candidates, eliminating financial barriers for pursuing advanced education in ESG.
- **Commitment to Sustainable Business Practices:** The initiative underscores a joint commitment to fostering sustainable business practices and driving positive societal impact.
- **Comprehensive Course on ESG:** The initiative offers a comprehensive six-month course on ESG, covering its philosophy, principles, relevance, and implications, with self-paced online modules and interactive master classes.
- **Professionals' Involvement:** Renowned ESG professionals of international and national repute are engaged in delivering live interactive master classes, providing valuable insights.
- **In-Person Networking Opportunity:** Participants will have a chance to meet their peers in an in-person session, fostering networking and collaboration among professionals.
- **Target Audience and Eligibility Criteria:** The programme caters to professionals in BHR, ESG, EHS, sustainability, and CSR fields, requiring a bachelor's degree and a minimum of five years of relevant experience for eligibility.

Indian Institute of Corporate Affairs

- **About:** It is an autonomous Institute under the Ministry of Corporate Affairs, Government of India.
- **Objective:** It serves as a think tank, capacity-building, and service delivery organization in the field of corporate affairs and corporate governance.

Havana syndrome: Report links mystery illness to Russian intelligence unit

Context: According to a joint media investigation, the mysterious so-called Havana Syndrome symptoms experienced by US diplomats have recently been linked to a Russian intelligence unit.

Havana Syndrome

- **About:** It refers to a collection of mental health symptoms experienced primarily by US intelligence and embassy officials across different nations.
- **Nature of Syndrome:** Contrary to a distinct medical condition, "syndrome" denotes a cluster of symptoms often occurring together, with elusive origins.
- **Common Symptoms:** Typical manifestations of Havana syndrome encompass auditory hallucinations, nausea, vertigo, headaches, memory loss, and balance disturbances.
- **Causes:**
 - **Initial Suspicions:** Following the Havana incident, speculation arose regarding a potential "sonic attack" carried out by Cuba, given its longstanding hostility towards the US.
 - **Scientific Investigation:** Further research by US scientists and medical examinations of victims suggested exposure to high-powered microwaves, which could damage or interfere with the nervous system.
 - **Mechanism of Harm:** High-powered microwaves were believed to build pressure inside the brain, generating the sensation of hearing a sound, while also disrupting balance, memory, and potentially causing permanent brain damage.
- **Origin:** Tracing its inception to late 2016 in Cuba, notably following the normalization of US-Cuban relations and the opening of the US embassy in Havana in 2015.
- **Initial Incidents:** The syndrome emerged shortly after the establishment of the US embassy, marked by sudden pressure sensations in the brain, persistent headaches, disorientation, and insomnia among embassy staff and intelligence personnel.

Havana Syndrome in India

- **Single Reported Incident:** As of July 2023, the 2021 incident stands as the sole documented occurrence of the Havana Syndrome in India.
- **Official Denial of Possession:** Indian security sources denied knowledge or possession of any weapon capable of causing the syndrome within Indian agencies.
- **Secrecy Surrounding Counter-Espionage Technology:** Even if such technology existed within Indian agencies, it is improbable that the government would acknowledge its possession due to the secretive nature of intelligence operations.

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