

Stepwells at Salar Jung Museum and Ammapalli Temple to be revived by Bharat Biotech

Hyderabad: Bharat Biotech in partnership with Confederation of Indian Industries (CII), Telangana and SAHE (The Society for Advancement of Human Endeavor) to rejuvenate and architecturally restore the historic stepwells at Ammapalli Temple and Salar Jung Museum, as part of its Corporate Social Responsibility (CSR) initiative. By restoring these stepwells, Bharat Biotech aims to preserve cultural heritage, promote water conservation, and improve lives and livelihoods by boosting eco-heritage tourism in Telangana, a press release said. "We are supporting a far-reaching cause to breathe new life into these vital, ancient stepwells, inspiring the community to engage with its rich heritage and promoting sustainable water management," Suchitra Ella, MD, Bharat Biotech said.

To further the cause, Bharat Biotech is collaborating with CII to promote environmental sustainability, preserve cultural heritage, and support Eco-Heritage Tourism. "The partnership with local government and industry stakeholders signifies a shared dedication to not only restore these stepwells of Ammapalli Temple and Salar Jung Museum but also to educate the public about their cultural significance," she added. Stepwells, once vital sources of water in rural and urban areas, are remarkable examples of ancient engineering and architecture. The Ammapalli Temple stepwell, believed to date back to the 13th century, served pilgrims and local communities with water for centuries. Similarly, the



stepwell at Salar Jung Museum, dating back to the Qutb Shahi period, known for its exquisite collection of art and artifacts, has historical significance as a community resource. Today, iconic stepwells like Agrasen ki Baoli in Delhi attract many tour-



ists, and Rani ki Vav near Ahmedabad has even earned UNESCO heritage status. However, the situation is quite different for smaller, less ornate stepwells. With a consistent supply of water in homes, these tra-

ditional structures have lost their importance.

Many have been demolished to make way for expanding urban areas, while others have unfortunately been repurposed as dumping grounds.

Ramappa, Kakatiya era temples become soft targets for treasure hunters

Mulugu: The historic Rudreshwara temple, popularly known as Ramappa temple, a UNESCO world heritage site, located at Palampet village of Mulugu district, lies in a state of neglect with the State government doing little for its development and security aspects. The temple, which suffered damages due to weather conditions and natural calamities over a period of time, was restored to its glory in the last 10 years by the Archaeological Survey of India (ASI), but of late, not much effort is being made by the State government to develop the surroundings and provide facilities for the tourists in and around the temple. During the recent heavy rains in Mulugu, there were also reports of seepage of rainwater in the temple premises. Due to the government's negligence and lack of security, Ramappa and other Kakatiya era temples situated near it are suffering damages due to lack of maintenance. In the absence of proper security,

the temples have become soft targets for treasure hunters. Recently, unidentified miscreants destroyed some parts of the Golla Gudi situated near Ramappa temple.

Archaeologists say that these situations are due to the lack of security arrangements that should be in the place of world heritage. They want the State government to respond and make necessary security arrangements in the vicinity of Ramappa. During the Kakatiya period, the Ramappa Temple and adjacent to it, Kateswara, Kameswara, Narasimhaswamy and Nandi Mantapa were built. There are Golla Gudi, Yakub Sab temple, Trikutalayam and two more Shiva temples inside the compound surrounding the Ramappa Temple. On the bankment of Ramappa pond there is a Kalyana mandapam, a Trikutalayam (a side of cottages) and two other small temples. Two other Shiva temples in Palampet are crumbling and stone pillars are collapsing.



Due to heavy rains last year, the rampart adjacent to the eastern gate collapsed.

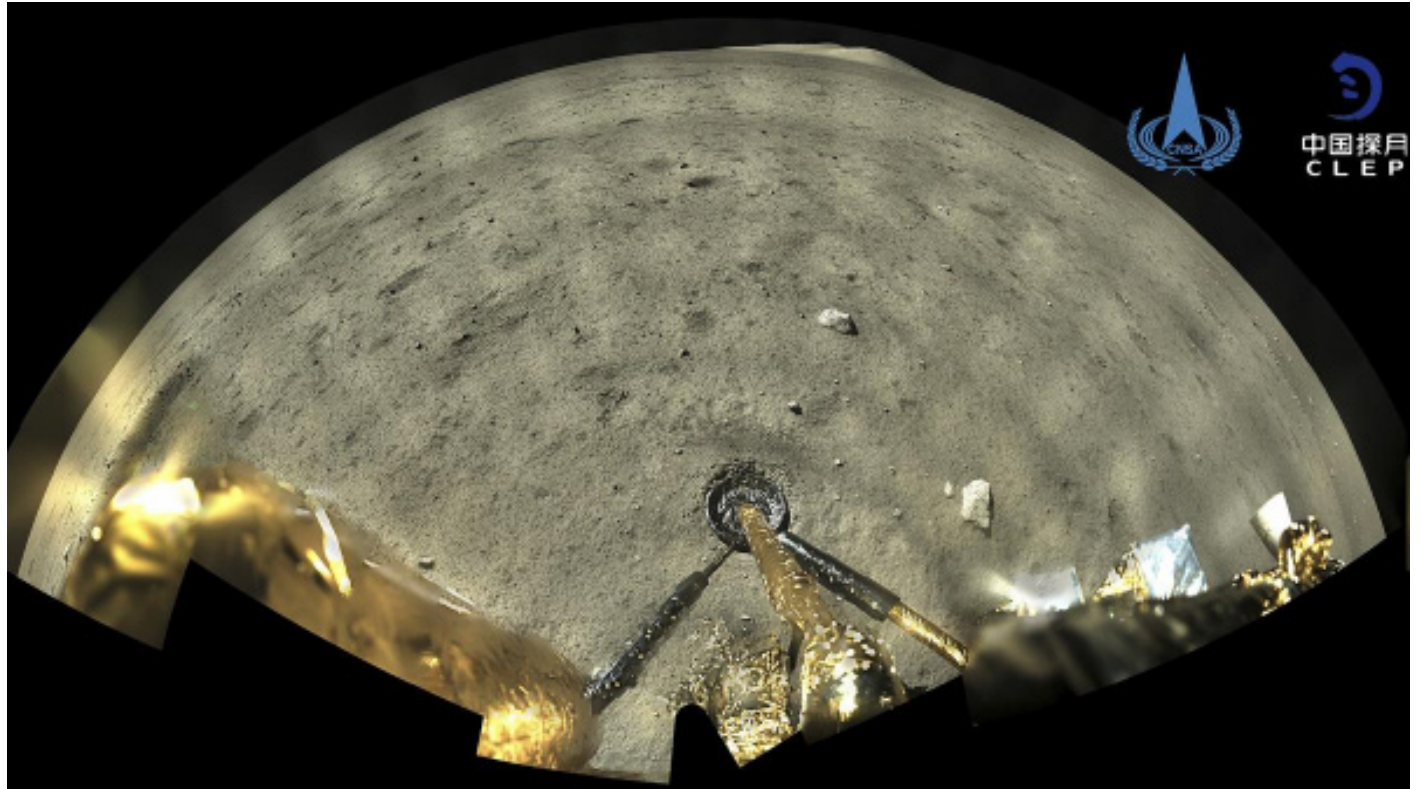
The Shiva temple 300 metres away

from the Ramappa temple has completely collapsed. Along with the main temple, the surrounding 16 small temples were completely destroyed.

Beads on the moon suggest it had volcanoes more recently than thought

Scientists widely believed volcanic activity on the moon ceased about a billion years ago. A study published in *Science* on September 5 called this idea into question with evidence suggesting the moon had active volcanoes as recently as 120 million years ago. The moon's volcanic activity sheds light on how its surface was formed, its atmospheric conditions, and its tectonic activity. Volcanoes can also create conditions suitable for life by releasing water and providing energy and nutrients. More recent research using remote-sensing data from satellites has found signs of volcanic activity from around 800 million years ago, but no exact date for the activity itself. Researchers behind the new study, led by Bi-Wen Wang of the Chinese Academy of Sciences, investigated moon samples collected by China's Chang'e-5 mission. They focused their analysis on lunar glass beads — small spherical or egg-shaped glass pieces formed by volcanic activity or impact events like when rocks from space smash the moon's surface. The moon-made specks The way high-energy events create glass beads on the moon is similar to how tektites formed from impacts and volcanic rock (like obsidian) from eruptions on the earth. In volcanic eruptions, magma from the moon's surface throws up lava fragments. When these fragments cool quickly they form the beads. Likewise, the surface rock and soil melt under the intense pressure and heat produced by asteroid or meteorite impacts. The melted material is tossed into the air, where it rapidly cools and lands on the surface as glassy beads. The materials thrown into the air are spherical because they take the least amount of energy to form. This is also why water droplets are spherical in space or egg-shaped on the earth, where gravity stretches them a little. The glass beads' atoms are arranged in a haphazard manner. They're composed of silicon, magnesium, and iron with trace amounts of potassium, titanium, and uranium.

A volcano within a bead Volcanic glass beads are typically more uniform while impact beads may display shock features like fractures or deformations. Nonetheless, identifying how some beads originated is challenging because they are derived from similar rocks. The presence of elements from an impactor that is no longer found on the moon's surface is another characteristic of impact glass beads. Volcanic glass beads on the other hand can have greater amounts of volatile elements, including sulphur emitted during eruptions. None of these criteria are conclusive by themselves: scientists use many of them together to ascertain a bead's origins. The samples collected by Chang'e-5 were from Statio Tianchuan, near the volcanic complex Mons Rümker and part of a terrain known for its elevated heat-producing elements, thin crust, and prolonged volcanic activity. The researchers analysed more than 3,000 bead samples, examining their physical features to look for patterns that would reveal clues to their origins. They also studied the samples' chemical composition to identify the most



and least abundant elements present and compared them to known impact and volcanic glass compositions. The team also looked out for evidence of incomplete melting, a characteristic of asteroid or meteorite impact. Two and two together From the 3,000 samples, the researchers shortlisted 13 for sulphur isotope analysis. Isotopes are atoms of the same element that have an equal number of protons in their nuclei but different numbers of neutrons. Isotope analysis reveals the various quantities of isotopes in a sample. The researchers compared the sulphur isotope ratios in the beads with established values from older samples. This approach provides insights into a substance's origin and the processes that helped form it. The researchers' analysis revealed that three of the 13 samples were from volcanic activity. Then they used the uranium-lead radiometric dating method to accurately date the materials present in these samples. The method works by assessing the quantity of uranium isotopes that have decayed to lead isotopes, which happens at a predictable time rate. They determined the ages of the three volcanic samples to be 116-135 million years. The composition of the glass beads also indicated they came from a magmatic source. While the age of the volcanic samples overlapped with those of impact glass beads collected by Chang'e-5, additional evidence based on mineral composition, sulphur isotope ratios, and lead isotopes pointed to a volcanic origin for the three beads. Ergo, the moon may have had volcanic activity 116-135 million years ago.

A mystery erupts The researchers' use of sulphur isotope ratios was novel. Sulphur isotopes aren't commonly used to identify the origin of materials on celestial bodies. Scientists instead rely on techniques based on carbon, oxygen, and lead. But volcanic activity makes sulphur a better choice pri-

marily because it releases sulphur dioxide gas. The research team also showed the moon was volcanically active as recently as 120 million years ago, refuting previous claims. The three volcanic glass beads contained high concentrations of potassium, rare earth elements, phosphorus, sodium, and thorium, suggesting the source was rich in these elements. According to the researchers, the presence of these minerals in the glass beads suggests they played a role in causing lunar volcanic activity by producing the heat required for an eruption. Chances for Chandrayaans We now have a new ques-

tion: even as the moon's interior cooled and its lithosphere thickened, how did volcanic activity continue for such a long time? Future Chandrayaan missions could help answer this question. Chandrayaan-4 is poised to conduct on-site sampling and analysis of lunar materials, which may include rocks from volcanic periods in the moon's history. The Chandrayaan missions are also set to explore the lunar poles. This could help scientists study preserved lunar ice that may hold gases released during ancient volcanic eruptions. Tejasri Gururaj is a freelance science writer and journalist with a master's degree in physics.

Planet Earth set to have an asteroid named 'Mini-Moon' for next one-month

Hyderabad: The planet Earth is all set to have a 'mini-moon' for the next one month! A tiny space rock (asteroid) named as 2024 PT5, which was reported by Asteroid Terrestrial-impact Last Alert System (ATLAS) - an asteroid early warning system funded by NASA in University of Hawaii - will be orbiting our planet till the end of November, before escaping the Earth's gravity. Labeled as 'mini-moon', the discovery of the small asteroid has triggered lot of excitement, among the community of amateur and professional astronomers, not only in India but across the globe.

The near earth object is expected to come within 5, 67, 000 kilometers of Earth during its closest approach. This distance is roughly one and half times the average distance to the moon, according reports suggested. While the size of the 2024 PT5 is significantly smaller than our moon, the

temporary orbiting of the asteroid, which is only 33 feet in width, is a rare event that occurs once in a decade or 20 years. Interestingly, according to the research lead author and Universidad Complutense de Madrid professor Carlos de la Fuente Marco, the 2024 PT5 originated from Arjuna asteroid belt between Mars and Jupiter, this celestial visitor offers a rare opportunity for scientists to study near-Earth objects up close. The sighting of the small asteroid, according to astronomers, provides an opportunity to capture invaluable data and helps to understand the dynamics of such asteroids that might pose a risk to our planet. The length of the mini-moon events can vary with some lasting for a year or even more to complete a full or multiple revolutions around Earth. Despite its diminutive size, 2024 PT5 is not visible to the naked eye and requires advanced telescopes for observation, according to reports.

AG Sports Club Navratri Nights: Celebrating the Fusion of North and South Indian Cultures

As part of the Curtain Raiser program, the organizers and models of the AG Sports Club Navratri Nights event unveiled the poster for the upcoming festivities. This was followed by a captivating performance of Dandiya dances by the models, setting the tone for the vibrant celebrations to come.

Speaking on the occasion, Mr. Kranti, the Founder of AG Sports Club, highlighted the unique nature of this 9-day event. "While Navratri celebrations in our city typically revolve around Dandiya, we at AG Sports Club are excited to present a fusion of North Indian Dandiya and the traditional Telangana culture's Bathukamma festival," he said.

Hyderabad is a melting pot of diverse cultures, and the AG Sports Club Navratri Nights aims to capture this essence. "Over the 9-day celebration, we will have Bathukamma song competitions, Dandiya dance performances, and even awards for the best-dressed Dandiya participants," Mr. Kranti explained. The event organizer, Vamshi Palle, and DJ Floza Chowdary and others were participated. The festivities, which will run from 7 PM onwards each day. The celebrations will feature a delightful mix of DJ music, Dandiya dances, Bathukamma songs, and delectable food. Those interested in participating in the Bathukamma song or Dandiya dance competitions can contact the organizers at 9105691076 for more details and registrations. The AG Sports Club Navratri Nights promises to be a unique cultural ex-



perience, blending the vibrant North Indian Dandiya with the traditional Telangana

Bathukamma festival, all under one roof. Hyderabad's residents are invited to join

in the celebrations and immerse themselves in this fusion of diverse traditions.

Trans activist Santa Khurai's *The Yellow Sparrow* traces her life in militarised Manipur and her struggle to self-identity

Two years ago, at a literature festival in Shimla, I came across Santa Khurai sitting in a corner by herself. When my friends and I told her how much we respect her work, she seemed surprised and asked us, "You know me?" That question might seem simple but it is a typical trait of people working at the grassroots, who really underestimate their influence on society. I relived that meeting when I read her recent memoir *The Yellow Sparrow* (Rs 499, Speaking Tiger), translated from the Manipuri by Rubani Yumkhaibam, which explores her revolutionary journey of self-realisation.

Santa speaks of a beautiful poem — which the book is named after — she wrote a day after an intense quarrel with her father, when she was sitting in her courtyard under a mango tree and observed a sparrow with a broken wing. The bird's pain and isolation inspired her to write the poem, encapsulating the sparrow's journey of accepting itself and its yellow feathers, different from all other sparrows, and its mother's incessant attempts to cloak that difference by plucking them out. Santa's life, too, growing up in a small village in Manipur, assigned male at birth and shunned by her parents and society for expressing her true self as a woman, was painful. Living in a highly militarised zone, she had to endure abuse from army per-

sonnels. In school, she was bullied for being different and wrote a diary that grew into this memoir. This book describes the heterogeneity and diversity of India's queer community. Khurai faced both gender discrimination and racism. Her location marginalised her as she tried to connect with national and international fora. Prejudice against people from Northeastern states is well-known in India, but even abroad, people are ignorant of Indians' diverse facial features. Despite all odds, she successfully opened a beauty parlour, though her responsibilities towards Nupi Maanbis (Manipuri transgender women) increased, so she had to let it go. She writes on how working for the community can cost one economic stability. Because of widespread loneliness in the queer community, it is common for individuals to be stuck in toxic relationships, the need for connection enabling abuse and disabling sharing of vulnerabilities. Khurai has explored that unabashedly. She narrates intimate memories like surviving an abusive marriage and overcoming drug abuse. In India's literary scene, translated literature is rising but some languages rarely take centre stage. Rubani brings out an important Manipuri voice that rekindles the hope of seeing diverse stories from Manipuri, in English and other languages. Reading her story in 2024,



In Autocrats, former diplomat Rajiv Dogra looks at what makes autocratic regimes rise and fall



A 2017 military parade in Pyongyang, North Korea commemorating a missile test (PTI) For some years, I have been interested in the genesis, evolution, decline and fall of dictators and autocrats. My interest was kindled initially by George Orwell's *Animal Farm* (1945). It was fascinating to read the story of the main protagonist, Napoleon, who overthrew his erstwhile ally, Snowball, deluded working-class animals with his lies and tyranny, all with the support of Squealer, a white pig who served as his second-in-command and minister of propaganda. I read *The Light on Faraway Hill* by JR Packard, a similar story of rats overcoming mice and an owl taking control. I have read several such books, and the one that stands out in my memory is *How to be a Dictator* (2019) by Frank Dikötter.

Former ambassador Rajiv Dogra's new book, *Autocrats: Charisma, Power and Their Lives* (Rs 795, Rupa), is probably the most comprehensive one I have read in this genre. As Dogra has described himself while introducing another one of his books, he is "an engineer by training, a diplomat by profession, a writer by choice". He is also an "artist, a television commentator and a newspaper columnist." Dogra has a rare talent and a remarkable facility with words, making each of his six books easy reading. Another characteristic of his writing is deep and meticulous research. He has studied the lives and methods of Nicolae Ceausescu, Stalin, Hitler, Xi Jinping, Vladimir Putin, Mussolini, Mao Zedong, Kim Jong Il, François Duvalier, Idi Amin and many others, drawing conclusions regarding how they seized and retained power for long.

The book is divided into seven parts, starting with the genesis of autocracy and ending with its downfall. He talks of how autocracy develops gradually to full-blown

dictatorship. The methods used by the autocrat, the pattern of autocratic rule, the gradual separation of the autocrat from reality and the end, where people's admiration turns to hatred and scorn, and the revival of democracy, are described in detail. He also talks about the "soft side of autocracy" — the eating habits of autocrats, the peculiarities of their wives and their family lives. In the last part, he talks of the horrific ends that some of them meet. Dogra says democracy alone does not guarantee that the elected leader will not arrogate power to himself. "But why do the otherwise democratic countries stray towards authoritarianism?" he asks. "A possible explanation is that they do so because institutional safeguards, meant to check just such trends, begin to crumble." Besides, the weaknesses inherent in democracy, feeble leadership, fear of losing elections, disunity in the leadership, inability to make timely decisions and a sluggish bureaucracy create deep discontent, which makes people look for a strongman who will usher in a new age of prosperity and happiness. People begin to feel, as Plato wrote many centuries ago, "What we need is a benevolent dictator." Indeed, the present moment in history is conducive to forming autocracies. As Biden said in 2021, "We're at an inflexion point between those who argue that autocracy is the best way forward... and those who understand that democracy is essential." Book cover from Amazon Rajiv Dogra's new book, *Autocrats: Charisma, Power and Their Lives* (Amazon.in) The man with autocratic tendencies rides to power on a groundswell of popular opinion. Such people have some common traits — they are generally narcissistic, lying comes easily to them; they have the capacity to weave dreams and project them convincingly, create hatred and divisions in society, and speak with authority in a manner that resonates with the people. As the ancient Greek writer Euripides puts it, "When one with honeyed words but evil

mind persuades the mob, great woes befall the state."

Having acquired power, the dictator knows how to preserve and strengthen it. He consolidates his rule through force and fear. He is prone to impulsive action. As he believes in his intuitive powers and the conviction that he can do no wrong, some of these actions prove detrimental to the people. Still, he is often given the benefit of the doubt, particularly in the early stages. He surrounds himself with yes-men and ensures that the bureaucracy speaks his language. He keeps people on their toes with sudden policy changes and imaginative follow-ups. He and his henchmen ensure that they control most of the mainstream media space: "Like God, he must observe you from everywhere." He constructs magnificent edifices designed to project his greatness. He spends time on how to present himself before the public and launches massive and expensive publicity programmes to enhance his image further. He endeavours also to garner plaudits from foreign leaders.

Some changes take place initially, which seem to be positive. Trains run on time; officials reach their offices at the stipulated time. But, over time, he creates a

dream world divorced from reality. He does not want to understand the genuine problems that people face. He takes dissent as personal hostility and endeavours to crush it with all the might, all the investigative and regulatory agencies at his disposal. As the writer puts it, "By one estimate, the yearly GDP growth is inflated in most authoritarian regimes by a factor of 1.15 to 1.35." Broadly speaking, countries led by autocrats have disappointing economic outcomes as compared to democracies. And it is not just on economic growth that dictators fail to deliver. They also fall short on employment, health and education spending, and government debt. Then comes disillusionment and the ultimate fall. He fails to read the writing on the wall. Rebellions similar to the Arab Spring and the more recent events in Sri Lanka and Bangladesh may happen, generally spearheaded by students and workers. The forces on which the autocrat depends say, "Thus far and no more," and the autocrat is left to fend for himself. The end can be tragic, as in the case of Ceausescu, Saddam Hussein and Muammar Gaddafi, or the erstwhile dictator may only retire into oblivion. All in all, this is a great book written by a highly skilled writer.

TGRTC to launch electric buses on Karimnagar-JBS route on Sunday

Karimnagar: The stage is set for operation of electric buses in the TGRTC's Karimnagar region. Initially, 33 electric super luxury buses will be operated between Karimnagar and the Jubilee Bus Station, Hyderabad. RTC officials have made elaborate arrangements for the launch of electric buses scheduled to be held at Ambedkar stadium here on Sunday. Transport Minister Ponnam

Prabhakar along with Ministers D Sridhar Babu and N Uttam Kumar Reddy and RTC MD VC Sajjanar will inaugurate buses. In order to protect the environment as well as reduce fuel burden, TGRTC is introducing electric buses in different routes.

As part of its plans, 70 electric buses have been allocated to the Karimnagar region as against request of region authorities' for 100 buses.

Extracting gold and silver from e-waste now possible with Indian recycling tech: Masood Mallick, MD, Re Sustainability

Masood Mallick is the Managing Director and Group CEO of Re Sustainability, Asia's leading provider of integrated sustainability solutions for cities and industries. Re Sustainability's areas of operation include waste management including hazardous waste, municipal waste, biomedical waste and e-waste, and is a leader in the waste-to-energy segment with more than 100 plants across the country. Re Sustainability has a global footprint, operating over 95 locations spread across India, Singapore, USA, and the Middle East. Masood spoke to indianexpress.com on the growing challenge of e-waste in India, the tech and innovations that are changing the sector and the need for consumer gadget makers to build their products with a Right to Repair mindset. Edited excerpts: Masood Mallick: Apart from substantive tech innovations in sectors like waste-to-energy, recovery of precious metals from waste, repurposing of sewage as water for industrial use, and the growing innovations in biodegradable plastics, there is a mindset change that is happening in the 'waste' industry. Nowadays, there is a fundamental change in the definition of waste in the sector. Industry pundits now do not see it as waste, as a problem that needs to be solved somehow, but see it as a resource, as a feedstock and this has led to the trend towards newer waste-to-wealth and waste-to-worth interventions. Now the focus has turned to what value we can get from this 'waste' rather than putting it in, say a landfill, and hoping it would go away. Even in waste, there is a hierarchy, based on what can be recovered. The lowest in the hierarchy is the construction and demolition waste, which is a huge problem across India and now there is tech to convert and recycle this waste into material that could be used in construction again. The highest in the waste hierarchy is electronic waste which is becoming a huge issue in India, and we have the only plant in India to recover precious metals from e-waste.

Venkatesh Kannaiah: On e-waste, what are the issues, challenges and opportunities for India? What role does the informal sector play in recycling?

Masood Mallick: The rate of growth of e-waste in India is mind boggling. Globally it is growing at three times the growth of population. You must understand that we in India are at the early stage of a consumerist lifestyle and with a growing economy and rising incomes, the problem is likely to grow exponentially. Earlier, we had radios or watches which worked for 30 years. Nowadays, electronics are being designed for a low lifespan. The average lifespan of electronic products and gadgets has declined and it is being designed for early obsolescence. Now, batteries cannot be removed from many gadgets, neither can they be replaced and hence all of it adds to the devices being thrown away. You might fondly remember your old Nokia phones where one could remove the battery with ease. Masood Mallick Re Sustainability has a global footprint, operating over 95 locations spread across India, Singapore, USA, and the Middle East. And what is inside this e-waste? Metals and minerals like copper, nickel, cobalt, and lithium which we import

at huge cost and then throw away with the e-waste. It is such a huge foreign currency loss. And then we say we are recycling, but what we are doing is that we are downcycling, that is taking something which is worth Rs 100 and then recycling it to something that is worth Rs 50. Ideally, what we should do is upcycling, increasing its value, say from Rs 100 to Rs 150. There is a huge informal sector in recycling and in due course they need to be integrated into the formal recycling network considering the safety and tech aspects. They should be made part of the larger value chain and should be made part of the circularity framework.

Right now, 80 per cent of the e-waste collection is from the informal sector while 20 per cent is from the formal sector. Here too there are players who claim to be part of the formal structure of recycling, but they too finally rely on the informal sector. The conditions of recycling in the informal sector are horrible and quite unhealthy. It could be surprising for you, but until last year, to get precious metals from e-waste, we needed to send the waste to Germany or Japan or Belgium. Just imagine sending such work to such high cost economies and centres.

Venkatesh Kannaiah: Tell us about your efforts at precious metal recovery from e-waste?

Masood Mallick: Our plant in Hyderabad is in its first year of operation and we hope to recover precious metals like gold and silver from e-waste. We wanted to demonstrate that a world class plant could be built with this tech and sustained in India. After a great effort of recycling gold, silver or copper from e-waste, we need to sell it in the open market at the same price as metals and minerals which are mined with a huge cost to the environment. We consider it as green gold and green silver, but we are unable to sell it at a premium. However, regulations are coming on extended producer responsibility (ERP) which would make this sector more profitable. We are also awaiting the monetisation opportunities that carbon credits and trading would offer.

Venkatesh Kannaiah: One hears about legislation on the Right to Repair. Is it likely to work and would it lead to lesser e-waste?

Masood Mallick: As part of the National Circular Economy Framework (NCEF), there is a voluntary roadmap by industry, looking at product design, reparability and the overall principle of Reduce, Repair and Reuse. There are various recommendations for policy changes including green credits. It has been received well by the government. What we find with gadget manufacturers is that there is a 'performance throttling' of gadgets, so that it starts to perform poorly as it ages. They are also designing for redundancy; it is designed in such a way that consumers would be forced to replace it at a certain point in time, and this replacement time is getting shorter and shorter. There are discussions in the ecosystem about a reparability index, recycling of materials and the larger circular economy ecosystem. The recent iPhone claims to have 30 per cent recycled con-



tent is surely a good thing. The recent case of Apple saying that it will be switching to USB-C from the lightning port is a huge win for the circular economy. There is a European Union mandate for all mobile device makers to adopt this technology, and such interventions are helping.

Venkatesh Kannaiah: How much of sustainability initiatives at companies and factories are real and how much of it is greenwashing?

Masood Mallick: For many of them, sustainability is a marketing gimmick and they do that because they want to join the sustainability bandwagon. There is a huge gap between their intentions and what gets done on the ground. Many companies also produce voluminous reports on environment and sustainability, but there is a gap between what is written in the report and what the real conditions are.

Venkatesh Kannaiah: How is the incentive structure for waste-to-energy plants? Does it make more sense to have smaller plants than larger ones?

Masood Mallick: The government has begun giving a lot of incentives and there are concessions on import duties for certain kinds of components, there are subsidies which are made available from Indian Renewable Energy Development Agency (IREDA) and other agencies. However, what would work in the long run are market-based incentives like carbon credits, green credits, differential energy credits for energy recycled from waste, and higher tariffs for energy received from waste-to-energy plants. For some type of resource recovery to happen, we need to have bigger plants. There are some who are enamoured of smaller plants, but in some of our waste-to-energy power plants, the pollution control equipment takes up two-thirds of the infrastructure, while the power plant takes up the remaining one-third. Smaller plants are just not viable, and I am telling it from 30 years of experience. I was associated with the first waste-to-energy plant in Delhi, which was to generate a mere one MW, and which did not take off. Some kinds of tech can be decentralised and some cannot. All waste-to-energy plants have a minimum scale, and in Indian conditions five MW is the minimum plant size, otherwise we would be compromising on quality and environmental

factors. That does not mean we should not experiment with various technologies. We are now experimenting with compressed biogas plants, with two totally different technologies.

Venkatesh Kannaiah: Can you talk about interesting startups in the waste collection/segregation/conversion space. Masood Mallick: We have mentored quite a few startups and are working with Jagruth Tech which converts waste to green coal. We in India burn a billion tonnes of coal every year to generate energy and these startups work on producing a higher calorific solid fuel from waste. We use coal in many sectors, apart from generating power. The issue is you cannot blend waste directly with coal, and the challenge is to create a solid fuel which can be directly fed into a power plant, as if it was coal. It should have a higher calorific value and also have the physical characteristics of coal. This is what the startup is doing. It was a winner in one of our startup competitions in the sector. We also work with organisations like Marico Innovation Foundation on a novel tech for recycling plastics, so that plastics of a particular quality are graded together and recycled, avoiding mixing of various kinds of plastic, which leads to reduction in the overall quality. We are also working with startups which use AI to identify and sort waste. They have cameras which use AI to look at a stream of waste and sort it out. We also work with startups in the medical waste space and are integrating them into our work on sorting of medical waste. We have 25 such medical waste plants in operation and we service thousands of hospitals in disposing of their medical waste. Some medical waste plants need incineration and to avoid manual handling, we modified robots used in the automotive industry and are integrating them into our activities.

Venkatesh Kannaiah: Can you tell us how AI might be used in the waste-to-wealth sector going forward?

Masood Mallick: For the waste-to-energy industry, AI can be used in a variety of ways, starting from sorting or segregating of waste. We at Re Sustainability use it for identifying trends in garbage disposal in cities and municipalities and help our garbage collection trucks follow optimised route planning. It is based on predictive

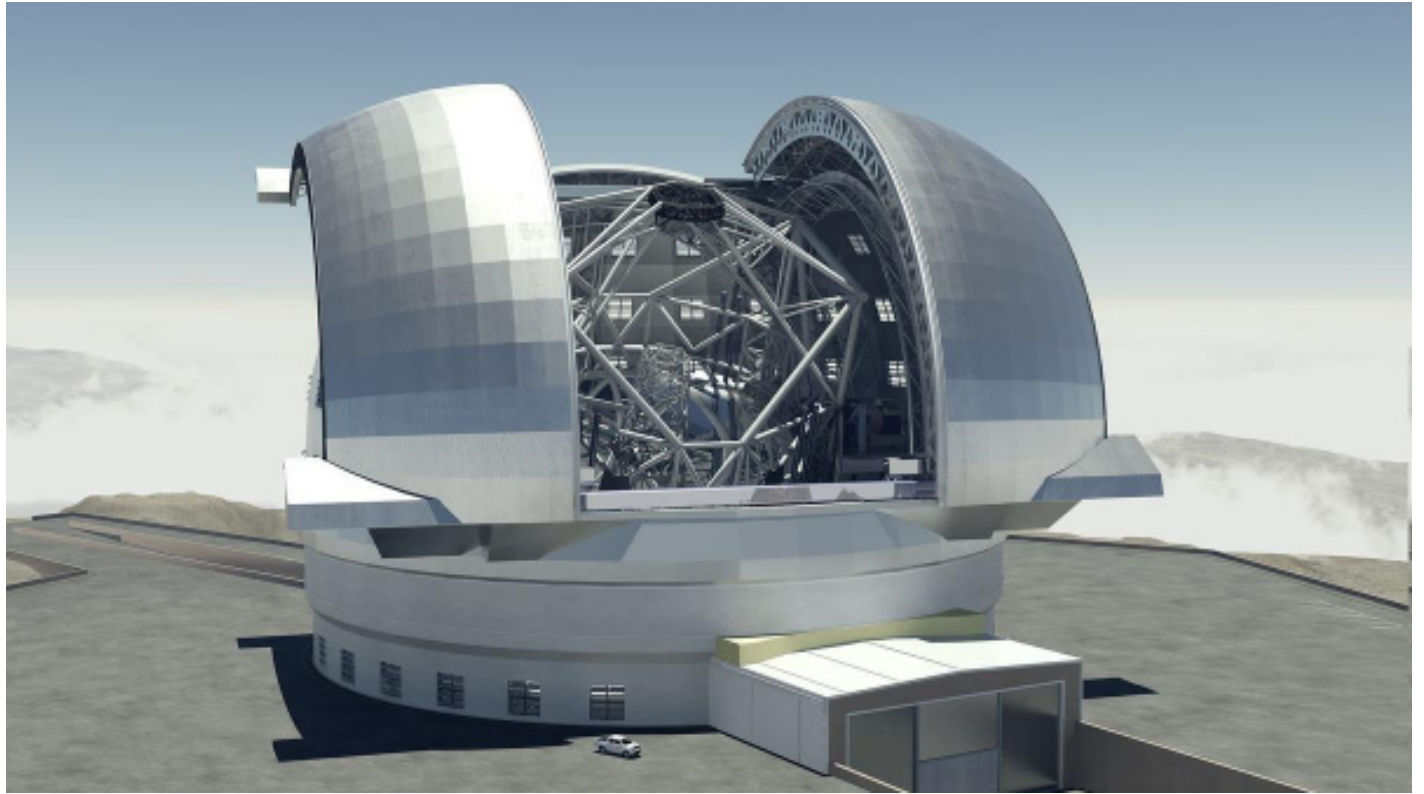
What is a telescope? How good are modern telescopes? | Explained

The modern telescope is a window into the universe, a sophisticated paintbrush in the hands of skilled astronomers that brings the fantastical wonders of the cosmos into view. And in so doing, telescopes give us an incomparable sense of our place and remind us of the joy of curiosity and exploration.

Two types of telescopesCelestial objects emit light in all directions. But only light rays travelling in the direction of the earth will reach us. And when these rays reach us after a lengthy journey, they are virtually parallel. There are two ways to concentrate these rays and create an image. We can use a concave mirror to focus incoming photons at the focus point. The image produced by this reflecting telescope is real, inverted, and smaller. Most contemporary telescopes are such reflecting telescopes. Giant telescopes use parabolic mirrors because light rays reflected from the concave produce several focal points, causing the image to blur. In a reflecting telescope, rays reflected by the primary mirror are diverted to a secondary mirror, which reflects them into an eyepiece with a small lens to enhance the image. Alternatively, a hole is drilled in the primary mirror's centre, and the rays the primary reflects pass through this hole to the secondary, which finally reflects them upward into the eyepiece. Some telescopes also use lenses to bend light and directly create an image instead of using lenses. This is a refracting telescope. To observe fainter cosmic objects, much bigger lenses are required, which will slump under their own weight and distort the image. The maximum practicable lens size in a refracting telescope is around 1 m. The world's largest refracting telescope is at Yerkes Observatory in the U.S., with a 1.02-m lens.

While reflecting telescopes have replaced many refracting ones, these instruments still use lenses, and their ability to refract light, for other purposes. For example, the telescope at the Vera C. Rubin Observatory uses three lenses to help sharpen images. One of these, shown here, is among the largest of its kind in the world with a diameter of 1.55 m. While reflecting telescopes have replaced many refracting ones, these instruments still use lenses, and their ability to refract light, for other purposes. For example, the telescope at the Vera C. Rubin Observatory uses three lenses to help sharpen images. One of these, shown here, is among the largest of its kind in the world with a diameter of 1.55 m. | Photo Credit: LSST

The primary function of telescopesIt's a common misconception that telescopes are designed to make astronomical objects appear larger. Instead their primary function is to enhance the brightness of celestial objects, measured by their light-gathering power. Say it's drizzling and you wish to collect rainwater. Place a cup with a small opening and a tub with a larger opening outside. Due to the larger opening, the tub will collect more water than the cup in a given time. This is what telescopes do with light. Views of an Asian male human eye, taken consecutively in well lit (left) and dim (right) environments to show the changes in pupil size. The pupil measured 3mm on



the left and 9mm on the right. Views of an Asian male human eye, taken consecutively in well lit (left) and dim (right) environments to show the changes in pupil size. The pupil measured 3mm on the left and 9mm on the right. | Photo Credit: Rapidreflex/Wikimedia Commons Let's expand the analogy to include the human eye. The opening size that regulates how much light may pass through an optical device is called the aperture. When the eye's pupil is fully dilated, its aperture area is around 153.9 sq. mm. To compare, a 0.07-m reflecting telescope — available as a toy — has an aperture area of 18241.4 sq. mm. This is 118.5-times more light-collecting area than the human eye. Various apertures for a Nikon AF Nikkor lens with focal length 50 mm. Changing the aperture by one stop changes the aperture area by a factor of two, i.e. the area at f/1.4 is twice as big as the area at f/2.0. Each step is specified by the diameter of the aperture as a fraction of the focal length. At f/1.4 the aperture has a diameter of 50 mm/1.4 = 35.7 mm. Various apertures for a Nikon AF Nikkor lens with focal length 50 mm. Changing the aperture by one stop changes the aperture area by a factor of two, i.e. the area at f/1.4 is twice as big as the area at f/2.0. Each step is specified by the diameter of the aperture as a fraction of the focal length. At f/1.4 the aperture has a diameter of 50 mm/1.4 = 35.7 mm. | Photo Credit: Koepi/Wikimedia Commons Features of telescopes The brightness of celestial objects is quantified by their apparent magnitude. Its values are logarithmic, meaning each step represents 2.512-times more brightness than the earlier. For example, a star of magnitude 4.0 is 2.512-times brighter than a star of magnitude 5.0.

The lower the apparent magnitude, the brighter the object; the larger the magnitude, the dimmer it is. The sun's apparent magnitude on this scale is -26.78,

Venus's is -4.92, and Sirius, the brightest star in the night sky, is -1.46. The Andromeda Galaxy, which has trillions of stars and an apparent magnitude of +3.44, is the furthest object we can see with our eyes. It appears as a fuzzy patch and we can't discern individual stars. The star V762 Cassiopeiae is 1,000,000-times brighter than the Sun. But because it is 16,000 lightyears away, it has an apparent magnitude of only +5.82. It's the faintest star visible to the naked eye. The Andromeda Galaxy (Messier 31) seen through a telescope and enhanced to highlight certain features. The small Messier 32 galaxy is seen above and slightly to the left (directly south) of the centre of M31, and Messier 110 is below and to the left. The Andromeda Galaxy (Messier 31) seen through a telescope and enhanced to highlight certain features. The small Messier 32 galaxy is seen above and slightly to the left (directly south) of the centre of M31, and Messier 110 is below and to the left. | Photo Credit: David Dayag/Wikimedia Commons The limiting magnitude is the brightness of the faintest object visible to an optical instrument. Anything fainter will be lost to this instrument. The human eye's limiting magnitude in ideal conditions is +6.5 while that of the toy telescope is +11.2. In other words, this telescope will reveal objects 100-times fainter than what a human eye can perceive. Resolution is another essential feature. Simply put, a telescope's resolution limit specifies the size of the smallest detail it can spot between two objects that are really close together. The greater the resolving capacity, the more details will be visible. The human eye with 20/20 vision has a resolving power of 60 arcsec. One arcsec is 1/3600th of a degree. The toy telescope's optimal resolving power is around 1.47 arcsec, over 40-times greater. Why are telescopes setup on mountains? The earth's tumultuous atmo-

sphere interferes with the telescope's functioning. When starlight passes through the turbulence of air, it twinkles. Even the largest telescopes have a resolution of just 0.3-0.5 arcsec. The higher we go, the less the air is disturbed, which is why most telescopes are erected atop mountains.

Space telescopes are more than 400 km above sea level, allowing them to entirely escape atmospheric disturbances. That is why the Hubble Space Telescope has a resolving power of around 0.04 arcsec, 10-times greater than the best ground-based telescopes. In recent years, scientists have developed a method to increase the telescope's resolution by correcting for the effects of air turbulence. They use a laser to make an artificial star in the upper atmosphere and then analyse how the guiding star fluctuates. Using this information, the deformable mirror is flexed to correct for distortions. A more enhanced version of this technology, called tomography, examines segments of the air column and eliminates aberrations to provide a crystal clear image. Limits to telescopes A telescope with a higher limiting magnitude is required to look deep into the universe, which demands a larger primary mirror. However, there is a limit to the size of the primary mirror. Grab a sheet of newspaper. Hold it only at the edges and try to keep it horizontal. Because of its weight, the sheet will sag and droop. Now reduce the size of the sheet. If the sheet is large enough, it will still droop, but when it's small enough, it will be easy for you to hold it flat. Similarly, a mirror wider than around 8.5 m will sink under its own weight, distorting its surface. Astronomers have found a workaround. Instead of a single primary mirror, today's large telescopes have many segments. Each piece is small enough to remain firm without slumping. And when they are combined, the overall light-collecting area is still large.

Could global warming impede weather and climate forecasting?

With the record warming of 2023-2024, we are getting a clearer picture of what global warming does. The medley of extremes strewn across the planet have covered the gamut from deadly heatwaves to devastating cyclones and floods, from droughts to wildfires. According to some estimates, the world has already crossed the 1.5° C warming threshold. (That is, the earth's average surface temperature has increased by more than 1.5° C over the pre-industrial average.) The caveat is that global temperatures are an estimate produced from a combination of data and climate models. Because the 1.5° C limit is part of a demand by the Alliance of Small Island and Developing States, scientists have built models to predict what environmental disturbances crossing this threshold could invite. However, and more importantly, it is not yet clear how long the warming has to remain above the threshold for the projected impacts to materialise.

The spectacular show that nature has put up during 2023-2024 is also a stark reminder that we are far from able to predict the weather and the climate with the requisite skills and spatial-temporal scales to manage disasters effectively. The loss of lives, livelihoods, property, and infrastructure continues to traumatise humanity, especially the poor, who remain very vulnerable to extreme events. 2024 v. our predictions Meteorologists predicted the 2023 El Niño as early as in the spring of that year, which is remarkable. But the level of warming during 2023-2024 has caught them, and the public, by surprise because it was much higher than expected from the addition of the so-called mini-global warming by the El Niño to the ongoing background warming. We speculate that water vapour thrown up by the underwater volcano Hunga Tonga-Hunga Ha'apai during 2022 and carbon dioxide emitted by the wildfires exacerbated the warming. The 2023 monsoon was deficit but it did not qualify as an El Niño drought, the reasons for which researchers are yet to diagnose. Predictions from nearly all major weather centres earlier promised a strong La Niña in late 2024. Now this seems less likely. Perhaps nature has another googly in waiting. Similarly, weather forecasts have called for the most intense hurricane season in decades but which has yet to step beyond normal.

The monsoon season has evolved erratically and has once again left many parts of India dry while producing devastating floods and landslides in many others. Now 2024 is set to emerge as a monsoon-surplus year yet it can hardly be called a typical La Niña monsoon. The cyclone season in the North Indian Ocean has also been weaker than one would expect in a La Niña year. Some weather centres were very gung-ho about an Indian Ocean Dipole (IOD) emerging in the Indian Ocean but it has played truant so far. To be clear: this is not a litany of grievances against predictions. It is an expression of caution: that we will be remiss if we don't learn all the lessons from this extraordinary period of warming vis-à-vis their implications for the future of predictions and for the climate pro-

jections we keep producing.

Predictions may pose bigger challenges. A quote often attributed to physicist Niels Bohr is apt here: prediction is difficult, especially if it's about the future. Weather and climate predictions frequently remind us of this. We do learn our lessons and continue to improve the models and the observational networks we need to produce better predictions. But what if predictions continue to become more difficult with global warming? Put another way, are all the misfires we have had this year just a coincidence or are they a portent of what is to come? Many studies have reported the impacts of warming on hurricanes, monsoons, El Niños, La Niñas, the IOD, etc. But the bigger question is: if the world is already warmer than 1.5° C, are there any conclusions we can draw about how all these natural variabilities have responded thus far? Unfortunately, the period of warming we have experienced of late hasn't been long enough for us to confidently say what changes we can already detect in the dominant climate modes. The models are amazing in their ability to reproduce all natural modes given just the energy coming from the Sun at the top of the atmosphere. But they are not perfect: model answers often disagree; even the same model can produce different answers depending on its configuration. For example, existing models cannot reproduce monsoon trends in the past half century and are considered unreliable for the future; they can only make skillful forecasts for the present. We have also not sorted out yet whether monsoon patterns are variable from decade to decade — patterns that we may currently be calling trends. We also don't know whether climate change can extend the timescale of natural decadal variability and make it a real trend. We need to address these critical questions to advance our understanding of processes and to make better predictions.

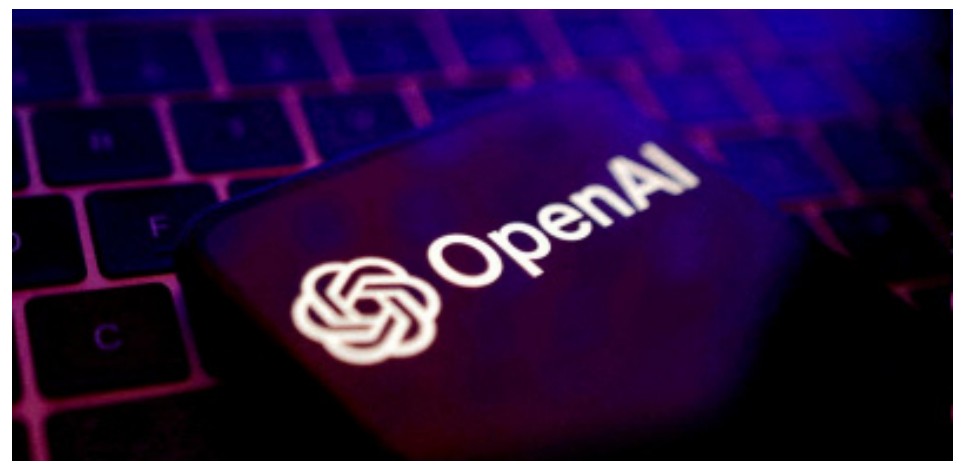
Predicting the future of predictions There is plenty of hope for the future of predictions, but as the adage goes, hope is not a strategy. We have our work cut out for us. We obviously need to continue to improve our models and build on the fact that models are already capable of amazing feats, with some deficiencies. We need to figure out if the predictability of natural modes such as hurricanes, El Niño, La Niña, IOD, etc. will decrease as the warming is relentless, if not accelerating. Well-trained and enthusiastic scientists toil to improve models and data networks and bring the latest technologies, including artificial intelligence, machine learning, and sensor-fit drones, to bear on this pressing challenge. We have plenty of reasons for optimism vis-à-vis reliable and actionable early warnings at the hyperlocal scale. Lessons from 2023 for climate projections We currently make climate projections using the same or similar models that project future climate based on how the concentrations of specific emissions increase, how populations grow, and what mitigation policies we implement, among other factors. For the coming decade or two, projection uncertainties depend on the



model uncertainties themselves plus natural variabilities in a warming world. The uncertainties in projections beyond a couple of decades are related entirely to the imagined scenarios that drive model simulations. The inability to capture the response of natural modes to warming will continue to haunt all projections. It will be necessary to translate improved weather and climate predictions to improve the models. The best strategy to ensure pro-

jections are reliable may be to restrict ourselves to just a decade or two into the future. The ongoing geopolitical perturbations and their cascades into markets, economies, and societies underscore the difficulty of imagining the future beyond a decade or so as well. Overall, it is critical that we assess the costs and benefits of the considerable human, financial, and computational resources for climate projections out to 2100.

OpenAI rolls out more realistic Advanced Voice Mode for premium users



OpenAI has started rolling out the advanced voice mode for premium users of its AI chatbot ChatGPT. The audio feature is touted to be more natural and immersive and will be released through the week. The AI firm has said that it's not yet available in EU countries including Iceland, Norway, Switzerland, Liechtenstein or the U.K. After ChatGPT Plus and Teams customers, the feature will be released for Enterprise and Edu users from next week. CEO Sam Altman announced the feature on X saying, "Hope you think it was worth the wait." ChatGPT will also be getting five new voices that users can test called Arbor, Maple, Sol, Spruce and Vale, making the total number of voice options nine. While OpenAI had announced the advanced voice feature in May, the rollout was pushed back after actress Scarlett Johansson alleged that the

demo voice called Sky was distinctly similar to her own in the 2013 film, "Her." While the company responded to the claim saying they hadn't modelled the voice after Johansson's but paused using it after her legal counsel sent letters stating they didn't have permission. For premium subscribers, they need to open the ChatGPT app to receive a notification once they have turned on access to the new feature. Then, the user can click on 'Continue' to go on. Once they start a new chat, a sound wave icon will appear next to the microphone icon and the 'Message' field. A small bump sound will be heard after a few seconds post which the circle in the middle of the screen that will then transform into a sky blue and white animation. The bot responds then. Users can choose a different accent or speed up a conversation.

U.S. Department of Justice sues Visa, alleges the card issuer monopolises debit card markets

The U.S. Justice Department has filed an antitrust lawsuit against Visa, alleging that the financial services behemoth uses its size and dominance to stifle competition in the debit card market, costing consumers and businesses billions of dollars. The complaint filed Tuesday says San Francisco-based Visa penalises merchants and banks who don't use Visa's own payment processing technology to process debit transactions, even though alternatives exist. Visa earns an incremental fee from every transaction processed on its network. According to the DOJ's complaint, 60% of debit transactions in the United States run on Visa's debit network, allowing it to charge over \$7 billion in fees each year for processing those transactions.

"We allege that Visa has unlawfully amassed the power to extract fees that far exceed what it could charge in a competitive market," said Attorney General Merrick B. Garland in a statement. "Merchants and banks pass along those costs to consumers, either by raising prices or reducing quality or service. As a result, Visa's unlawful conduct affects not just the price of one thing — but the price of nearly everything." In a statement, Julie Rottenberg, Visa's general counsel, said the lawsuit doesn't take into account the "ever expanding universe of companies offering new ways to pay for goods and services." "Today's lawsuit ignores the reality that Visa is just one of many competitors in a debit space that is growing, with entrants who are thriving," Rottenberg said. She added the lawsuit is "meritless" and the company will defend itself "vigorously." The Biden administration has aggressively gone after U.S. companies that it says act like middlemen, such as Ticketmaster parent Live Nation and the real estate software company RealPage, accusing them of burdening Americans with nonsensical fees and anticompetitive behavior. The administration has also brought charges of monopolistic behaviour against technology giants such as Apple and Google.

"In some of the Justice Department's antitrust enforcement actions, the harm caused by the alleged illegal conduct is more visible: higher prices for air travel, for concert tickets, for smartphones," Garland said during a news conference in Washington on Tuesday. "The harmful effects of Visa's alleged anticompetitive conduct is less visible, but they are no less harmful." According to the DOJ complaint, filed in the U.S. District Court for the Southern District of New York, Visa leverages the vast number of transactions on its network to impose volume commitments on merchants and their banks, as well as on financial institutions that issue debit cards. That makes it difficult for merchants to use alternatives, such as lower-cost or smaller payment processors, instead of Visa's payment processing technology, without incurring what DOJ described as "disloyalty penalties" from Visa. The DOJ said Visa also stifled competition by paying to enter into partnership agreements with potential competitors. In 2020, the DOJ sued to block the company's \$5.3 billion purchase of fi-

ancial technology startup Plaid, calling it a monopolistic takeover of a potential competitor to Visa's ubiquitous payments network. That acquisition was eventually later called off. Visa previously disclosed the Justice Department was investigating the company in 2021, saying in a regulatory filing it was cooperating with a DOJ investigation into its debit practices. Since the pandemic, more consumers globally have been shopping online for goods and services, which has translated into more revenue for Visa in the form of fees. Even traditionally cash-heavy businesses like bars, barbers and coffee shops have started accepting credit or debit cards as a form of payment, often via smartphones.

KBW analyst Sanjay Sahrani said in a note to investors that he estimates that U.S. debit revenue is likely at most about 10% of Visa revenue. "Some subset of that may be lost if there is a financial impact," he said. Visa's "U.S. consumer payments business is the slowest growing piece of



the aggregate business, and to the extent its contribution is affected, it is likely to have a very limited impact on revenue growth." He added the lawsuit could stretch out for years if it isn't settled and goes to

trial. Visa processed \$3.325 trillion in transactions on its network during the quarter ended June 30, up 7.4% from a year earlier. U.S. payments grew by 5.1%, which is faster than U.S. economic growth.

Beads on the moon suggest it had volcanoes more recently than thought

Scientists widely believed volcanic activity on the moon ceased about a billion years ago. A study published in Science on September 5 called this idea into question with evidence suggesting the moon had active volcanoes as recently as 120 million years ago. The moon's volcanic activity sheds light on how its surface was formed, its atmospheric conditions, and its tectonic activity. Volcanoes can also create conditions suitable for life by releasing water and providing energy and nutrients. More recent research using remote-sensing data from satellites has found signs of volcanic activity from around 800 million years ago, but no exact date for the activity itself.

Researchers behind the new study, led by Bi-Wen Wang of the Chinese Academy of Sciences, investigated moon samples collected by China's Chang'e-5 mission. They focused their analysis on lunar glass beads — small spherical or egg-shaped glass pieces formed by volcanic activity or impact events like when rocks from space smash the moon's surface. The moon-made specks

The way high-energy events create glass beads on the moon is similar to how tektites formed from impacts and volcanic rock (like obsidian) from eruptions on the earth. In volcanic eruptions, magma from the moon's surface throws up lava fragments. When these fragments cool quickly they form the beads. Likewise, the surface rock and soil melt under the intense pressure and heat produced by asteroid or meteorite impacts. The melted material is tossed into the air, where it rapidly cools and lands on the surface as glassy beads. The materials thrown into the air are

spherical because they take the least amount of energy to form. This is also why water droplets are spherical in space or egg-shaped on the earth, where gravity stretches them a little. The glass beads' atoms are arranged in a haphazard manner. They're composed of silicon, magnesium, and iron with trace amounts of potassium, titanium, and uranium.

A volcano within a bead

Volcanic glass beads are typically more uniform while impact beads may display shock features like fractures or deformations. Nonetheless, identifying how some beads originated is challenging because they are derived from similar rocks. The presence of elements from an impactor that is no longer found on the moon's surface is another characteristic of impact glass beads. Volcanic glass beads on the other hand can have greater amounts of volatile elements, including sulphur emitted during eruptions. None of these criteria are conclusive by themselves: scientists use many of them together to ascertain a bead's origins. The samples collected by Chang'e-5 were from Statio Tianchuan, near the volcanic complex Mons Rümker and part of a terrain known for its elevated heat-producing elements, thin crust, and prolonged volcanic activity. The researchers analysed more than 3,000 bead samples, examining their physical features to look for patterns that would reveal clues to their origins. They also studied the samples' chemical composition to identify the most and least abundant elements present and compared them to known impact and volcanic glass compositions. The team also looked out for evidence of incomplete melting, a characteristic of asteroid or meteorite impact.

Isotopes are atoms of the same element that have an equal number of protons in their nuclei but different numbers of neutrons. Isotope analysis reveals the various quantities of isotopes in a sample. The researchers compared the sulphur isotope ratios in the beads with established values from older samples. This approach provides insights into a substance's origin and the processes that helped form it. The researchers' analysis revealed that three of the 13 samples were from volcanic activity. Then they used the uranium-lead radiometric dating method to accurately date the materials present in these samples.

The method works by assessing the quantity of uranium isotopes that have decayed to lead isotopes, which happens at a predictable time-rate. They determined the ages of the three volcanic samples to be 116-135 million years. The composition of the glass beads also indicated they came from a magmatic source. While the age of the volcanic samples overlapped with those of impact glass beads collected by Chang'e-5, additional evidence based on mineral composition, sulphur isotope ratios, and lead isotopes pointed to a volcanic origin for the three beads.

The researchers' use of sulphur isotope ratios was novel. Sulphur isotopes aren't commonly used to identify the origin of materials on celestial bodies. Scientists instead rely on techniques based on carbon, oxygen, and lead. But volcanic activity makes sulphur a better choice primarily because it releases sulphur dioxide gas. The research team also showed the moon was volcanically active as recently as 120 million years ago, refuting previous claims.