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JADES-GS-z14-0 & JADES Program

A new study has detected the 2 earliest and most distant galaxies.

- **JADES-GS-z14-0 –** It is estimated to have formed *about 290 million years after the Big Bang*, making it the earliest-known galaxy.

  ***The Big Bang theory** proposes that the universe began from an infinitely hot and dense single point, known as a singularity, around 13.7 billion years ago.*

- **Observed by** – *NASA's* James Webb Space Telescope (JWST)
- **Umbrella programme** – ***JADES program*** (JWST Advanced Deep Extragalactic Survey).
- **Location** – It measures about 1,700-light years across.

  A light year is the distance light travels in a year, which is 9.5 trillion km.

- **Mass** – It is equivalent to 500 million stars the size of our Sun and is rapidly forming new stars, about 20 every year.
- **Size** – It is significantly larger than other galaxies that the JADES team has measured at these distances.
- **Luminous** – It is brighter.

  Galaxies tend to grow larger as the universe evolves, thus it would potentially get significantly brighter in the next many 100 million years.

- **JADES-GS-z14-1 –** It is smaller with a mass equal to about 100 million sun-sized stars, measures roughly 1,000 light years across and forms about 2 new stars per year.

JADES Program

- **JADES** – JWST Advanced Deep Extragalactic Survey.
- **Partnership** – An international collaboration of more than 80 astronomers from 10 countries.
- It is conducting an ambitious program of *deep infrared imaging and multi-object spectroscopy*.
- **Technique** – It uses 3 JWST instruments, in the 2 most famous deep fields on the sky
  - The Hubble Deep Field (GOODS-N)

    - The Hubble Ultra Deep Field (GOODS-S)
- **3 scientific instruments**
    - **NIRCam** – Near-Infrared Camera
    - **NIRSpec** – Near-Infrared Spectrograph
    - **MIRI** – Mid-Infrared Instrument

References

1. The Indian Express| Discovery of Earliest Galaxies
2. JADES Survey| JADES Program

North Korea's Spy Satellite

Malligyong-1-1 satellite launch failed as the rocket exploded and fell into the Yellow Sea shortly after lift-off.

- It is a ***military reconnaissance satellite***.
- **Launched by** – *North Korea.*
- **Russia's assistance** – Russian experts have visited North Korea to help with the satellite and space rocket program.

Malligyong-1 satellite *which was launched successfully in 2023 is North Korea's 1st spy satellite.*

- **Reason for failure** – One of the main issue is due to the failure of newly developed *liquid-fuel rocket motor*, which is the 1st stage.
- It uses a combination of ***liquid oxygen and petroleum engine***.
- **Challenges** – Liquid oxygen engines require specialised storage and handling due to extremely *low boiling points* ***(-183 degree Celsius)***.
- It is quite difficult to solve combustion instability problems of this fuel system and apply materials and parts that can withstand extremely low temperatures.

North Korea's ***Chollima-1 satellite*** *uses hypergolic fuels, substances that can be stored at room temperature but ignite on contact each other, thus require careful handling. It is used in nuclear ballistic missiles.*

Hypergolic fuels *include hydrazine (N2H4) and its derivatives including: monomethylhydrazine (MMH), unsymmetrical dimethylhydrazine (UDMH), and Aerozine 50 (A-50).*

- **Significance** – Using different engines might allow North Korea to differentiate its civilian space program from its missile program, which is banned by the UN Security

Council.

Yellow Sea
• It is a large *inlet of the western Pacific Ocean*. • **Yellow colour** – It was named so as the yellowish sand particles originating from the Gobi Desert that descend on the surface of the sea, thereby giving it a golden yellow colour. • Also known as *Huang Hai or Hwanghae*. • **Location** – It is lying between mainland China on the west and north, the Korean peninsula on the east and the Shandong Peninsula & Liaodong Peninsula to the south. • **Boundaries** – It is to the north of the *East China Sea* while the *Bo Hai Sea* is the north-western extension of the Yellow Sea. • It is dotted with numerous islands, some of which are - Jeju Island (South Korea), Shandong Peninsula islands (China), and Ganghwa Island (South Korea). 

References

1. Business Insider| Malligyong-1-1 Satellite Launch Failed
2. The Print| North Korea's spy satellite

Spot-bellied Eagle Owl

Pench Tiger Reserve reports first photographic record of forest eagle owl.

- **Scientific Name** - Bubo Nipalensis.
- **About -** It is a large, bold, nocturnal species of owl known for their distinctive spots on their belly. It is also known as ***forest eagle owl.***
- **Habitat –** It is found in dense evergreen and moist deciduous forest usually near water, mostly observed in Arjun and Banyan trees.
- **Distribution**
    - **In world –** Bhutan, Cambodia, China, India, Laos, Myanmar, Nepal, Sri Lanka, Thailand, and Vietnam.
    - **In India** – Foothills of Uttarakhand to North-eastern India, Gujarat, Western and Eastern Ghats.

These birds have also been reported from Madhya Pradesh and Kanha Tiger Reserve.

- **Calls –** Their call is a low, deep *double hoot* lasting 2 seconds. They make calls to communicate across long distances, territorial defence, and attracting mates.
- **Prey -** It is an ***apex predator***, feeding on a variety of prey including large birds, rodents, small mammals, reptiles, and insects. It occasionally hunt on day.
- **Conservation Status**
    - **IUCN –** Least concern
    - **CITES –** Appendix II
    - **WPA –** Schedule IV



Pench Tiger Reserve

- Pench Tiger Reserve is located in satpura hills of ***Madhya Pradesh.***
- It is the ***19th Tiger Reserve*** of the country, comprises of the Indira Priyadarshini Pench National Park, the Pench Mowgli Sanctuary.
- It derives its name from the River Pench which splitting the Park into two, while forming the boundary of Seoni and Chhindwara districts.
- The ***Meghdoot dam*** built across ***Pench River.***

Reference

The Times of India | Forest eagle owl sighted in Pench Tiger Reserve

LignoSat wooden satellite

Recently scientists have developed the satellite named LignoSat.

- It is ***world's 1st wooden satellite***.
- **Developed by** – ***Japan***, a collaboration between Kyoto University and the logging company Sumitomo Forestry.
- **Aim** – To test the idea of using wood as an *eco-friendly alternative to metal based satellites* as wood would burn completely upon re-entry into Earth's atmosphere.
- To measure the deformation of the wooden structure in space.
- **Size** – It is a cube that measures *10 centimetres* on each side.
- **Material** – A timber from *magnolia wood.*

> ***Magnolia wood*** *is a highly sought-after timber, known for its striking colouration and fine grain.*

- **Significance –** It was founded to be *particularly stable and resistant to cracking* in laboratory tests.
- There is no oxygen in space which could cause wood to burn, and no living creatures to cause it to rot.
- **Future prospects** – If the LignoSat succeeds in orbit, wood could become a material for future satellites.
    - Over *2,000 spacecraft expected to launch annually.*

Issues with Satellites made of Metals
• **Creates space debris** – All the metal based satellites which re-enter the Earth's atmosphere burn and create tiny alumina particles, which will float in the upper atmosphere. • **Threat to satellites and spacecraft** – Metals particles can damage the space observatory instruments. • **Depletes the ozone layer** – Ozone layer protects us from harmful UV radiations from the Sun. • **Alters the amount of sunlight** – It travels through the atmosphere and reaches the ground.

> *Currently, more than 27,000 tracked pieces of space debris orbit Earth at speeds of approximately 15,700 mph in low Earth orbit.*

Reference

The Guardian| Development of Lignosat, the wooden satellite

Virus-like Particles (VLPs)

Scientists had recently developed a novel method to generate non-infectious virus-like particles (VLPs) that mimic the Nipah virus (NiV).

- **Nipah Virus -** Nipah virus (NiV) is a zoonotic disease that spreads primarily between animals and humans.
- Nipah is a highly pathogenic paramyxovirus, with a fatality rate of up to 80% in affected humans.
- The genome of the NiV encodes 6 major proteins:
  - Glycoprotein (G)
  - Fusion protein (F)
  - Matrix (M)
  - Nucleocapsid (N)
  - Long polymerase (L)
  - Phosphoprotein (P)
- **Virus-like Particles (VLPs) –** VLPs are molecules that closely resemble viruses, but are non-infectious because they contain ***no viral genetic material.***
- **Characteristics -** VLPs carry most of the characteristics of the virus, except their ability to replicate (because it lacks the viral genome).
- The advent of NanoBiT technology and "HiBiT-tagged" VLP (HiBiT is an 11 amino acid peptide) makes it far more sophisticated.
- Scientists at the Institute of Advanced Virology (IAV) have generated "HiBiT-tagged" Nipah virus-like particles (NiV-VLPs).
- Highly sensitive and quantitative HiBiT-tagged Nipah virus-like particles is a platform for rapid antibody neutralisation studies.
- It was generated using plasmid-based expression systems, encoding the NiV structural proteins G, F, and M.
- The VLPs produced are morphologically and functionally identical to the native virus.
- The inclusion of a highly sensitive HiBiT tag on these VLPs accelerates their potential in antiviral drug screening and vaccine development.
- **Virus neutralisation assays –** These are critical for the development and evaluation of vaccines and immune-therapeutics,
- They are also used for conducting basic research into the immune response and pathogenesis of NiV.
- These tests, which traditionally require to be done in high security labs (BSL-4) with the infectious organism, can now be done safely in BSL-2 labs in the country using the NiV-VLPs.
- Biosafety level 4 (BSL-4) laboratories are designed to handle pathogens that are highly contagious and can cause fatal diseases.
- These pathogens are known as Risk Group 4 pathogens and include viruses like Ebola, Lassa, Nipah, Marburg and Crimean-Congo hemorrhagic fever.

References

The Hindu | New method to generate virus-like particles



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