Prelim Bits 08-05-2024 | UPSC Daily Current Affairs

Cosmic Glitch

A group of researchers from Canada have discovered a potential "cosmic glitch" in the universe's gravity, explaining its strange behaviour on a cosmic scale.

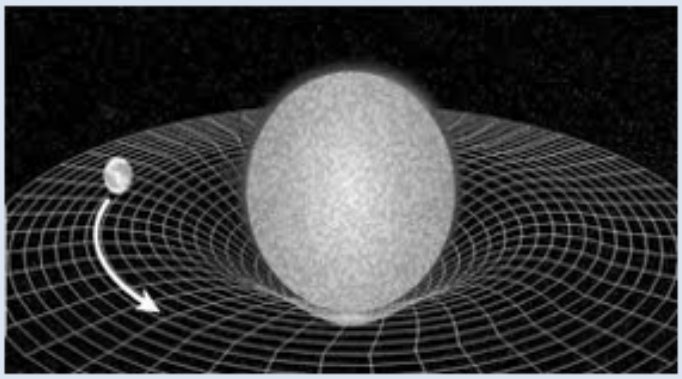
- **Challenges** – The theory of gravity, general relativity still has inconsistencies when it comes to calculating its effect on vast distances.
- **Cosmic glitch** – It is the apparent *inconsistencies* that occur *with the predictions of general relativity* in understanding gravity on a cosmic scale, *at the scale of galaxy cluster and beyond*.
- The ***gravity becomes around 1% weaker*** when dealing with distances in the billions of light years.

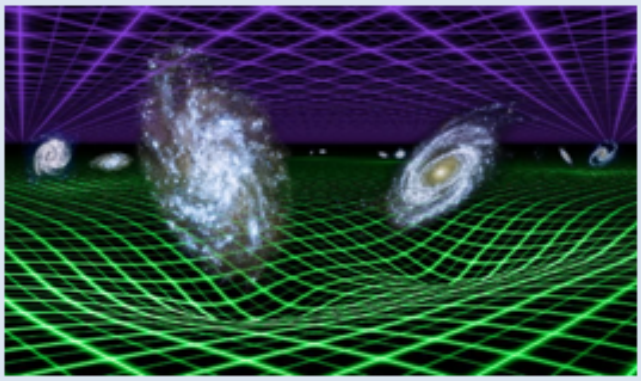
  The Particle horizon or superhorizon is the maximum distance light could have travelled since the origin of the universe.

- **Cosmic glitch model** – It modifies and extends Einstein's mathematical formulas by adding a single extension to the standard cosmological model.
- This model is known as the *lambda cold dark matter model*.
- This should clear up inconsistencies in measurements at cosmological scales without affecting the existing successful uses of general relativity.

Albert Einstein's Theory of Gravity & General Relativity

• **Theory** – It posited that gravity arises from the curvature of the very fabric of space and time, united as a single entity called "spacetime."
• This curvature is said to have been shaped by objects with mass.
• It also suggests that gravity impacts not simply 3 physical dimensions but also a 4th dimension: time.
• **Curved Spacetime** - When a smaller mass passes near a larger mass, it curves toward the larger mass because spacetime itself is curved toward the larger mass.
• The smaller mass follows the structure of curved spacetime near the larger mass.





• Moons have less mass than planets, planets less than stars, and stars less than galaxies — thus, the gravitational influences of these celestial bodies increases respectively.
• **Significance** – It has been essential in theorizing the Big Bang, the existence of black holes, the gravitational lensing of light and tiny ripples in spacetime called gravitational waves.

Reference

Space| Cosmic Glitch Model

Fusobacterium nucleatum

A new study finds that a mouth bacteria has starring role in colorectal cancer (CRC) tumours.

- **Fusobacterium nucleatum** – It is a *Gram-negative, anaerobic oral bacterium*, commensal to the human oral cavity that plays a role in periodontal disease.
- It lives in the human mouth and are rarely found elsewhere.
- **Types** – It has *4 subspecies*.
- Among the 4 subspecies, only ***Fusobacterium nucleatum animalis (Fna)*** subspecies was associated with CRC tumours.

  *Research showed that when a mice infected with Fna type of Fusobacterium, their intestines developed precancerous formations called **adenomas**.*

- **Role in colorectal cancer** – They are found in tumours in the gut, where they *help cancer cells escape from the immune* system and spread to other parts of the body.
- **Genetic adaptation** – There are 2 different clades of Fna, namely Fna C1 and Fna C2,

where Fna C2 bacteria are significantly associated with CRC tumours with their extra genetic factors.

*A **clade** is a group of life-forms belonging to one evolutionary lineage. The **pangenome** contains all genes encoded by a species, with the core genome present in all strains and the accessory genome in only a subset.*

- **Mouth to gut** – It could go from the mouth to the gut by infecting the *bloodstream or* could have descended *through the gastrointestinal tract to reach the colon*.

Bacteria don't usually take gastrointestinal tract as they can't survive the highly acidic environment of the stomach.

- It was found Fna C2 could *grow in more acidic conditions* than Fna C1.

Colorectal cancer (CRC)
• It is the 7th most common type of cancer in India, where the number of cases rose by 20% from 2004 to 2014. • The overall CRC incidence has declined worldwide but the incidence of age-adjusted early-onset CRC has risen at an alarming rate of 2-4% in many countries, with even sharper increases in individuals younger than 30 years.

Reference

The Hindu| Association of Fusabacterium nucleatum with cancer

Pulicat Lake (Pazhaverkadu)

The Tamil Nadu government has taken steps to denotify the boundaries of the Pulicat bird sanctuary which will reduce the sanctuary's eco-sensitive zone.

- **Area** – It is spread across 720 square kilometres (kms).
- **Location** – It sprawls across Andhra Pradesh and Tamil Nadu (less than 20% in Tiruvallur district of Tamil Nadu).
- About 60 kms north of Chennai, it is separated from the Bay of Bengal by the Sriharikota Island.
- **Water discharge** – It is fed by 3 major rivers
    - The Arani River at the southern tip
    - The Kalangi River from the northwest
    - The Swarnamukhi River at the northern end
- The Buckingham canal is a navigation channel located on the western side of this lagoon.
- **Significance** – A unique ecotone that supports rich biodiversity from aquatic life to

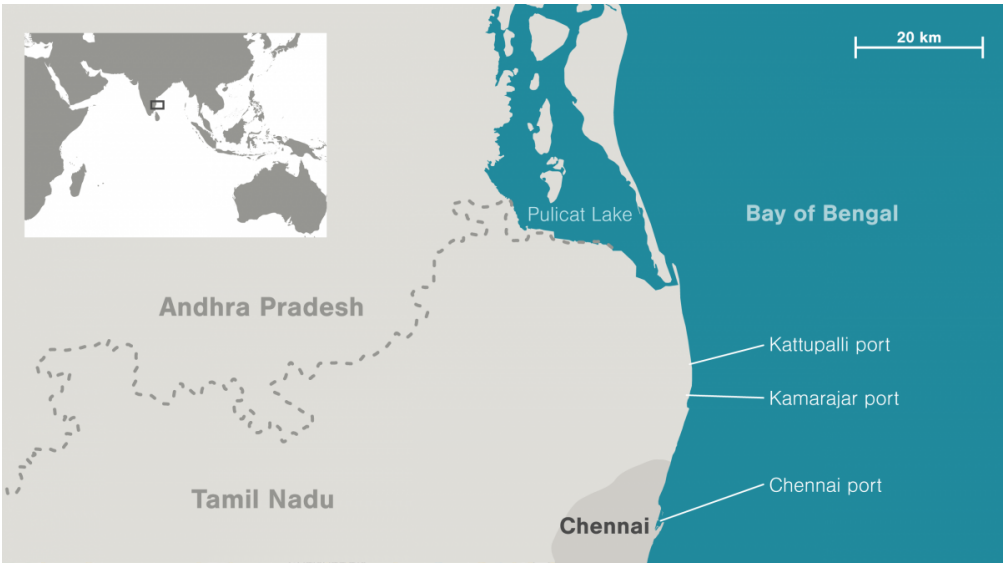
more than 200 avian species.
- Flamingo festival will be held in this lake every year.
- Many fisher families depend on the waterbody for their livelihood.
- As a floodwater catchment site when cyclones hit the TN coast.

The Pulicat Lake, the 2nd largest brackish water lagoon in India after Chilika Lake.

- **Pulicat bird sanctuary** – It was notified in 1980 under Section 18 of the Wild Life (Protection) Act, 1972 in declaring the intention along with 13 revenue villages surrounding the lake.
- But it needs a final notification specifying the area limits within the sanctuary under Section 26A.
- **Threats** – *Denotifying 13 villages* from sanctuary limits.

The ESZ rules do not mandate displacement and evacuation of locals living in the villages, but they regulate activities.

- A *port expansion plan and an industrial park* proposal for setting a detergent and steel factory within the eco-sensitive zone (ESZ).
- These factory units have been classified as *the 'red' industries* by the Tamil Nadu Pollution Control Board.
- The draft e*nvironment impact assessment for the Adani Kattupalli Port* shows that the lake is located within 7.2 kms and the present bird sanctuary boundary is a mere 3.17 kms away.



The Ministry of Environment, Forest, and Climate Change has mandated wildlife clearance from the National Board for Wildlife (NBWL) to establish any industry within a 10-km radius of any protected area.

- Proliferation of the invasive charru mussels.
- Pollution from sewage, pesticides, agricultural chemicals and industrial effluents.
- **Conservation** – IUCN had declared it as a Ramsar site of international importance and the World Wide Fund for Nature declared it a protected area.

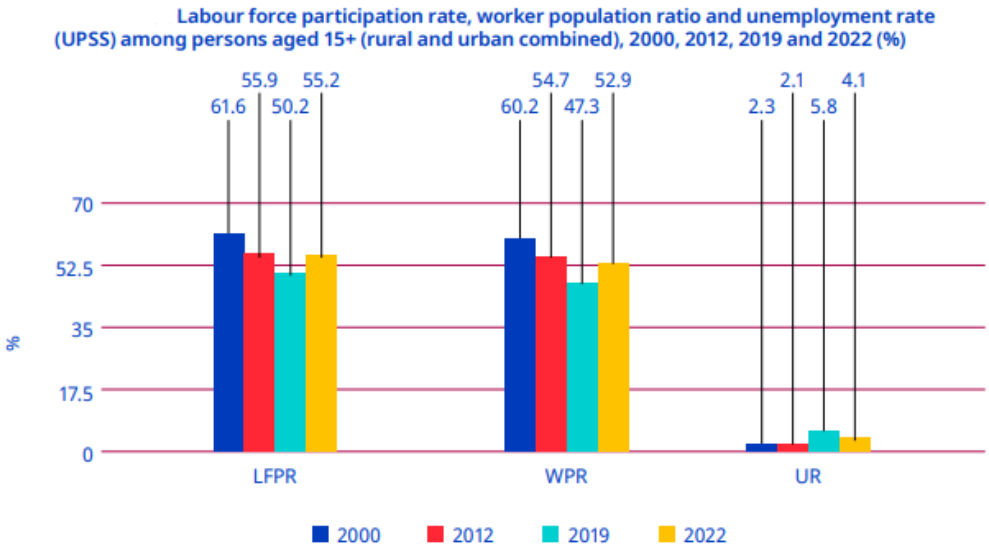
Reference

The Hindu| Pulicat Lake and its threat

India Employment Report, 2024

India is likely to have a demographic advantage for at least another decade according to India Employment Report 2024.

- It is the 3rd in the series of publication.
- **Published by** – The Institute for Human Development on labour and employment issues and International Labour Organization.
- **Tagline** – Youth employment, education and skills.
- **Aim** – To examine the *challenge of youth employment* with respect to emerging economic, labour market, educational & skills scenarios and the changes witnessed over the past 2 decades in India.
- **Data source** – Largely on the Employment and Unemployment Surveys (EUS) and Periodic Labour Force Surveys (PLFS), conducted by NSSO.
- **Analysis** – It *compares 4 years*: 2000, 2012, 2019, and 2022.
- **Findings** – Unemployment and underemployment rates increased till 2018 but declined thereafter.
    - Unemployment rate declined from 6% in 2018 to 3.2% in 2023
    - Youth unemployment rate fall from 17.8% to 10% in 2023
- The employment quality, as per Employment Condition Index, has improved in all states, albeit differently.
- *Increase in the share of non-farm employment* (and decline in agriculture employment) between 2000 and 2019, implies a movement *towards the structural transformation* of the economy.
- A *steady increase in regular employment* & decline in unorganised sector employment which was halted during the Covid period.
- In comparison to the wages of regular workers, the *wages of casual workers increased* even during 2019-22.
- Increase in the female workforce participation (FWFP) rate from 24.5% in 2019 to 37.0 in 2023.



- **Challenges** – The employment pattern remains skewed towards agriculture (around 46.6% workers higher than in 2019).
- The production process has been increasingly becoming capital and skill-intensive, leading to distortions in the labour market.
- Despite an increase in educational attainments, unskilled and semi-skilled workers abound.
- Women's participation is still low and they remain largely engaged in somewhat less remunerative jobs.
- Educated youth, who account for nearly two-thirds of total unemployment.
- Unemployment rate rises with a rise in education levels, 28% among graduates and above (the proportion of women being higher).
- The proportion of youth not in employment, education and training (NEET) is quite high at around 28% in 2022, with the share of females being around 5 times more than males.
- Over 90% employment is informal, and 83% are in informal sector.

References

1. The Indian Express| Youth unemployment-India's biggest challenge
2. ILO| India Employment Report 2024

Phi-3-mini

The latest version of a lightweight AI model, the Phi-3-Mini was launched.

- It is a small language model, available on AI development platforms such as Microsoft Azure AI Studio, HuggingFace, and Ollama.
- **Launched by** – Microsoft
- It expands the selection of high-quality language models available to customers, offering more practical choices as they build generative AI applications.
- **In India** – India's ITC also leveraged the new Phi-3-mini.

Language models are the backbone of AI applications like ChatGPT, Claude, Gemini, etc.

- **A language model** – It is a *machine learning model* that aims to predict and generate plausible language.
    - *Autocomplete* is a language model, for example.
- These models are *trained on existing data* to solve common language problems such as text classification, answering questions, text generation, document summarisation, etc.

> *The amount of conversation that an AI can read and write at any given time is called the **context window**, and is measured in something called **tokens**.*

	Small Language Models	Large Language Models
Size	Less parameter count	Higher parameters
Processing speed	Quicker	Relatively slower
Computational Requirement	Can use mobile device processor	Require hundreds of GPU processors
Handling capacity	Simple tasks	Complex tasks
Deployment	Easier	Require substantial infrastructure
Training Time	In a week time	Can take months
Training Data	Specialisation	On general data
Efficiency	More efficient	Less efficient
Training and Inference Cost	Expensive	Less expensive

Reference

The Indian Express| Launch of phi-3-mini model