DAILY CURRENT AFFAIRS 25-10-2025

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Celestial Body –Chiron

Syllabus: GS-1: Geography – Solar system.

Context:

Recently, astronomers for the first time **observed a ring system forming around the icy celestial body Chiron**, marking a significant discovery in outer solar system studies.

About Chiron

- **Classification:** Chiron belongs to a group called **Centaurs** – celestial objects that orbit the Sun between **Jupiter and Neptune.**
- **Nature:** Exhibits characteristics of **both asteroids and comets**.
- **Discovery:** Found in **1977** by **astronomer Charles Kowal**.
- **Orbital Period:** Takes approximately **50 years** to complete one revolution around the Sun.
- **Diameter:** Around **200 km (125 miles)**.

Recent Observation – Ring System

- **Discovery:** For the first time, scientists observed **a ring system** around Chiron using **stellar occultation** technique.
- **Structure:**
  - **Total of 4 rings** detected.
  - **Three inner rings** are embedded within a **dusty, disk-like region**.
- **Composition:** Rings are primarily made of **water ice** and **rocky material**, similar to those seen around **Saturn**.

- **Formation Hypothesis:** Likely the result of **collisions** or **volatile ejections** from Chiron's surface.

Physical & Chemical Composition

- Composed mainly of:
    - Rock
    - Water ice
    - Complex organic compounds
- Exhibits **comet-like activity**, occasionally **ejecting gas and dust** into space when heated by the Sun.

Observation Method

- **Technique Used:Stellar Occultation**
    - Occurs when Chiron passes in front of a distant star, briefly blocking its light.
    - Enables detailed study of its **size, shape, and surrounding material.**
- **Research Collaboration:** Conducted by a **Brazilian, French, and Spanish** team.

Significance of Discovery

- **First evidence** of **ring system formation** around a Centaur-class object.
- Suggests that **ring systems may be more common** among small bodies than previously thought.
- Provides insights into **planetary ring evolution** and **solar system dynamics**.
- Supports the theory that **Centaurs are transitional objects**, evolving from **Kuiper Belt objects** into **comets**.

Fomoflation

Syllabus: GS-2; International Relations

Context

- The U.S. President recently signed a **proclamation raising the annual fee for H-1B visas to $100,000**, sparking widespread panic among employers and visa applicants.
- This sudden surge in urgency and demand led to skyrocketing ticket and processing costs, providing a **real-world example of "fomoflation"** — a phenomenon where **fear-driven consumer psychology fuels inflation beyond normal economic causes**.

About Fomoflation

- **Definition:**
  Fomoflation refers to inflation driven by the **Fear Of Missing Out (FOMO)** — when consumers, fearing scarcity or future price hikes, **rush to purchase goods or services**, thereby driving prices up artificially.
- **Key Characteristics:**
  - **Behavioral-based inflation:** Rooted in *demand psychology* rather than standard economic triggers like monetary policy or production costs.
  - **Artificial demand loop:** Panic buying creates a **self-reinforcing cycle** — demand spikes → prices rise → fear of scarcity deepens → more buying follows.
  - **Amplified by media and social platforms**, which spread perceived shortages or opportunities faster than markets can stabilize.
- **Comparison with Traditional Inflation:**
  - *Normal inflation* = macroeconomic causes (supply chain issues, fiscal deficits, monetary expansion).
  - *Fomoflation* = **psychological causes** (panic, speculation, herd behaviour).
- **Examples:**
  - The **H-1B visa fee panic** is a current international illustration.
  - During festive seasons in India, **staple prices like pulses and oil** often rise when media reports suggest impending shortages — even if supplies remain stable.

Pokkali rice

Syllabus: GS-3: Sustainable Agriculture – Traditional Agriculture.

Context:

The 'endangered' pokkali farming cluster of Ezhikkara, which is set to receive an experiential tourism boost.

Pokkali Rice

Pokkali is a traditional, saline-resistant rice variety cultivated in the coastal regions of **Kerala**, primarily in the **Alappuzha, Ernakulam, and Thrissur districts**.

It is among the oldest known rice cultivation systems in the world, uniquely adapted to **brackish water ecosystems**.

Key Features of Pokkali Rice

Feature	Description
Type	Indigenous, saline-tolerant rice variety
Region	Coastal Kerala (Kuttanad& adjoining coastal wetlands)
Soil Type	Waterlogged, saline, clayey soils
Irrigation Source	Tidal brackish water (backwaters)
Cultivation Season	June to November (monsoon season)
Height	Tall variety (up to 1.5–2 m) — helps survive flooding
Duration	110–150 days
GI Tag	Granted in **2008**, under the name "Pokkali Rice"
Farming System	Integrated Rice-Fish farming system

Unique Eco-Agricultural System

1. Integrated Rice–Prawn Farming (Rotation System)

- During **monsoon (June–Nov)** → Pokkali rice is grown when water salinity is low.
- After harvest → The same fields are converted into **prawn/fish farms** (Nov–Apr) when salinity rises.

- This **cyclical use** enhances soil fertility and reduces chemical input needs.

2. Zero Chemical Input

- No use of fertilizers or pesticides — completely **organic and sustainable**.
- Nutrient recycling through **prawn excreta** enriches the soil.

3. Climate-Resilient System

- Pokkali thrives in **flood-prone and saline areas**.
- Highly resistant to **salinity, flooding, and pest attacks** — ideal for coastal resilience against **climate change and sea-level rise**.

Scientific and Environmental Importance

Aspect	**Details**
Salinity Tolerance	Genetic trait makes it valuable for breeding salt-tolerant rice varieties.
Carbon Sequestration	Acts as a carbon sink due to anaerobic, waterlogged cultivation conditions.
Biodiversity	Supports fish, crabs, and microflora in the paddy ecosystem.
Sustainability	Traditional model of **ecological balance** between agriculture and aquaculture.

Economic and Social Aspects

- Cultivated mostly by **small and marginal farmers**.
- Labour-intensive but offers **dual income**: from **rice and prawn harvests**.
- **Declining cultivation area** due to:
    - Urbanisation and land conversion.
    - Labour shortage.
    - Younger generations moving away from agriculture.

Research and Conservation

- **Kerala Agricultural University (KAU)** is leading conservation and genetic improvement of Pokkali.
- Research on using Pokkali genes for developing **salt-tolerant rice hybrids**.
- Promoted under:

- **FAO's Globally Important Agricultural Heritage Systems (GIAHS)** nomination.
- **Paramparagat Krishi Vikas Yojana (PKVY)** for organic farming.

Recognition and Initiatives

- **GI Tag (2008)** for "Pokkali Rice."
- **UN FAO recognition** of Pokkali wetlands as potential **agro-ecological heritage sites**.
- Efforts by **Kerala State Biodiversity Board (KSBB)** to revive Pokkali farming through farmer cooperatives and branding.

Conclusion

Pokkali rice represents a **model of ecological harmony**, blending **traditional wisdom** with **climate resilience**.

Its conservation and promotion can contribute to:

- Food security under changing climate conditions,
- Preservation of biodiversity, and
- Revitalization of coastal livelihoods.

Gaganyaan

Syllabus: GS-3: Science and Technology – Space Missions

Context:

ISRO Chairman confirmed that **around 90% of development work** for the mission has been completed.

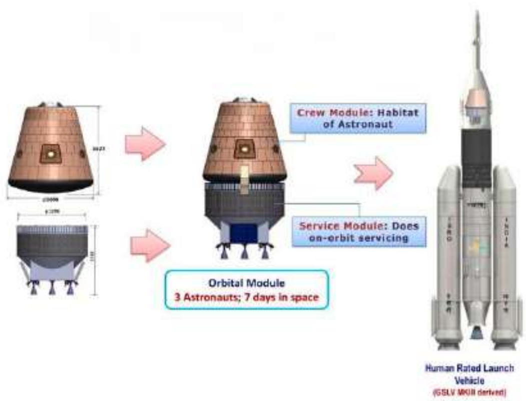
Recent Developments

- **Key progress areas:**
  - Human-rated **Launch Vehicle (HLVM3)** development and testing.
  - **Crew Module (CM)** and **Service Module (SM)** systems nearing completion.
  - **Life-support systems**, **crew escape mechanism**, and **re-entry validation** tests are in advanced stages.
- **Uncrewed test missions** are planned before the crewed launch:

- **First uncrewed mission** to be launched in **December 2025**, carrying the humanoid robot *Vyommitra*.
- **Crewed mission** expected in **early 2027**, following successful tests.

Background

- **Gaganyaan** is India's first **human spaceflight mission**, being developed by the **Indian Space Research Organisation (ISRO)**.
- Objective: To **send Indian astronauts (Gagannauts)** into **Low Earth Orbit (LEO)** (~400 km altitude) and ensure their safe return.
- The mission aims to demonstrate India's capability in **crew safety, life-support systems, and human-rated launch vehicles**.
- It will make India the **fourth nation** to independently conduct human spaceflight missions after the **USA, Russia, and China**.



Technical Components

(a) Launch Vehicle

- Uses the **Human-Rated LVM3 (HLVM3) –** an upgraded version of the GSLV Mk-III.
- Equipped with additional safety features, redundancy, and reliability standards suitable for human spaceflight.

(b) Crew Module (CM)

- Designed to carry **3 astronauts.**
- Features **thermal protection**, **environmental control**, **crew displays**, and **communication systems**.
- Re-entry tested for **aerodynamic stability and safe landing** using parachute-based splashdown.

(c) Service Module (SM)

- Provides **power, propulsion, and support systems** to the Crew Module in orbit.

(d) Crew Escape System

- A **quick-reaction safety mechanism** designed to pull the crew module away from the rocket in case of an emergency during launch.

(e) Life Support and Monitoring Systems

- Ensure **temperature, oxygen, CO_2 levels, and humidity** suitable for human survival.
- Integration and qualification nearly completed.

Testing & Validation

- Series of **abort tests** and **re-entry trials** conducted to validate crew safety.
- **Vyommitra**, the humanoid robot, will simulate human physiological conditions during uncrewed flights.
- Extensive ground testing and astronaut training are ongoing at the **Astronaut Training Facility in Bengaluru**.

Significance of the Mission

- **Strategic Milestone:** Positions India among advanced spacefaring nations.
- **Technological Advancement:** Develops indigenous capability in complex systems like life-support, crew escape, and human-rated vehicles.
- **National Prestige:** Reflects India's growing competence in high-end space technology.
- **Economic & Industrial Boost:** Encourages private sector participation in aerospace and manufacturing.
- **Scientific Benefits:** Enhances R&D in robotics, material science, and space medicine.
- **Future Pathway:** Lays foundation for long-duration missions, lunar projects, and potential **Indian Space Station** in the future.

Challenges Ahead

- **Human safety** is paramount — requires flawless system performance.
- **Stringent reliability standards** needed for life-critical systems.
- **High cost and time-intensive testing** for qualification.
- **Coordination** across multiple agencies and private partners.
- **Maintaining timelines** while ensuring uncompromised safety.

Future Roadmap

- Conduct all **uncrewed missions by 2025-26** to validate systems.
- Launch **first crewed flight in 2027** with three Indian astronauts.
- Possible extension towards:
    - **Long-duration crewed missions.**
    - **Microgravity experiments** in space.
    - Collaboration with international agencies for **joint missions**.

Conclusion

- The Gaganyaan mission marks a **historic leap in India's space journey**, showcasing self-reliance in human space technology.
- With 90% of the developmental work complete, ISRO is in the **final preparation phase** toward achieving a **crewed orbital flight.**
- Successful execution will not only enhance India's space stature but also **open avenues for future space exploration and scientific innovation**.

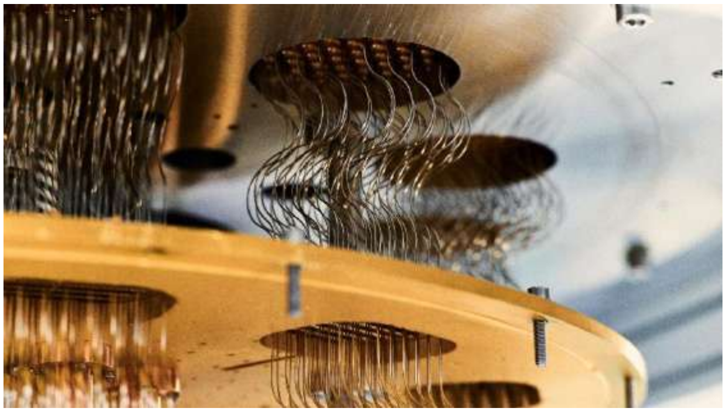
Quantum Echoes Algorithm

Syllabus: GS-3: Science and Technology – Frontier Technology.

Context:

- Google Quantum AI has unveiled a new algorithm called **"Quantum Echoes"**, achieving a performance **13,000 times faster** than the world's most powerful classical supercomputers.
- This marks a significant step towards achieving **practical quantum computing**, where quantum systems outperform classical ones in real, useful tasks.

Background



- Quantum computing harnesses the principles of **superposition** and **entanglement** to perform parallel computation.
- Previous milestones by Google, such as **quantum supremacy (2019)**, demonstrated speed advantages but lacked real-world verification.
- The **Quantum Echoes** experiment is viewed as a move towards *verifiable and useful* quantum advantage.

Key Features of the Quantum Echoes Algorithm

- **Core Concept:**
  - Uses an "echo" method — sending a signal into a quantum system and then reversing it — to measure interference and entanglement.
  - Enables scientists to extract deep insights into quantum system dynamics.
- **Performance:**
  - Executed on Google's **Willow QPU**, a 105-qubit processor.
  - Achieved a **13,000× speed-up** compared to the fastest supercomputers for specific physics simulations.
- **Verification:**
  - Unlike earlier quantum advantage claims, the results are **verifiable**, enhancing scientific credibility.
  - The outcomes can be cross-checked either by other quantum systems or controlled experiments.
- **Scientific Achievement:**
  - Demonstrated the ability to compute **out-of-time-order correlators (OTOCs)**, a complex quantum interference effect nearly impossible to simulate classically.

Significance of the Breakthrough

- **Towards Practical Quantum Advantage:**Moves quantum computing from theoretical demonstrations to solving physically meaningful problems.
- **Massive Computational Efficiency:**Tasks that might take **years or decades** on a supercomputer can be performed in **hours** using Quantum Echoes.
- **Wider Applications:**
    - Drug discovery and molecular modelling
    - Materials science
    - Artificial intelligence and machine learning optimisation
    - Climate modelling and financial simulation
- **Algorithm-Hardware Synergy:**Highlights the importance of developing both advanced qubits and sophisticated algorithms simultaneously.

Challenges and Limitations

- Current systems have **limited qubits** and still face **error correction** challenges.
- The algorithm represents a **proof-of-concept**, not yet suitable for large-scale industrial applications.
- **Verification at scale** remains difficult, and reproducibility needs independent confirmation.
- Sustained progress will require stable qubit architecture, quantum error mitigation, and cost-effective scaling.

Implications for India and Global Context

- **Strategic Significance:**Quantum computing has critical implications for **cybersecurity, defence, and advanced scientific research**.
- **India's Initiatives:**
    - **National Quantum Mission (NQM)** aims to develop 1,000-qubit quantum computers by 2030.
    - Promotion of research through IITs, IISc, and DRDO's quantum technology projects.
- **Global Race:**Major powers like the US, China, and the EU are competing for **quantum leadership**; India must enhance collaboration and investment to stay competitive.

Conclusion

- Google's **Quantum Echoes** algorithm represents a pivotal advancement in quantum computing — verifiable, fast, and closer to real-world utility.

- It demonstrates that **useful quantum advantage** is within reach, not merely a theoretical promise.
- For India, such global developments underline the urgency of strengthening **quantum research ecosystems**, policy frameworks, and international cooperation.