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Space & Astronomy:

1. Celestial Events & Observations:

Perseid Meteor Shower Begins: The highly anticipated Perseid meteor shower, considered one of the best of the year, is now active. It occurs annually from approximately July 17 to August 23, typically peaking in mid-August. Skygazers in the Northern Hemisphere, particularly in the pre-dawn hours and away from light pollution, have the best chance to view it. On July 30, observers might have an even better opportunity as two other meteor showers, alpha Capricornids and Southern delta Aquariids, will also be active.

Vesta Forms a Double Star: On July 19, 2025, Asteroid 4 Vesta (the second-largest body in the main belt) is creating a temporary artificial double star as it appears near a fainter background star. It is visible with binoculars or a telescope in the northwestern corner of Libra.

2. Indian Space Missions (ISRO):

Gaganyaan Mission Progress: Service Module Propulsion System (SMPS) Completed: ISRO has successfully completed the development and qualification testing of the Service Module Propulsion System (SMPS) for the Gaganyaan human spaceflight mission. A full-duration hot test, conducted on July 11, validated the system's performance, including for off-nominal mission abort scenarios. This bi-propellant propulsion system is crucial for orbit circularization, on-orbit control, de-boost maneuvers, and providing abort capability during ascent.

Gaganyatri Shubhanshu Shukla on Axiom-4

Mission: Gaganyatri Shubhanshu Shukla, as part of India's participation in the Axiom-04 space mission, is actively progressing a suite of seven microgravity experiments on the International Space Station (ISS). Four experiments have been successfully completed, and three are nearing completion. The Crew Dragon spacecraft carrying Shubhanshu Shukla successfully undocked from the ISS on July 14, 2025, for its return journey to Earth, with splashdown expected near the coast of California, USA, on July 15, 2025.

Chandrayaan-4 Mission Update: The conceptualization phase for Chandrayaan-4 has been completed, and the design phase is nearing completion. This lunar sample return mission is planned for launch around 2027 and aims to bring back up to 3 kg of lunar regolith from near the Shiv Shakti point (Chandrayaan-3's landing site). The mission is designed to involve docking and undocking maneuvers in lunar orbit and will be launched in two phases onboard two LVM3 rockets. ISRO organized a national meet on April 16, 2025, to discuss the potential aspects of lunar sample science in the context of Chandrayaan-4.

3. International Space Missions & Discoveries:

SpaceX Starship Launch Targets: Elon Musk has indicated that SpaceX is aiming for the tenth Starship test flight around three weeks from July 16, 2025, which would place it in early August. This would be the fourth Starship test flight in 2025.





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NASA's Artemis Program Updates: The July 2025 issue of Tech Briefs highlights significant progress in NASA's Artemis program, which aims to return humans to the Moon and serves as a stepping stone for future Mars missions.

Artemis I Mission: The successful completion of the Artemis I flight test, with Orion's splashdown, was crucial for testing systems.

Gateway Lunar Space Station: Progress on the Gateway, a lunar space station orbiting the Moon, continues as an international collaboration to support long-term lunar exploration and act as a staging point for Mars missions.

Artemis IV Preparations: NASA is prepping key components for the Artemis IV mission, including testing the SLS payload adapter, which connects the spacecraft to the launch vehicle. Artemis IV will focus on the first lunar space station, Gateway.

Next-Generation Spacesuits: Advancements in spacesuit technology, particularly the Axiom Extravehicular Mobility Unit (AxEMU) for Artemis III, are also highlighted for enhanced astronaut mobility and safety.

James Webb Space Telescope (JWST) Discoveries: The JWST continues to deliver groundbreaking observations, celebrating three years of science:

Cat's Paw Nebula (NGC 6334): On July 10, 2025, Webb released a dazzling new image of the Cat's Paw Nebula, a massive star-forming region, revealing intricate details of how massive stars carve cavities in gas and dust.

Lightweight Planet around TWA 7: On June 25, 2025, Webb captured compelling evidence of a Saturn-mass planet orbiting the young star TWA 7. If confirmed, this would be Webb's first direct image discovery of a planet and the lightest ever seen with this technique.

Titan's Methane Showers: On May 14, 2025, Webb data, combined with Keck II telescope data, showed evidence of cloud convection on Saturn's moon Titan's northern hemisphere, suggesting occasional methane and ethane rain.

Jupiter's Aurora: New details of Jupiter's auroras, hundreds of times brighter than Earth's, were captured by Webb on May 12, 2025.

Hidden Supermassive Black Hole in M83: Evidence suggests a hidden supermassive black hole at the heart of spiral galaxy Messier 83 (M83) was uncovered by Webb on April 17, 2025.

Hubble & Webb Collaboration: On July 7, 2025, the James Webb and Hubble space telescopes joined forces to capture a striking new view of two open star clusters (NGC 460 and NGC 456) within the Small Magellanic Cloud, revealing star formation processes.

Massive Black Hole Merger Observed (GW231123): The LIGO-Virgo-KAGRA (LVK) collaboration detected the most massive black hole merger ever observed, named GW231123. This involved two black holes, approximately 100 and 140 times the mass of the Sun, colliding to form a single, larger black hole about 225 times the Sun's mass. This event, detected during the fourth observing run of the LVK network on November 23, 2023, suggests that some supermassive black holes may form





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through mergers of smaller black holes. The waves from this event reached Earth in 2025.

Europa Clipper Mission Update: The Europa Clipper spacecraft, launched on October 14, 2024, performed a gravity assist from Mars on March 1, 2025. It is set to use another gravity assist from Earth on December 3, 2026, before arriving at Europa in April 2030. NASA is also looking to Earth's deep-sea microbes as an analogue for potential alien life beneath Europa's icy shell.

MCQS

1. The Perseid meteor shower is currently active. During which period does it typically occur annually?

- A) June 1 - July 15
- B) July 17 - August 23
- C) August 1 - September 10
- D) September 15 - October 30

Answer: B) July 17 - August 23

The summary states, "It occurs annually from approximately July 17 to August 23..."

2. On July 19, 2025, which celestial body is creating a temporary artificial double star as it appears near a fainter background star?

- A) Jupiter
- B) Asteroid 4 Vesta
- C) Mars
- D) The Moon

Answer: B) Asteroid 4 Vesta

The summary specifies, "On July 19, 2025, Asteroid 4 Vesta (the second-largest body in the main belt) is creating a temporary artificial double star..."

3. ISRO recently completed the development and qualification testing of the Service Module Propulsion System (SMPS) for which human spaceflight mission?

- A) Aditya-L1
- B) Chandrayaan-3
- C) Gaganyaan
- D) Mangalyaan 2

Answer: C) Gaganyaan

The summary mentions, "ISRO has successfully completed the development and qualification testing of the Service Module Propulsion System (SMPS) for the Gaganyaan human spaceflight mission."

4. Gaganyatri Shubhanshu Shukla, participating in the Axiom-04 space mission, successfully undocked from the International Space Station (ISS) on which date for his return journey to Earth?

- A) July 11, 2025
- B) July 14, 2025
- C) July 15, 2025
- D) July 19, 2025

Answer: B) July 14, 2025

The summary states, "The Crew Dragon spacecraft carrying Shubhanshu Shukla successfully undocked from the ISS on July 14, 2025, for its return journey to Earth..."

5. Chandrayaan-4, a lunar sample return mission, is planned for launch around which year?

- A) 2026
- B) 2027
- C) 2028
- D) 2030

Answer: B) 2027

The summary notes, "This lunar sample return mission is planned for launch around 2027..."





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6. Elon Musk indicated that SpaceX is aiming for the tenth Starship test flight approximately three weeks from July 16, 2025. This would be the ____ Starship test flight in 2025.

- A) second
- B) third
- C) fourth
- D) fifth

Answer: C) fourth

The summary states, "This would be the fourth Starship test flight in 2025."

7. The Artemis IV mission, part of NASA's Artemis program, will focus on delivering the first modules for which lunar space station?

- A) Lunar Outpost
- B) Gateway
- C) Moonbase Alpha
- D) Lunar Orbital Platform

Answer: B) Gateway

The summary highlights, "Artemis IV will focus on the first lunar space station, Gateway."

8. On July 10, 2025, the James Webb Space Telescope (JWST) released a dazzling new image of which massive star-forming region?

- A) Orion Nebula
- B) Eagle Nebula
- C) Cat's Paw Nebula
- D) Carina Nebula

Answer: C) Cat's Paw Nebula

The summary states, "On July 10, 2025, Webb released a dazzling new image of the Cat's Paw Nebula, a massive star-forming region..."

9. On June 25, 2025, JWST captured compelling evidence of a Saturn-mass planet orbiting which young star?

- A) Proxima Centauri

- B) TRAPPIST-1
- C) TWA 7
- D) Kepler-186

Answer: C) TWA 7

The summary states, "On June 25, 2025, Webb captured compelling evidence of a Saturn-mass planet orbiting the young star TWA 7."

10. On July 7, 2025, the James Webb and Hubble space telescopes collaborated to capture a striking new view of two open star clusters within which galaxy?

- A) Andromeda Galaxy
- B) Triangulum Galaxy
- C) Small Magellanic Cloud
- D) Large Magellanic Cloud

Answer: C) Small Magellanic Cloud

The summary mentions, "...the James Webb and Hubble space telescopes joined forces to capture a striking new view of two open star clusters (NGC 460 and NGC 456) within the Small Magellanic Cloud..."

11. The LIGO-Virgo-KAGRA (LVK) collaboration detected the most massive black hole merger ever observed, named GW231123. The resulting single, larger black hole was about how many times the Sun's mass?

- A) 100
- B) 140
- C) 225
- D) 345

Answer: C) 225

The summary states, "...colliding to form a single, larger black hole about 225 times the Sun's mass."

12. The Europa Clipper spacecraft performed a gravity assist from Mars on which date in 2025?

- A) January 1, 2025





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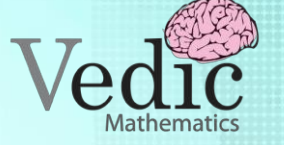
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- B) March 1, 2025
- C) May 1, 2025
- D) July 1, 2025

Answer: B) March 1, 2025

The summary states, "...performed a gravity assist from Mars on March 1, 2025."

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