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KEY FACTS ABOUT THE INTERNATIONAL ASTRONOMICAL UNION (IAU)

A 3.5-billion-year-old Martian crater has been named after pioneering Indian geologist M.S. Krishnan, following the International Astronomical Union's (IAU's) approval of this and several other Kerala-proposed names for Martian landforms.

- It was **founded in 1919** as a senior body **governing international professional astronomical activities worldwide.**
- Its mission is to promote and **safeguard the science of astronomy** in all its aspects, including **research, communication, education, and development,** through international cooperation.
- Activities:
    - **Definition of fundamental astronomical and dynamical constants** and **unambiguous astronomical nomenclature**
    - Rapid dissemination of new discoveries
    - Organization of **international observing campaigns**
    - Promotion of educational activities in astronomy to early informal discussions of possible future international large-scale facilities.
- It is the **only organization recognized** professionally **for the naming of astronomical bodies,** which it **does solely on the basis of merit, history, or discoverer's privilege.**
- The IAU **holds** a **General Assembly every three years** in varying parts of the world. The long-term policy of the IAU is defined by the General Assembly.
- **Headquarters: Paris, France.**
- **Membership:**
    - Its **individual Members** — structured into Divisions, Commissions, and Working Groups — are **professional astronomers** from all over the world, **at the Ph.D. level and beyond**, who are active in professional research, education and outreach in astronomy.

YOUNG STELLAR OBJECTS

- These are stars in **the earliest stages** of their lives where stars stably fuse hydrogen in their cores.
  - This is the stage before the **stars enter the main sequence** of what is called the **Hertzsprung-Russell diagram** (a plot showing stars in **various stages of evolution** based on their temperature and brightness).
- These objects typically reside within **dense molecular clouds rich in gas** and interstellar material.
- **Formation:** YSOs form from the **collapse of dense molecular clouds**, triggered by events like nearby **supernova explosions**, **stellar radiation**, or turbulence in the interstellar medium.
- **Types:** There are **two principal kinds of YSOs**: Protostars and Pre-main sequence stars.

Stages of Young Stellar Objects:

- **Class 0 and Class I phases**: These are mostly visible in **infrared and radio wavelengths** due to their thick dust envelopes.
- **Class II and Class III**: In this phase object **becomes visible in optical wavelengths** as it clears away its surrounding envelope.

Significance of studying Observing YSOs :

- **Understanding Star Formation:** They provide Insights into the processes that **lead to star formation**, including magnetic activity, stellar winds, and outflows.
- **Planet Formation:** They help in understanding the conditions that lead **to planet formation and the early solar system.**

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CENTRE SET TO TABLE NEW HIGHER EDUCATION REFORMS BILL

- The Higher Education Commission of India (HECI) Bill draws directly from NEP 2020, which recommended replacing the fragmented regulatory structure with a single overarching authority.
- Currently, India's higher education landscape is regulated by multiple statutory bodies:
    - the University Grants Commission (UGC) oversees higher education,
    - the All India Council for Technical Education (AICTE) regulates technical and professional education, and
    - the National Council for Teacher Education (NCTE) governs teacher education.
- **Four Verticals Under HECI**
    - NEP 2020 outlines four specialised bodies within HECI:
        - **National Higher Education Regulatory Council (NHERC):** Regulates all higher education except medical and legal fields.
        - **National Accreditation Council (NAC):** Serves as the accrediting authority.
        - **General Education Council (GEC):** Frames academic learning outcomes and standards.
        - **Higher Education Grants Council (HEGC):** Handles funding and grants (though officials indicate funding may still rest with the government).
    - HECI itself will function as a compact body of eminent experts overseeing the four verticals.
- **Reducing Red Tape and Conflict of Interest**
    - NEP 2020 criticised the existing system for being "mechanistic and disempowering", with concentrated powers, regulatory overlap, and conflicts of interest.
    - The new commission aims to streamline governance, ensure accountability, and eliminate bureaucratic hurdles.

- **Autonomy and Quality Focus**
  - The Bill seeks to empower higher education institutions to operate as "independent self-governing institutions" while ensuring excellence through a transparent accreditation system and enhanced institutional autonomy.

Opposition to HECI: Concerns Over Centralisation and Autonomy

- **Fears of Excessive Centralisation**
  - Critics argue that the HECI framework concentrates too much authority with the Union government.
  - The 2018 Bill shifted UGC's financial powers to the MHRD, raising concerns that universities could lose autonomy and become dependent on central directives.
- **Lack of Diverse Representation**
  - Opposition leaders objected to the commission's composition.
  - They noted the absence of representation from disadvantaged groups — women, Dalits, Adivasis, OBCs, minorities, and persons with disabilities — while industry stakeholders were prominently included.
- **Apprehensions From States**
  - The then CM of Tamil Nadu warned that centralised funding could lead to biased resource allocation.
  - He feared that replacing UGC grants with ministry-controlled funding might shift to a 60:40 Centre-state share, reducing states' financial autonomy.
- **Parliamentary Panel's Warning**
  - A parliamentary standing committee flagged "excess centralisation" concerns.
  - The panel noted that while multiple regulators create inconsistency, the proposed HECI model risks trapping state universities between national and state rules, with insufficient state representation in decision-making.

Overall Concern Across political and academic circles, the prevailing worry is that HECI could weaken federalism, dilute institutional autonomy, and marginalise key stakeholders in higher education governance.

DELHI'S POLLUTION TRACKERS: FUNCTIONING, FLAWS, AND FAILURES

- Delhi's air-quality monitors use specialised, CPCB-approved techniques to measure each pollutant.
- Particulate matter (PM2.5 and PM10) is tracked using Beta Attenuation Monitors, which gauge how dust collected on filter tape reduces beta-ray transmission.
- Gaseous pollutants are measured through optical and chemical methods:
  - sulphur dioxide via UV fluorescence,
  - ozone by UV photometry, and
  - carbon monoxide with Non-dispersive infrared (NDIR) absorption.
    - NDIR absorption is a gas sensing technology that measures the concentration of a specific gas by analyzing how much infrared light it absorbs.
  - Nitrogen oxides are detected through **chemiluminescence**, while ammonia is measured using optical spectroscopy.
    - Chemiluminescence is the emission of light as a result of a chemical reaction.
    - Optical spectroscopy is a scientific technique that studies the interaction of light with matter to determine a sample's physical and chemical properties.
  - These instrument-based techniques comply with the **National Ambient Air Quality Standards** to ensure uniform, reliable data nationwide.

Factors That Distort Air-Quality Readings

- AQI accuracy depends on equipment reliability and the volume of validated data recorded daily.
- Stations often miss CPCB's 16-hour data requirement due to shutdowns caused by calibration, power cuts, extreme weather or transmission failures.
- A recent **CAG report** found many Delhi stations failed to log complete data or measure key pollutants like lead, weakening daily AQI assessments.

- **Technical issues** also distort readings: high humidity inflates particulate measurements, instruments drift without frequent calibration, and poor station siting near buildings or vents skews airflow.
- Together, these operational and environmental challenges reduce the precision of Delhi's air-quality readings.

What Research Reveals About PM Measurement Errors?

- Multiple studies show that Delhi's particulate readings — especially from Beta Attenuation Monitors (BAM) — can significantly overestimate pollution under certain weather and loading conditions.
- A 2021 CSIR–NPL and AcSIR study found that beta gauge accuracy declines sharply when relative humidity (RH) exceeds 60%, causing particles to absorb moisture and appear heavier.
- The study reported more than 30% overestimation, with bias rising up to fivefold during high-pollution events when particle mass loading is high.
- Seasonal effects worsen errors, particularly in winter and post-monsoon months.
- Researchers advised using site-specific correction factors, which lowered biases from 46% to below 2%.
- The U.S. EPA similarly warns that heavy particle accumulation can disrupt airflow and destabilise readings.
- These issues help explain why Delhi's stations experienced data dropouts on Diwali night, when sudden pollution spikes overloaded the instruments.
- **Need to Upgrade and Reposition Stations**
  - CAG recommendations include:
    - Relocating stations obstructed by buildings, trees or improper siting.
    - Upgrading or replacing equipment unable to measure all mandated pollutants.
    - Ensuring daily data availability for all pollutants to provide a complete air-quality picture.

REVERSING INDIA'S BRAIN DRAIN - A STRATEGIC PUSH TO REPATRIATE STAR FACULTY

- The Government of India is considering **a new scheme** to attract "star faculty" and researchers of Indian origin back to the country.
- This comes at a time when the **US academic environment** is witnessing rising political interference, prompting globally mobile scholars to explore more stable and autonomous research ecosystems.
- The initiative aims to strengthen India's R&D ecosystem, boost STEM capacity, and enhance India's position as a **global knowledge economy**.

Key Features of the Proposed Scheme:

- **Set-up grant:** Substantial financial assistance for star faculty to build labs, teams, and research ecosystems in premier institutions. Supports operational autonomy and smoother onboarding.
- **Creating a seamless experience:** Returning academics require far more than monetary incentives—intellectual freedom, cultural alignment, and ease of doing research are crucial.

Challenges:

- **Salary and compensation gaps:**
  - Indian full professors earn approximately $40,000/year, significantly lower than the US ($130,000–$200,000/year) and China (~$100,000/year).
  - India, unlikely to match global salary benchmarks, must compensate with intellectual, cultural and research ecosystem returns.
- **Administrative and structural barriers:**
  - Bureaucratic hurdles in logistics, procurement, funding flows, recruitment.
  - Previous programmes (e.g., **VAJRA Faculty Programme**) suffered from procedural delays, funding uncertainty, and fragmented short-term engagement mechanisms.

- **Lack of institutional preparedness:**
    - Many public institutions lack experience in onboarding international faculty.
    - Persistent hierarchical structures, limited interdisciplinary collaboration, and inadequate academic freedom.
- **Personal and social ecosystem gaps:** Challenges in spousal employment, housing, schooling for children, and lack of well-defined tenure-track pathways.
- **Competition from other countries:** India must undertake deeper reforms to stay competitive with -
    - **Europe** - Strengthening academic freedom
    - **China** - Aggressive recruitment and high funding
    - **Taiwan** - Rapid internationalisation of universities

Institutional Reforms Needed:

- **Administrative autonomy and red carpet mandate:** Ensure seamless procurement, funding flows, hiring processes, lab setup. Use expanded autonomy for non-government procurement.
- **Clear tenure-track and career security:** Move beyond fragmented fellowship-type programs. Establish explicit tenure-track conversion pathways.
- **Strong protection of academic freedom**: High-level government assurance of autonomy, non-interference, freedom from excessive monitoring, essential to attract global researchers.
- **Intellectual Property (IP) clarity**: Standardised and clear IP ownership policies, especially for scientific research.
- **Building a supportive social ecosystem:** Institutional support for spousal employment, housing facilities, quality schooling.
- **Cultural transformation:** Shift from rigid hierarchies to interdisciplinary collaboration; merit-based advancement; open, critical inquiry; and integration of international pedagogic practices.

SCHEME TO PROMOTE MANUFACTURING OF SINTERED RARE EARTH PERMANENT MAGNETS

- It aims to **establish 6,000 Metric Tons per Annum** (MTPA) of integrated Rare Earth Permanent Magnet (REPM) **manufacturing in India.**
- It will support the creation of **integrated REPM manufacturing facilities**, involving conversion of rare earth oxides to metals, metals to alloys, and alloys to finished REPMs.
- **Features of Scheme to Promote Manufacturing of Sintered Rare Earth Permanent Magnets:**
  - **Duration**: **7 years** (2 years for setting up an integrated REPM manufacturing facility + 5 years incentive disbursement on the sale of REPM.)
  - With this initiative, India will establish its **first ever integrated REPM** manufacturing facilities in India.

What are Rare Earth Magnets?

- These are a type of **permanent magnet** made from **alloys of rare earth elements.**
- **Properties:** Exceptional magnetic strength, **high energy density**, and superior performance compared to other types of magnets.
- **Types: Neodymium** (Nd-Fe-B) and **Samarium Cobalt** (SmCo) are the two most common types of rare earth magnet materials. Both types are extremely strong.
- Neo magnets are composed primarily of **neodymium, boron and iron,** and samarium cobalt is composed of **samarium and cobalt.**
- **Applications:** These are used in electric vehicles, **renewable energy, electronics, aerospace**, and **defence applications.**