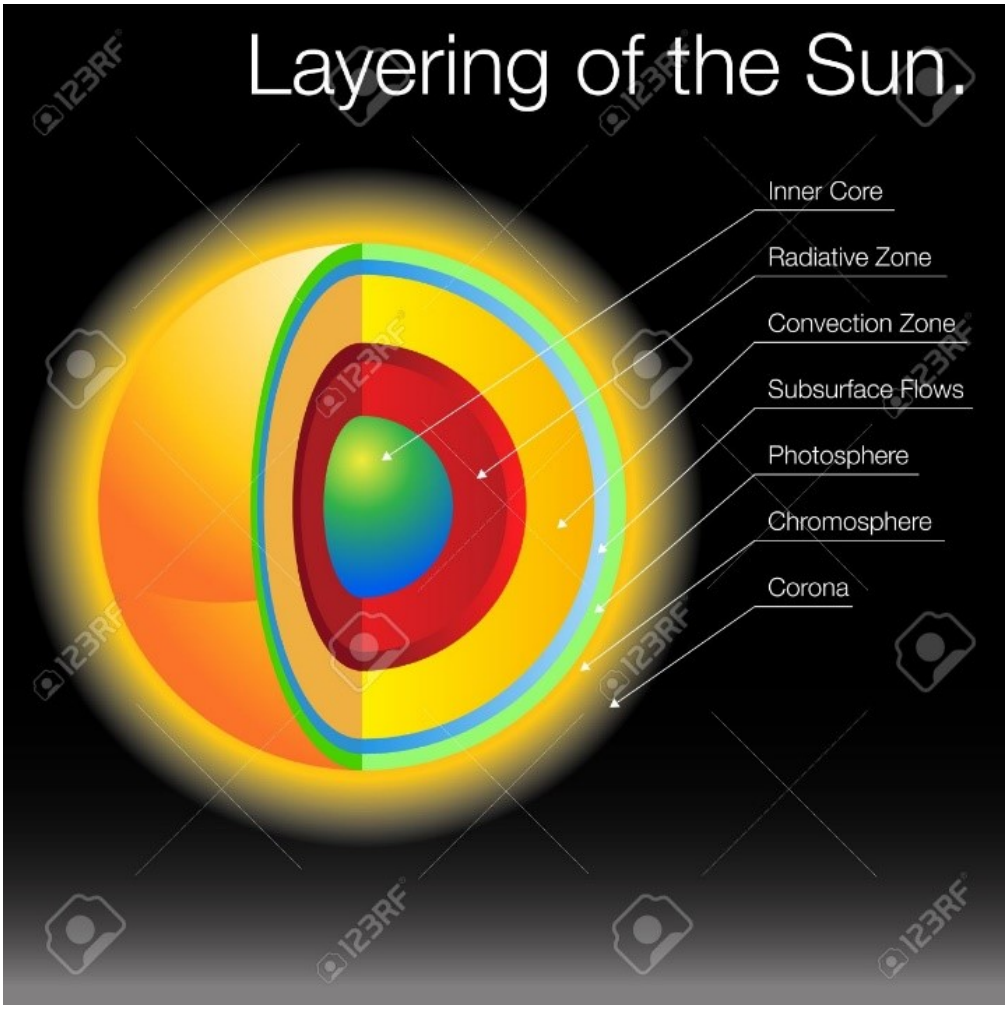
UPSC Daily Current Affairs | Prelim Bits 27-09-2024

Sun’s chromosphere

Astronomers from the Indian Institute of Astrophysics (IIA), have mapped the variation in the rotation speed of the Sun’s chromosphere using 100 years of daily records at the Kodaikanal Solar Observatory.

- The sun's atmosphere is made up of several layers, mainly the photosphere, the chromosphere and the corona.

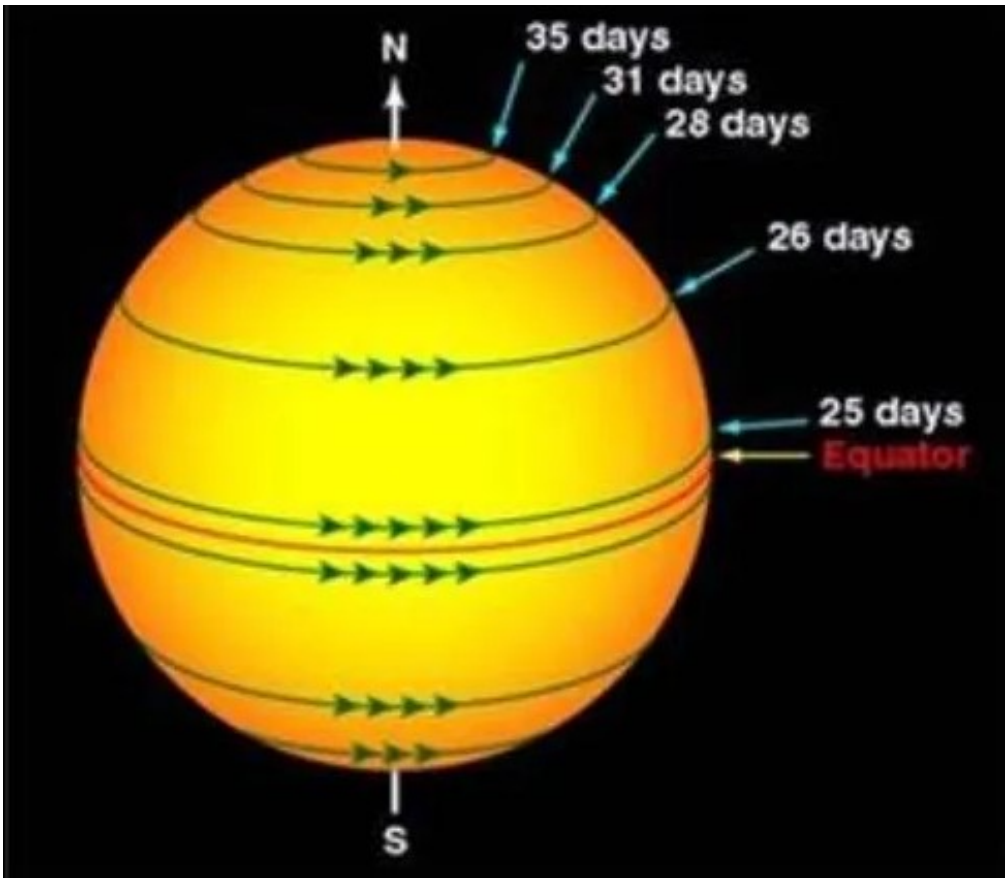


- **Photosphere -** The term photosphere means "sphere of light", the layer where most of the sun's energy is emitted.
- **Chromosphere -** The layer above the photosphere is the chromosphere.
- The first part of the word, ''chromo'' means color. Thus, the word chromosphere means sphere of color.
- It contains both hydrogen and calcium. The chromosphere has several important features, such as spicules, filaments, and other anomalies.

- The chromosphere emits a reddish glow as ***super-heated hydrogen*** burns off. But the red rim can only be seen during a total solar eclipse.
- At other times, light from the chromosphere is usually too weak to be seen against the brighter photosphere.
- **Temperature**
    - Minimum – around 6700 degrees Farenheit or 3700 degree Celsius.
    - Maximum – 14,000 degrees Farenheit or 7760 degree Celsius.
- The chromosphere play a role in conducting heat from the interior of the sun to its outermost layer, the corona.
- **Corona -** The 3rd layer of the sun's atmosphere is the corona. Like the chromosphere, the sun's corona can only be seen during a total solar eclipse (or with NASA's Solar Dynamics Observatory).
- Sun is a ball of gas with no solid form, different regions rotate at different rates.
- The sun's equatorial regions rotate in about 24 days, while the polar regions take more than 30 days to make a complete rotation.

Recent Findings

- Findings revealed a picture of the Sun’s differential rotation faster at the equator (13.98 degrees per day) and slower towards the poles (10.5 degrees per day at 80 degrees latitude).



References

1. Greater Kashmir | Differential rotation of Sun’s chromosphere
2. Space | Sun Atmosphere

CO_2-to-methanol plant

India's first CO2-to-methanol pilot plant with a capacity of 1.4 tons per day (TPD) to come up at Thermax Limited in Pune, Maharashtra.

- The plant marks a pioneering effort in carbon reduction and conversion technology.
- **Implemented by -** The public-Private Partnership (PPP) model between the Indian Institute of Technology (IIT), Delhi, and Thermax Limited.
- **Fund** – Estimated cost of Rs. 31 crore.
- **Supported by –** Department of Science and Technology under the Ministry of Science and Technology.
- **Features -** The project will act as a living lab for CCU research, focusing on developing new catalysts and processes for converting captured CO2 into chemicals.
- This includes both pre-combustion and post-combustion carbon capture techniques, which aim to reduce CO2 emissions significantly.
- This project aligns with India's commitment to the Panchamrit target, COP 26, which focuses on reducing carbon emissions and achieving sustainable development goals.

CO_2-to-methanol

- The carbon capture and utilization (CCU) process of converting carbon dioxide (CO2) to methanol involves capturing carbon emissions before they enter the atmosphere.
- **Carbon capture -** CO2 is captured from sources like power plants or directly from the air using direct air capture (DAC) technologies.
- **Hydrogenation -** The captured CO2 is then reacted with hydrogen to produce methanol.
- **Methanol use -** Methanol can be used as a fuel or as a base material to produce other chemicals.
- The CO2-to-methanol process can help reduce greenhouse gas emissions and create a sustainable fuel source.
- It can also help reduce the demand for fossil-based methanol production, which contributes to global CO2 emissions.
- However, the overall process can be net CO2 positive if the CO2 comes from non-renewable fossil fuels.
- To make the process more sustainable, it's important to use renewable energy sources, especially for hydrogen production.

Reference

The Hindu Business Line | India's first CO2-to-methanol pilot plant

PARAM Rudra Supercomputers

PM Modi launched 3 Param Rudra supercomputers and an HPC system for weather research recently.

- The supercomputers have been indigenously built under the ***National Supercomputing Mission.***
- **Developed by** - Centre for Development of Advanced Computing, C-DAC in Pune.
- **Deployed to -** It have been deployed in Pune, Delhi and Kolkata to facilitate pioneering scientific research.
- In Pune, the Giant Metre Radio Telescope (GMRT) will leverage the supercomputer to explore Fast Radio Bursts (FRBs) and other astronomical phenomena.
- In Delhi, the Inter-University Accelerator Centre (IUAC) will enhance research in fields such as material science and atomic physics.
- In Kolkata, S N Bose Centre will use supercomputing technology to drive advanced research in areas such as physics, cosmology, and earth sciences.

National Supercomputing Mission

- **Aim –**To enhance the capabilities of Indian academic and R&D institutions by setting up a network of over 70 high-performance computing (HPC) facilities across the country.
- To boost India's supercomputing infrastructure amid increasing demand in sectors such as academia, researchers, MSMEs, and startups.
- It is a ***first of its kind attempt*** to boost the country's computing power.
- **Launched in –** 2015.
- **Developed by -** It is a collaboration between the Ministry of Electronics and Information Technology (MeitY) and the Department of Science and Technology (DST).
- **Implemented by -** The Centre for Development of Advanced Computing (C-DAC), Pune and the Indian Institute of Science (IISc), Bengaluru.
- **Network -** These supercomputers will also be networked on the National Supercomputing grid over the ***National Knowledge Network (NKN).***
    - The NKN is another programme of the government which connects academic institutions and R&D labs over a high speed network.
- Academic and R&D institutions as well as key user departments/ministries would participate by using these facilities and develop applications of national relevance.
- Under the mission, the first indigenously assembled supercomputer, named PARAM Shivay, was installed at IIT (BHU) in 2019.

References

1. The Print | PM Modi dedicates three PARAM Rudra supercomputers
2. Hindustan Times | PM launches 3 PARAM Rudra supercomputers

Minerals Security Finance Network (MSFN)

India is now formally a part of the Minerals Security Finance Network

- **Aim -** It is a US-led initiative aiming to strengthen cooperation among Indo-Pacific region and Europe ***to secure supply chains for critical minerals.***
- It is a new initiative that stems from the Minerals Security Partnership (MSP), a

framework established by the US in 2022.
    - India was inducted to the MSP in June 2023.
- **Key Functions -Coordination and Collaboration** -The network encourages cooperation among members to align policies, share best practices, and streamline efforts to secure critical mineral supply chains.
- **Investment Facilitation** - The MSFN aims to mobilize private sector investment in mineral projects that are deemed critical for energy transition technologies and national security.
- **Technical Assistance** - It provides technical support to help member countries develop their mineral resources responsibly and sustainably, focusing on environmental and social governance (ESG) standards.
- **Market Development** - The network works to identify and promote market opportunities for critical minerals and improve infrastructure for mining and processing.
- **Geological and Economic Assessments** - It includes initiatives for shared research and assessment of mineral resources to better understand the availability and potential of critical minerals globally.
- **Policy Advocacy** - It advocates for policies that can enhance mineral security, such as trade policies and regulatory frameworks that support sustainable mineral extraction and processing.
- **Members -** As of now, the Minerals Security Finance Network (MSFN) has 15 member countries, which include:
    - United States, Australia, Canada, ***India,*** Japan, European Union, Finland, France, Germany, Italy, Netherlands, Norway, Sweden, United Kingdom, South Korea.
- **India—**India's participation in this initiative aims to diversify and secure its supply of critical minerals from nations like Argentina, Chile, Australia, and select African countries.

Reference

Business Standard | India joins US-led security finance network

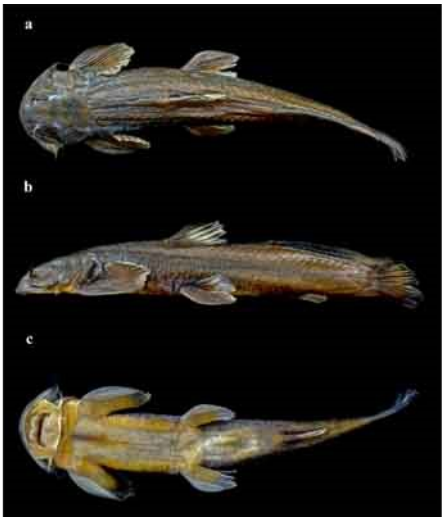
Exostoma sentiyonoae

A new species of catfish was recently discovered in the Dzuleke River, a tributary of the Barak River in Nagaland.

- It is a new species of ***glyptosternine catfish*** in Genus Exostoma.
- **Genus -** Exostoma is a genus of ***sisorid catfishes native to Asia.***
    - Exostoma sentiyonode is the first known member of this genus discovered from the Dzuleke River in Nagaland.
- **Endemic to -** Exostoma sentiyonoae is a species of catfish endemic to the Mekong River basin, particularly found in Thailand.
- **Nomenclature—**Dr Limatemjen, who discovered the species, named it in honor of his daughter, combining "Senti" from the Ao Naga language with "Yono" from the Angami

Naga language.

- This species is notable for its distinct characteristics that contribute to its identification and classification within the family of catfishes.
- This marks ***the 4th species*** of Exostoma described from the Barak drainage.
- **Unique characteristics**
    - Adipose fin attached to the upper procurrent caudal-fin rays,
    - Tubercles on the dorsal-fin spine,
    - A slender head,
    - A long distance between the dorsal and adipose fins,
    - Small eyes, and 41 vertebrae.
- **Distinction from other species -** *E. sentiyonoae* differs from *E. berdmorei* in having a shorter dorsal-fin base, a longer dorsal-adipose distance, and a smaller eye.
- Compared to *E. gaoligongense*, the new species has a shorter pectoral-pelvic distance and a smaller eye.
- *E. sentiyonoae* can be differentiated from 2 species found in the Chao Phraya drainage in Thailand.
    - It is distinct from E. effreni due to its adipose fin being confluent with the upper procurrent caudal-fin rays (versus separate in E. effreni), a wider head, and deeper caudal peduncle.
    - It also differs from E. peregrinator in having a longer dorsal-adipose distance and a shorter anal-fin base.



Reference

Mokokchungtimes | New species of catfish discovered in Nagaland