Prelim Bits 06-09-2023 | UPSC Daily Current Affairs

SCRIT System

Physicists have found a way to 'see' inside short-lived nuclei.

Seeing the atom nuclei

- Three scientists named Ernest Rutherford, Hans Geiger, and Ernest Marsden exposed a thin gold foil to radiation.
- Based on how the rays were deflected by atoms in the foil, they figured out that every atom has a dense center where its mass and positive charge are concentrated.
- Seventy years ago, Robert Hofstadter led a team that bombarded electrons at thin foils.
- The higher energy of the electrons allowed them to 'probe' the nucleus.
- In each case, physicists were able to 'see' inside stable atoms, and then inside their nuclei, by using other particles.
- Now, researchers in the RIKEN Nishina Center for Accelerator-Based Science, in Japan, have taken a big leap forward in this tradition.
- The previous experiments used thin foils that were easy to hold.
- The new one is more sophisticated, using an apparatus to hold the nuclei of caesium-137 atoms as well as make sure electrons could interact with them, using a system called SCRIT.

The SCRIT advantage

- The researchers accelerated electrons in a particle accelerator to energize them, and then smashed them into a block of uranium carbide.
- This produced a stream of caesium-137 ions (atoms stripped of electrons).
- This isotope of caesium has a half-life of around 30 years.
- The ions were then transported to the SCRIT system, which is short for 'Self-Confining Radioactive-isotope Ion Target'.
- This method enables us to trap the target ions in three dimensions along the electron beam using the electric attractive force between the ions and the electrons.

References

1. The Hindu – SCRIT System
2. Science Direct – The SCRIT electron scattering facility

ISI Mark

The Bureau of Indian Standards (BIS) has made certification mandatory for reusable water bottles and utensils made of various to curb sales of substandard products.

- Retailers will be sensitised to clear stock within the stipulated time as manufacturing, storing and sale of non-BIS certified products will be considered as a violation of the BIS Act.
- Licences would be granted after testing product samples through BIS recognised labs.

Indian Standards Institute (ISI) & Bureau of Indian Standards (BIS)

- ISI is now known as BIS (Bureau of Indian Standards).
- It sets the standard of quality for consumer goods and industrial goods.
- It verifies each product's quality and standard and gives them a certification mark.
- By 1986 legislation, BIS is permitted to provide certification.
- The ISI label is mandatory for the sale of certain products in India.
- Any manufacturing company that meets the BIS criteria for its product or service can qualify for ISI certification.
- BIS is the National Standard Body of India established under the BIS Act 2016.
- BIS aims for the harmonious development of the activities of standardization, marking and quality certification of goods and for matters connected therewith or incidental thereto.
- BIS has been providing traceability and tangibility benefits to the national economy in a number of ways, providing safe reliable quality goods; through standardization, certification and testing.

References

1. The Hindu – Water bottles, cookware to have mandatory ISI mark
2. BIS – Bureau of Indian Standards (BIS)

One-Hour Trade Settlement System

Securities and Exchange Board of India (SEBI) is planning to implement one-hour settlement of trades system.

- The current cycle of T+1 means trade-related settlements happen within 24 hours of the actual transactions.
- SEBI now says it will bring in one-hour settlement of trades.

Trade Settlement

- Settlement is a two-way process which involves the transfer of funds and securities on the settlement date.
- A trade settlement is said to be complete once purchased securities of a listed company are delivered to the buyer and the seller gets the money.
- The current cycle of T+1 means trade-related settlements happen within a day, or 24 hours of the actual transactions.
- The migration to the T+1 cycle came into effect in January this year.
- India became the second country in the world to start the T+1 settlement cycle in top-listed securities after China.

One-hour trade settlement system

- Under the current T+1 settlement cycle, if an investor sells securities, the money gets credited into the person's account the next day.
- In one-hour settlement, if an investor sells a share, the money will be credited to their account in an hour, and the buyer will get the shares in their demat account within an hour.

References

1. The Indian Express – One-hour trade settlement system
2. The Economic Times – SEBI to introduce one-hour trade settlements

Quantum Random Number Generator (QRNG)

A new type of random number generator being developed in Linköping University, Sweden, promises to make digital information exchange safer, cheaper and more environment-friendly.

- The system which is under development is expected to be in use to boost cybersecurity in five years.
- Encryption is done by generating random numbers through a computer programme or hardware, the latter considered safer due to physical processes involved.
- At the receiving end, the data can be unlocked using keys provided by the random number generator and known only to the receiver.
- In hardware random number generation, the best randomness, according to the researchers, is provided by the QRNGs.
- Existing QRNGs are using traditional lasers which are expensive and higher energy-consuming.
- The Linköping University researchers are developing the new system using light emitting diodes made from the crystal-like material perovskite, a naturally occurring mineral of calcium titanate.

QRNG

- They are a special case of True Random Number Generators (TRNG) that generate randomness by measuring quantum processes, which are, by nature non-deterministic.
- The advantages are multiple, including:
    1. A fundamental advantage in using quantum indeterminacy.
    2. Typically faster performances by leveraging photonics.
    3. The ability to understand and verify the origin of unpredictability.
- These are the core assurance for the entire cybersecurity chain.

True random number generators (TRNGs)

- TRNGs are based on measuring a specific (random) physical process to produce random digits.
- Thus, the randomness of such numbers comes from the underlying physical process, which may indeed be completely unpredictable.
- TRNGs are the baseline for security applications.
- TRNGs are hardware components and sophisticated engineering is required to build

them properly.

References

1. The New Indian Express – Making a cyber secure fortress
2. ANI – New technology for new type of quantum communication

Erg Chech 002

In May 2020, some unusual rocks containing distinctive greenish crystals were found in the Erg Chech sand sea.

- **Erg Chech** - It is a sandy region of the *Sahara* in *western Algeria and northern Mali*.
- It consists largely of shifting dunes.



- **Erg Chech 002** - On close inspection of the rocks containing distinctive greenish crystals, it turned out to be from outer space, left over from the dawn of the Solar System.
- They were all pieces of a meteorite known as Erg Chech 002, which is the *oldest volcanic rock* ever found.
- Erg Chech 002 is an "*ungrouped achondrite*" (its parent body and family relationship is unknown.)
- Achondrites are rocks formed from melted planetesimals, which is what we call solid lumps in the cloud of gas and debris that formed the Solar System. **Ex** – *Angrites, Erg Chech 002.*
- Erg Chech 002 contains abundant lead-206 and lead-207, as well as undecayed uranium-238 and uranium-235.
- **Findings** - By analyzing it, it was found that it is some *4.56556 billion years old* (around 120,000 years).
- It was also found that the *Aluminium-26* was distributed quite unevenly throughout the cloud of dust and gas which formed the solar system.

Aluminium-26 decays relatively quickly (after around 705,000 years). It is useful

for determining the relative ages of different objects, but not their absolute age in years.

References

1. The Hindu | Sahara space rock and the early Solar System
2. World Atlas | Algeria Map

