

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](#)

