

## Nuclear Fusion Technology - Pranos Fusion

**Prelims:** *Current events of national and international importance| Science and Technology*

### Why in News?

Recently the Bengaluru-based startup Pranos Fusion is developing India's first privately built tokamak, with the blueprint expected to be finalised by 2027.

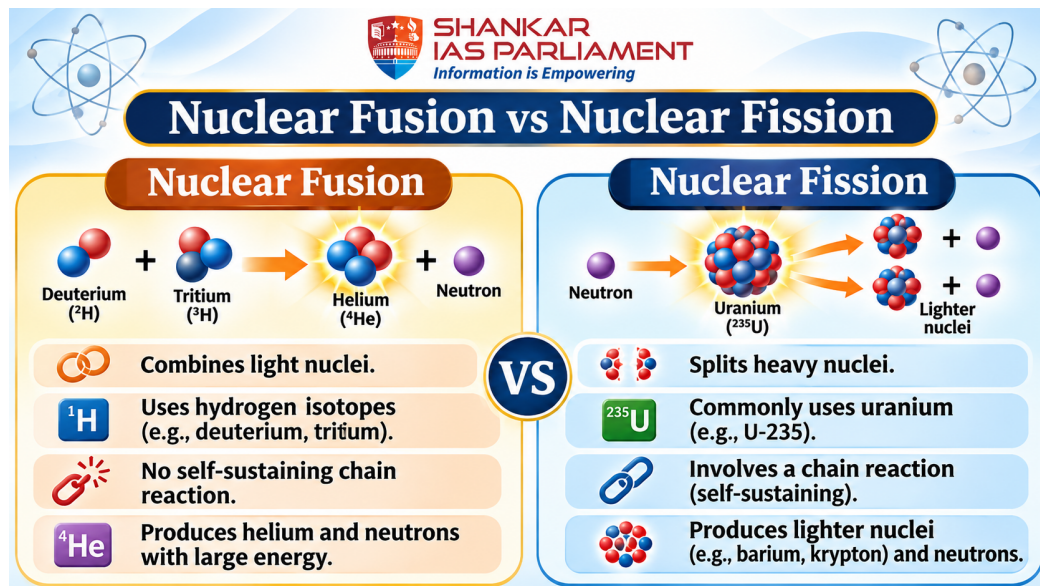
- **Aim** – To advance indigenous nuclear fusion technology and develop future fusion-based energy systems.

### About Pranos Fusion

- **PRAGYA** – A compact, doughnut-shaped tokamak developed to test plasma control and superconducting magnets.
- **PRANIK** – A larger proposed tokamak designed to achieve the extreme temperatures required for nuclear fusion.
- **JENGA** – Simulation, design and control software functioning as a digital twin of the reactor.
- **MAGGA** – High-temperature superconducting (HTS) magnet development programme.
- The startup is incubated at the Institute for Plasma Research (IPR) and JNCASR, Bengaluru.

### Nuclear Fusion

- **Nuclear fusion** – It involves combining two light atomic nuclei to form a heavier nucleus, releasing enormous energy.
- It generally uses two hydrogen isotopes, **deuterium and tritium**, to produce helium and a fast neutron.
- Fuel must be heated to approximately 100 million°C to form superheated plasma and initiate fusion.



## Tokamak Technology

- A tokamak is a doughnut-shaped fusion device that uses powerful magnetic fields to confine extremely hot plasma.
- Magnetic confinement prevents plasma from contacting reactor walls and helps sustain fusion conditions.

## India's Nuclear Fusion Initiatives

- **ADITYA** – India's indigenous tokamak experiment developed by the Institute for Plasma Research.
- **SST-1** – Steady State Tokamak, developed to study sustained plasma confinement.

*India participates in the **International Thermonuclear Experimental Reactor (ITER) project** in France, alongside 6 other international partners.*

## Global Developments

- **ITER** – International collaboration aimed at demonstrating the feasibility of fusion energy.

***ITER** is, the largest tokamak under construction, a collaboration between China, the European Union, India, Japan, Russia, South Korea, and the U.S.*

- **JET** – Britain's tokamak produced a record 69 megajoules of fusion energy in 2023.
- **National Ignition Facility (USA)** – Achieved fusion ignition in December 2022 using laser-based inertial confinement.

## Reference

[The Hindu| India's first fusion power company takes key steps](#)



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