

India's Artificial Sun

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Why in News?

India's indigenous nuclear fusion research reached a key milestone with the installation of Steady State Superconducting Tokamak-1 (SST-1) at the Institute for Plasma Research (IPR) in Gandhinagar, Gujarat.

India's 'Artificial Sun'

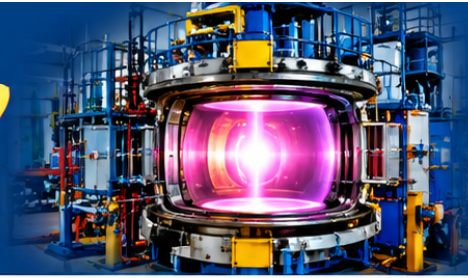
- **Not an Actual Sun** - It refers to ground-based experimental nuclear fusion reactors, specifically tokamaks, designed to replicate the core energy-generation process of the Sun.
- **Core Mechanism** - Unlike nuclear fission (splitting heavy atoms like Uranium), fusion forces light atomic nuclei (typically isotopes of hydrogen - Deuterium and Tritium) together under extreme temperature and pressure to form Helium, releasing massive clean energy.
- **Temperature Requirement** - Reaching fusion conditions requires heating hydrogen gas into a superheated ionized state called **plasma**.
- In India's experiments, plasma temperatures have exceeded **200 million°C** (over 10 times hotter than the core of the Sun).

Key Highlights of the SST-1 Upgrade

- **Role of the Gyrotron** - A gyrotron is a high-power vacuum tube device that generates high-frequency microwave energy.
- It provides **Electron Cyclotron Resonance Heating (ECRH)** to heat and sustain plasma.
- **Upgraded Performance**- Replaces older 42 GHz systems.
- Thus, enhancing India's capacity to heat, maintain stability, and extend the confinement time of ultra-hot plasma without touching the reactor walls.
- **Magnetic Confinement**- Utilizes strong superconducting magnets to trap the plasma inside a donut-shaped chamber (*torus*).

India's 'Artificial Sun'

Not the Sun in the sky, but a step towards clean, limitless energy on Earth.



Fusion Research in India

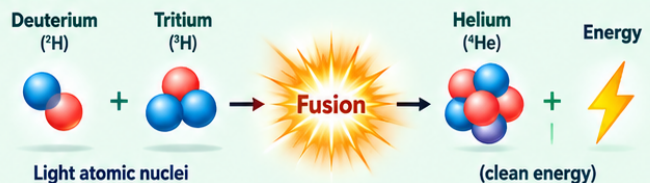
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4 India's Fusion Research



SST-1 Tokamak

Institute for Plasma Research (IPR), Gujarat



The Goal

- ✓ Clean energy
- ✓ Energy security
- ✓ A sustainable future



Over **200 million°C** — hotter than the core of the Sun, right here on Earth!

India's Indigenous Tokamaks

- **ADITYA / ADITYA-U**- India's first medium-sized conventional air-core tokamak with copper coils, used for basic plasma physics research.
- **SST-1 (Steady State Superconducting Tokamak)**- India's **first superconducting tokamak** designed for long-duration, steady-state plasma operation.

Institute for Plasma Research (IPR) Located in Gandhinagar (Gujarat), it is an autonomous R&D institute under the Department of Atomic Energy (DAE) leading domestic fusion research.

Reference

[News 18 | India's 'Artificial Sun' Project](#)



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