



China's Artificial Sun

Why in News

China successfully powered up its “**artificial sun**” **nuclear fusion reactor** for the first time recently, marking a great advance in the country’s **nuclear power research capabilities**. The nuclear reactor is expected to provide clean energy.

Key Points

- The [HL-2M Tokamak reactor](#) is China’s **largest and most advanced nuclear fusion** experimental research device, and scientists hope that the device can potentially unlock a powerful clean energy source.
 - HL-2M Tokamak device is used in it to replicate the **nuclear fusion process that occurs naturally in the sun**.
- It uses a **powerful magnetic field** to fuse **hot plasma** and can reach temperatures of over **150 million degrees Celsius**, approximately **ten times hotter than the core of the sun**.
- Located in **Sichuan province**, the reactor is often called an “**artificial sun**” on account of the **enormous heat and power it produces**.
- **Other Similar Experiment:**
 - [International Thermonuclear Experimental Reactor](#)
 - International Thermonuclear Experimental Reactor (ITER) is a collaboration of **35 nations launched in 1985**.
 - It is located in **France**.
 - **Aim:**
 - It aims to build the world's largest tokamak to prove the feasibility of fusion as a large-scale and carbon-free source of energy.
 - The tokamak is an **experimental machine designed to harness the energy of fusion**. Inside a tokamak, the energy produced through the **fusion of atoms** is absorbed as heat in the walls of the vessel. Like a conventional power plant, a fusion power plant **uses this heat to produce steam and then electricity by way of turbines and generators**.

Nuclear Reactions

- **Description:**
 - A nuclear reaction is the process in which two nuclei, or a nucleus and an external subatomic particle, collide to produce one or more new nuclides. Thus, a nuclear reaction must cause a transformation of at least one nuclide to another.
- **Types:**
 - **Nuclear Fission:**

- The nucleus of an atom splits into **two daughter nuclei**.
 - This decay can be natural spontaneous **splitting by radioactive decay**, or can actually be simulated in a lab by achieving necessary conditions (**bombarding with neutrons, alpha particles, etc.**).
 - The resulting fragments tend to have a combined mass which is less than the original. The **missing mass is usually converted into nuclear energy**.
 - Currently **all commercial nuclear reactors are based on nuclear fission**.
- **Nuclear Fusion:**
- Nuclear Fusion is defined as the **combining of two lighter nuclei** into a heavier one.
 - Such nuclear fusion reactions are the **source of energy in the Sun** and other stars.
 - It takes considerable **energy to force the nuclei to fuse**. The conditions needed for this process are extreme millions of degrees of temperature and millions of pascals of pressure.
 - The hydrogen bomb is based on a **thermonuclear fusion** reaction. However, a nuclear bomb based on the fission of uranium or plutonium is placed at the core of the hydrogen bomb to provide initial energy.

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