White Dwarfs System

Why in News

- For the first time ever, astronomers have found an indirect evidence of a giant planet orbiting a **white dwarf star (WDJ0914+1914).** The system was found in the Cancer constellation.
- The planet was **not seen directly** but evidence of its presence was in the form of a disc of gas (hydrogen, oxygen and sulphur) formed due to its evaporating atmosphere.
    - Spikes of gas were detected by the Very Large Telescope of the European Southern Observatory in Chile.

Significance

- This is the **first evidence of an actual planet revolving around a white dwarf star.** Prior to this discovery, only smaller objects such as asteroids had been detected.
- WDJ0914+1914 is providing us with a glimpse into the very distant future of our own solar system. In about 4.5 billion years from now, the Sun will become a white dwarf evaporating all the planets.

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White Dwarfs

- Stars like our sun **fuse hydrogen in their cores into helium** through nuclear fusion reactions. White dwarfs are stars that have **burned up all of the hydrogen** they once used as nuclear fuel. Such stars have very high density.
- Fusion in a star's core produces **heat and outward pressure** (they bloat up as enormous **red giants**), but this pressure is kept in balance by the inward push of gravity generated by a star's mass.
- When the hydrogen, used as fuel, vanishes and fusion slows, gravity causes the star to **collapse in on itself into white dwarfs.**

- **Black Dwarf:** Eventually—over tens or even hundreds of billions of years—a white dwarf cools until it becomes a **black dwarf, which emits no energy.** Because the universe's oldest stars are only 10 billion to 20 billion years old there are no known black dwarfs
- It must be noted that not all white dwarfs cool and transform into black dwarfs. Those white dwarfs which have enough mass reach a level called the **Chandrasekhar Limit.** At this point the pressure at its center becomes so great that the star will detonate in a **thermonuclear supernova.**

Chandrasekhar Limit

- **Chandrasekhar Limit** is the maximum mass theoretically possible for a stable white dwarf star. A limit which mandates that no white dwarf (a collapsed, degenerate star) can be more massive than about **1.4 times the mass of the Sun.** Any degenerate object more massive must inevitably collapse into a neutron star or black hole.
- The limit is named after the **Nobel laureate Subrahmanyan Chandrasekhar,** who first proposed the idea in 1931. He was awarded the **Nobel Prize in Physics in 1983 for his work on the physical processes involved in the structure and evolution of stars.**