Origin of Water in the Universe

Prelims *– General science.*

Mains *– GS III | Awareness in the fields of IT, Space, Computers, robotics, Nano technology, bio-technology.*

Why in news?

A recent study published in Nature Astronomy suggests that the earliest stars, known as Population III stars, were significant sources of water in the universe.

- **Big Bang and First Stars** – The universe began approximately 13.8 billion years ago with the Big Bang.
- First stars emerged just a few hundred million years after this cosmic explosion.
- *Initial stars were composed entirely of hydrogen and helium*.

> ***Water*** *is the third most abundant molecule in the universe, after hydrogen and carbon monoxide.*

- **Three groups of stars** – Based on stars age and metallicity (i.e. proportion of any element other than hydrogen and helium), *astronomers divide stars into 3 groups*.
- The 3 groups are Population I stars, population II stars and population III stars.
- *Population I stars, like the sun, are the youngest* and are the most metal-rich, while population II stars are older and are less metallic.
- **Population III Stars** – Are the *oldest stars* that played a *crucial role in water formation*.
- These massive stars were hundreds of times larger than our sun and they had *extremely short lifespans* due to their immense size.

> *The longevity of a star depends on its mass. More massive stars die faster. The more the mass of the star, the more heat it has and thus die faster than the star with lesser mass.*

- **Water-Creating Event** – When Population III Stars exhausted their hydrogen fuel, they exploded as supernovae.
- During these explosions, they produced and expelled oxygen and *oxygen combined with hydrogen created water molecules*.
- This process occurred between 50 million and 1 billion years after the Big Bang.
- **Scientific Significance** – This study necessitates a *revision of the cosmic timeline*, as

it indicates water's presence in the early universe occurred significantly sooner than previously believed.
- Potential implications for the origins of life.
- Possibility of planet formation with water much earlier in cosmic history.

Reference

[The Hindu | The Universe's First Water]

