Syllabus subtopic: Science and Technology- developments and their applications and effects in everyday life Achievements of Indians in science & technology; indigenization of technology and developing new technology.

Prelims and Mains focus: about the discovery and its significance; about Stardust, meteors, meteorite and meteoroids

News: A meteorite that crashed into rural south-eastern Australia in a fire-ball in 1969 contained the oldest material ever found on Earth, stardust that predated the formation of our solar system by billions of years, scientists said on Monday.

About the discovery

- The oldest of 40 tiny dust grains trapped inside the meteorite fragments retrieved around the town of Murchison in Victoria state dated from about 7 billion years ago, about 2.5 billion years before the sun, Earth and rest of our solar system formed, the researchers said.

- In fact, all of the dust specks analysed in the research came from before the solar system’s formation—thus known as “presolar grains”—with 60% of them between 4.6 and 4.9 billion years old and the oldest 10% dating to more than 5.6 billion years ago.

- The stardust represented time capsules dating to before the solar system.

Why is the discovery so significant?

- Though the universe abounds with floating stardust, no presolar grains have ever been found in Earth’s rocks. That’s because plate tectonics, volcanism and other planetary processes heated and transformed all the presolar dust that may have collected during Earth's formation.
- When large, orphan space rocks form — such as the asteroid that produced Murchison — they, too, can pick up ancient, interstellar dust. But unlike
dynamic planets, Murchison's parent asteroid is "an almost-inert piece of rock that formed from the solar nebula and hasn't changed since then," so the presolar grains haven't been cooked down into another type of mineral.

- Most presolar grains measure about 1 micron in length, or are even smaller. But the grains the scientists analyzed for the study were much bigger, ranging from 2 to 30 microns in length.
- Scientists call them 'boulders; they can be seen with an optical microscope.

**About Stardust (Cosmic dust)**

- Cosmic dust, also called **extraterrestrial dust or space dust**, is dust which exists in outer space, or has fallen on Earth. Most cosmic dust particles are between a few molecules to 0.1 µm (1 micron) in size.

- Cosmic dust can be further distinguished by its astronomical location: intergalactic dust, interstellar dust, interplanetary dust (such as in the zodiacal cloud) and circumplanetary dust (such as in a planetary ring).

- In the Solar System, **interplanetary dust causes the zodiacal light**. Solar System dust includes comet dust, asteroidal dust, dust from the Kuiper belt, and interstellar dust passing through the Solar System.

- Thousands of tons of cosmic dust are estimated to reach the Earth's surface every year, with each grain having a mass between $10^{16}$ kg (0.1 pg) and $10^{24}$ kg (100 mg). The density of the dust cloud through which the Earth is traveling is approximately $10^{6}$ dust grains/m$^3$.

- Cosmic dust contains some complex organic compounds (amorphous organic solids with a mixed aromatic–aliphatic structure) that could be created naturally, and rapidly, by stars. A **smaller fraction of dust in space is "stardust" consisting of larger refractory minerals that condensed as matter left by stars.**

- Interstellar dust particles were collected by the **Stardust spacecraft** and samples were returned to Earth in 2006.
How are meteoroids, meteors and meteorite related?

Meteoroids and meteors are 2 parts of a whole, meteorites are what they are if they survive the landing to Earth's surface.

Explanation:

- A meteor refers to the flash of light we see in the sky and the meteoroid is the actual debris that makes the light from entering Earth at high velocities. When the meteor hits the ground, if it somehow doesn't burn up in the atmosphere, it is then referred to as a meteorite.

- Meteoroid in common language can refer to the rock in space and meteor can refer to what the rock is when it enters the atmosphere. Meteorite remains consistent.