PASIPHAE: A Sky Surveying Project

Why in news

The **Wide Area Linear Optical Polarimeter (WALOP),** a **vital instrument for the PASIPHAE Project,** is being **developed at Inter-University Centre for Astronomy and Astrophysics (IUCAA), India.**

- **Polar-Areas Stellar-Imaging in Polarisation High-Accuracy Experiment (PASIPHAE)** is **an international collaborative sky surveying project.**

Astronomical Polarimetry

- Polarimetry, **a technique to measure the polarisation of light,** is a powerful tool that allows astronomers to infer information about celestial objects, from passing comets to distant galaxies, that can not be obtained using other techniques.
- **Polarization** is **a property of light that represents the direction that the light wave oscillates.**
- Two decades ago, an Indian astrophysicist Sujan Sengupta, put forth an idea, that the light emitted by a **cloudy brown dwarf**, or reflected off an **extrasolar planet**, will be polarised.

Key Points

- **About the PASIPHAE Survey:**
    - It is an **opto polarimetric survey** aiming to **measure the linear polarization from millions of stars.**
    - The survey **will use two high-tech optical polarimeters to observe the northern and southern skies,** simultaneously.
    - The survey **will be conducted** concurrently from the **South African Astronomical Observatory in Sutherland,** South Africa in the **southern hemisphere,** and the **Skinakas Observatory in Crete, Greece,** in the **north.**
    - It will focus on **capturing starlight polarisation** of very faint stars that are so far away that polarisation signals from there have not been systematically studied.
    - The distances to these stars will be obtained from measurements of the **GAIA satellite.**
        - GAIA is on a **mission to chart a three-dimensional map of our Galaxy,** the Milky Way, in the process revealing the composition, formation and evolution of the Galaxy. It is **a European Space Agency astronomical observatory mission.**
    - Scientists from the University of Crete, Greece, Caltech, USA, **IUCAA, India,** the South African Astronomical Observatory and the University of Oslo, Norway, are involved in this project, steered by the Institute of Astrophysics, Greece.
- **Importance of the Project:**
    - Since its birth about 14 billion years ago, the **universe has been constantly expanding,**

as evidenced by the presence of **Cosmic Microwave Background (CMB) radiation** which fills the universe.

        - The **Milky Way Galaxy contains a lot of dust clouds** that are present in the form of clusters. When **starlight passes through these dust clouds,** they **get scattered and polarised.**
    - The PASIPHAE polarimetric map **will be used to perform magnetic tomography of the Milky Way Galaxy.**

        - That is, it will **deduce the 3-dimensional structure of the magnetic field and the dust that resides in our own Galaxy.**
        - This map will **provide invaluable information for future CMB B-mode experiments** searching for inflationary **gravitational waves.**
        - The **B-mode experiment** was used **to test the theory of cosmic inflation** and distinguish between inflationary models of the very early universe by making precise measurements of the polarization of the Cosmic Microwave Background (CMB).
        - According to the **theory of inflation,** the **early Universe expanded exponentially fast for a fraction of a second** after the **Big Bang.**
    - Beyond studies of the early Universe, the survey will **lead to leaps forward in some of the most actively pursued areas in Astrophysics,** including high-energy astrophysics, stellar astrophysics, and interstellar medium dynamics.
- **Wide Area Linear Optical Polarimeter (WALOP):**

    - It was **planned in 2013** after the success of the **RoboPol experiment survey during 2012-2017.**

        - WALOP and its predecessor RoboPol **share the photometry (measurement of the brightness of celestial objects) principle.**
        - But the **WALOP will be capable of observing hundreds of stars concurrently** present both in the northern and the southern skies as opposed to RoboPol, which has a much smaller field of view in the sky.
    - **Working Principle:**

        - WALOP will operate on the principle that at any given time, the data from a portion of the sky under observation will be split into four different channels.
        - Depending on the manner in which light passes through the four channels, the polarisation value from the star is obtained.

            - That is, each star will have four corresponding images which when stitched together will help calculate the desired polarisation value of a star.
    - **Installation:**

        - A WALOP each will be mounted on the 1.3-metre Skinakas Observatory, Crete, and on the 1-metre telescope of the South African Astronomical Observatory located in Sutherland.

Source: IE