# 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.

**<u>Source: IE</u>**