# Detection of variable stars in the open cluster NGC 2506

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This is a four-week report of the work carried out at ARIES under the supervision of Dr. Yogesh Chandra Joshi, Aryabhatta Research Institute of Observational Sciences (ARIES). The report provides a fundamental image reduction and photometry analysis of the cluster NGC 2506 using the data taken from 1.3-m Devasthal Fast Optical Telescope (DFOT).

## Image reduction:

Image reduction is a crucial step in astronomical data processing, aimed at removing various sources of noise and artifacts from the raw images. I used data from the NGC2506 star cluster captured by the Devasthal Fast Optical Telescope(DFOT), a 1.3-meter aperture optical telescope. This data contains 375 frames of 2k×2k dimension with an exposure time of 10 sec each.

For image reduction, I combined bias frames to create a master bias frame and flat frames to create a master flat frame using the `ccdproc.combine()` function provided by the `ccdproc` package in the `astropy` library. Five bias frames and four flat frames were used for this purpose. Then the master bias frame was subtracted from each raw image and the master flat frame to remove the electronic noise component using `ccdproc.subtract_bias()` function. The resulting images were then divided by the bias-cleaned master flat frame to correct for the optical system's non-uniformities using `ccdproc.flat_correct()` function. This process is known as flat-fielding. Additionally, cosmic ray hits, which appear as bright spots or streaks in the images, were identified and removed using `ccdproc.cosmicray_lacosmic()`. Once all the images were cleaned, they were aligned with respect to the reference image so that all the stars have the same coordinates making it easy to locate the star in multiple frames.

## Photometry:

Photometry involves measuring the flux or brightness of celestial objects. The process includes determining an appropriate aperture around the target object, creating an annulus for background noise estimation, measuring the flux within the aperture, calculating the average background level, and obtaining the instrumental magnitude. Photometric calibration is then performed by comparing the instrumental magnitude to standard stars, considering the zero-point magnitude, and applying corrections. This calibration magnitude is added to the instrumental magnitude to derive the corrected magnitude of the target object.
I could detect about 2500 stars in each frame using the Python algorithm. After doing photometry, I plotted the light curve for bright stars for the total duration of about 4 hrs.

## Proposed plan for the next month:

We plan to study the variation in the magnitude of stars from the data obtained on multiple nights. By analyzing the patterns and characteristics of these variations, we can gain insights into the physical processes happening within the variable star. Analyzing light curves also allows us to study periodicity, stellar evolution, cataclysmic events, and exoplanets.