Photometry

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December 2024

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Introduction

Photometry is the technique of measuring the intensity, brightness, or flux of light emitted by celestial objects such as stars, galaxies, and nebulae. By analyzing the light from these objects, we can infer important physical properties such as their luminosity, distance, size, temperature, composition, and variability over time.

Types

- Aperture
- Point Spread Function (PSF)

Applications of Photometry

- **Determining Stellar Properties:** Helps estimate a star's temperature, size, and stage of evolution.
- **Studying Variable Stars:** Changes in brightness reveal pulsation periods, eclipses, or surface activity.
- **Exoplanet Detection:** Periodic dips in brightness from a host star (via the transit method) can indicate orbiting planets.
- **Distance Measurement:** Photometry of standard candles like Cepheid variables or supernovae helps determine distances to far-away galaxies.

Aperture Photometry

In aperture photometry, we measure the brightness of a celestial object by summing up the light within a defined circular region, called the aperture, and **subtracting the contribution from the background light.** This technique is one of the simplest and most commonly used methods for photometry, especially when dealing with **isolated or well-resolved sources.**

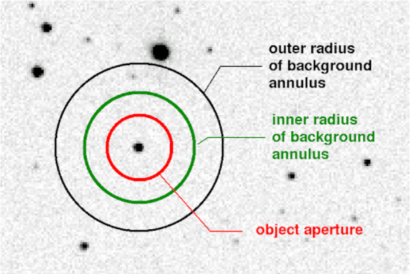

Figure: Aperture Photometry

Calculations

Calculations (1/2)

I calculated the angular radius using the following formula :

$$Angular\ radius = \frac{206265}{10^6}\left(\frac{R}{D}\right) \tag{1}$$

where R and D are the physical radius of the aperture (in pc) and the distance of the galaxy (in Mpc) respectively.
Then we convert this to the aperture radius using the formula :

$$Aperture\ radius = \frac{Angular\ radius}{\theta} \tag{2}$$

where θ is the pixel scale of the data in arcsec/pixel.

Calculations (2/2)

We would like the physical radius R of the aperture to be of the order of the average size of the star clusters which is about **15 pc.** The distance D of NGC 1365 is about **19.57 Mpc.** The pixel scale for the data is found to be **0.03962 arcsec/pixel.**

Substituting these values gives us **4 pixels** as the aperture radius. For the annulus, I took the inner and outer radii to be **7** and **8 pixels** respectively. To perform photometry, I created aperture objects at the coordinates of the star clusters and implemented the code to get the flux.

Plots

Plots (1/3)

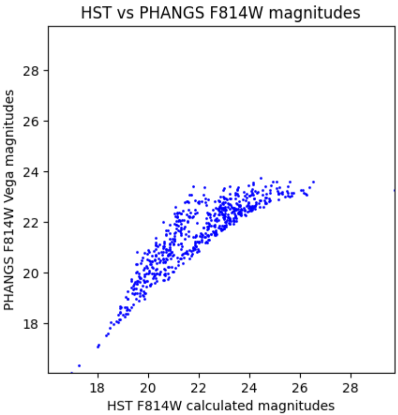

Figure: Photometric analysis without Background correction

Plots (2/3)

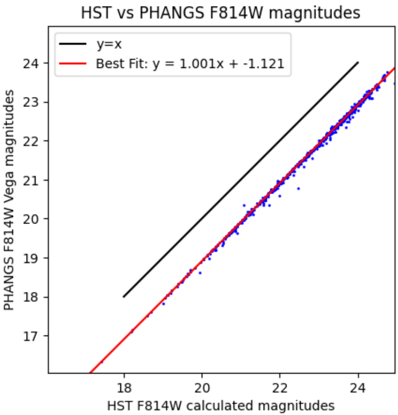

Figure: F814W magnitude comparison

Plots (3/3)

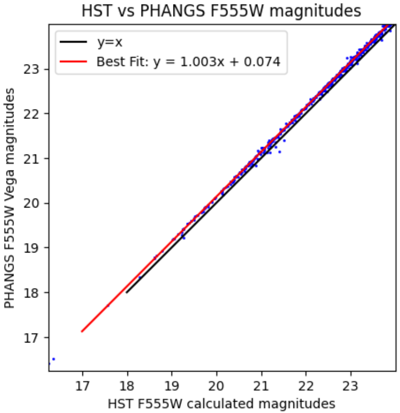

Figure: F555W magnitude comparison

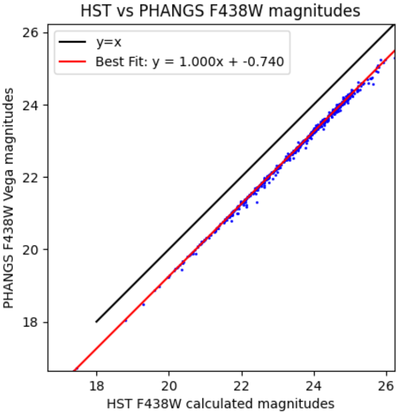

Figure: F438 magnitude comparison

Thank You