



PHOTOMETRY

Calculating Magnitude





PHOTOMETRY - Calculating Magnitude

Overview

One of the capabilities of Photometry is to calculate magnitude of a given object.

This is accomplished through Aperture Photometry.

It is recommended that you have a good understanding of Aperture Photometry. Please review that lesson, if needed, before continuing.



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Process

Magnitude can be computed as: Mira computes the magnitude as: $m = K - 2.5 \log (\text{Flux})$

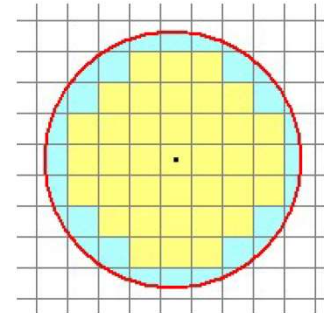
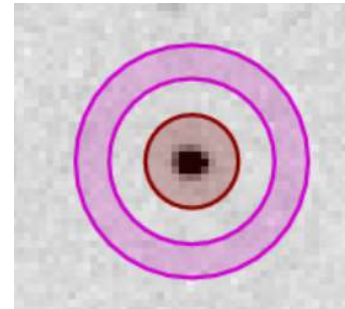
K is the photometric "zero point"

$\text{Flux} = \text{Gain} * \text{Counts} / \text{Exptime.}$

Gain and Exptime are captured from the FITS header

The value of Counts is the net signal from the object, subtract the sky background, measured in the raw pixel value units, ADU's.

The Flux, from the above, represents a total number of electrons per second for the object.





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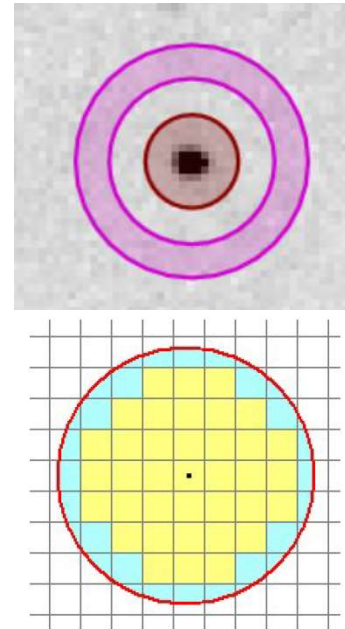
To compute the Flux, the image signal is summed over all pixels inside the innermost aperture, including the partially filled pixels along the rim of the aperture.

From this sum is subtracted the estimated sky brightness which is computed from pixels in the sky annulus formed between the 2 outer apertures.

If the GAIN and EXPTIME keywords are not present in the image header, or they are wrong, you can add them or edit them using software designed to edit FITS headers.

The value K is the photometric zero point (Transform Coefficient). A zero point value is computed for a particular instrumental setup and used in the calculation, the result is called "instrumental magnitude".

NOTE: If the zero point value, K, is unknown, it may be calculated using standard stars of known magnitude.





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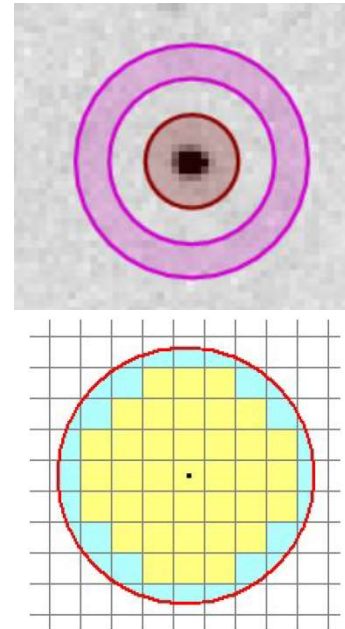
Remembering:

K is the photometric "zero point"

$\text{Flux} = \text{Gain} * \text{Counts} / \text{Exptime.}$

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Insert the values above to derive the apparent magnitude.





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Summary

Apparent Magnitude can be calculated from a CCD image by using the ADU counts measured through aperture photometry.

Application of a Transform Coefficient must also be applied. Remember that these values are adjustments, derived through testing, to make your image system “standardized” against other standards such as Landolt, APASS, or others.

Once the apparent magnitude is known, if the distance is also known, Absolute Magnitude can be obtained.



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Questions?