



## Colour Error Bars

How to add error bars to graphs that include calculated colours

### Classroom Activity

#### Outline

This worksheet describes how to add error bars to your colour graphs to investigate how much you can trust the trends you might see.

When you have plotted simple graphs, you will present your further results on graphs to display the **error bars**.

Prior to carrying out this activity, if you have not used the AstrolmageJ software previously or carried out photometry, it is recommended that you read through and complete the '**Light Curve Photometry**' worksheet. You must have also completed the photometric analysis of an object in several filters, by reading through and completing the relevant worksheet, e.g. '**XR B Colour Time**'.

#### Errors in Quadrature:

While the colour value itself is a simple subtraction, its associated uncertainty is not quite so straightforward and is calculated in the following way, known as quadrature.

***Uncertainty in colour = square root ((uncertainty in one filter)<sup>2</sup> + (uncertainty in other filter)<sup>2</sup>)***

In other words, we square both uncertainties, add them and take the square root of this value. So, the final uncertainty is greater than either individual uncertainty but not as large as if we simply added them together.

#### Procedure:

1

Open the original files that contain your photometry results.

Online Observatory: [onlineobservatory.eu](http://onlineobservatory.eu)

The online observatory collaboration consists of the following partners:

Baldone Observatory, Brorfelde Observatory, Cardiff University, Harestua Solar Observatory, Helsinki Observatory



2

Copy and paste the 'mag err' columns to the spreadsheet in which you've plotted a graph that includes colour, renaming each column to "[letter representing filter] error", e.g. "B error".

3

Create a new column to the right of your colour column.

4

Name it "[letters representing colour] error", e.g. "B-V error".

5

In the first box of this column type "=SQRT(", then click on the first box in one of the error columns, then type "^2+", followed by clicking on the first box in the other error column, and finally type "^2)", then press Enter.

6

Drag this box to the bottom of the spreadsheet.

7

Add error bars to any colour measurement you have in your graph.

8

If you have used an average JD on your x-axis, use the longest exposure time for your error bar.