

Variable Star Photometry

Some stars are variable in their brightness, either cyclically or cataclysmically. By measuring a star's brightness and plotting its magnitude vs. time, we can learn about its behavior and infer other interesting properties.

1. Open an image in AI4WIN and measure the instrumental magnitude of your variable star as well as the magnitudes of several comparison stars with known magnitudes. Because Delta Cephei is a very bright star its image is large, and so you will have to reset the aperture photometry settings. The inner circle should encompass all the star's brightness, and the outer ring should be just background sky.

Delta Cephei images:

20 August, 2003 c

21 November, 2003 d

23 November, 2003 b

1 December, 2003

29 December, 2003 a

29 June, 2004 a

6 July, 2004 b

8 July, 2004 a

9 July, 2004 b

28 July, 2008 -001

2. Construct a table of Julian Dates and corresponding magnitudes. It is easiest if you record the Julian Date minus 2, 400,000 or so in order to make the numbers more manageable. Record what you do.
3. Make a graph of these. Usually the dates are not spread out evenly, so the data do not immediately show you a nice cyclic curve.
4. At the top of the spreadsheet pick a cell for the trial period: (say cell D1, and type a number there.)
5. On the spreadsheet, make a new column between Julian Date and magnitude. Type = MOD(JulianDateCell, \$D\$1) Fill down. (This will anchor all the rows to the same trial period value.)

6. Make a graph of magnitude vs. modified Julian Date. This will fold the data back on itself every “period” days. Now just try various values of the period until the graph begins to look organized. Note that the period is not limited to integer days, but can also be fractional days such as 5.36 days.

7. A final graph will be magnitude vs. phase. This goes from 0 to 1, and is just the modified Julian Date divided by the period. (You need to insert another new column before the magnitudes.)