

# Nova Search

RBSE, M.L. West

**Equipment:** Computer with Scion Image software, RBSE CD-ROM, colored pencils

## Background:

A nova stella (“new star” in \_\_\_\_\_) is a star which suddenly brightens up. Usually it begins to fade right away and returns to its original brightness in a few days or weeks. Some novae recur after decades of constant light output. Maybe many novae recur on much longer time scales. No one knows.

The theoretical explanation of this behavior is that a nova is a cataclysmic nuclear explosion caused by the accretion of hydrogen onto the surface of an aged white dwarf star.

Where might this hydrogen come from? a) \_\_\_\_\_,

or b) \_\_\_\_\_.

Which possibility is more probable? (a or b) Why?

**Observables:** apparent or absolute magnitude at peak brightness, half-life for fading, number of nova per year, ...

**Variables** which might correlate with the observables: mass of the white dwarf star, crowding of stars together, range of magnitudes of stars, metallicity of stars, distance from center of their galaxy, ...

We will examine images taken of small sections of the Andromeda Galaxy M31 over a period of time, in hopes of locating some novae and determining their time scale for fading.

The images were taken by Travis Rector with Kitt Peak Telescopes of aperture .9 m, 1.3 m, and 2.1 m from September 1995 to October 2000. Dr. Rector is one of the best known astrophotographers in the world.

We will use aperture photometry to measure the brightness of the stars we are interested in. This adds up all the photons within 3 pixels of the point clicked on. Then it subtracts the sky background by counting all the photons in a ring (annulus) of radius 7 to 11 pixels.

## Procedure:

1. Insert the RBSE CD-ROM into the computer.

- Go to M31 Data, M31 Finder Charts.pdf. Choose a field (subrafter \_\_\_\_\_) and print only your page. How many subrasters are there? \_\_\_\_\_
2. On the computer open Start, All Programs, Scion Image, Scion Image. (This is a version of NIH Image). Click OK to continue using the software even though Frame Grabber capabilities are disabled. Click OK on Release Information also.
  3. Special, Load Macros. Go to My Computer, RBSE CD-ROM, Software, Windows, Scion Image, Macros, Nova Search Macros.txt
  4. Special, Make Stack for Blinking  
Choose the RBSE CD-ROM, M31 Data folder, and choose one subrafter field to investigate, fxx, such as f10.  
Choose m31e01fxx.fits (This is epoch 1 for field xx) and then set the epoch in the dialog box from 1 to 18.  
Click OK for Import Scale Minimum =0, and for Import Scale Maximum = 1000.
  5. Stacks, Animate
  6. Look carefully for blinking stars. When you find one, click on the image and use > and < keys to step through the images one by one. Record which epochs the star shows up in.
  7. On the first image in which you see this star, measure its spatial coordinates (x, y) using Special, Read Coordinates, then click on the star. Circle it in colored pencil on your print.
  8. Zoom in using the magnifying glass tool to see that it is a star and not just a single black square pixel.
  9. Special, Close All Image Windows.
  10. Special Import FITS, then choose the field and only the first epoch for your blinker.  
Measure the star's magnitude in comparison to known stars in the same field by:  
Special, Record Known Magnitude  
Click on a numbered standard star found at the bottom of the print you made in step 1.  
Type the known magnitude (at the bottom of the print) into the dialog box.  
Wait for the software to label the known star.  
Repeat for 2 other known stars.  
Special, Measure Magnitude, click on your blinker star. Write down the resulting magnitude.
  11. For each epoch in which the star is seen repeat your measurements of its magnitude.
  12. Compile a spreadsheet and plot the star's brightness vs. date.
  13. Pick another blinker and repeat.
  14. We will combine all the blinkers found to look for correlations with other variables.