Lecture 9

Variable Star Stuff

March 11 2003
8:00 PM
BMPS 1420

This week's topics

- CCD Review
- Differential Photometry
- Julian Date
- Heliocentric Corrected Julian Date
- How to get to the MSU telescope

CCD Review

What we need	Why we need it
• Gain	•
• Bias	•
• Dark	•
• Flat	•

CCD Review

What we need	Why we need it
• Gain	• Converts charge to amount of light
• Bias	•
• Dark	•
• Flat	•

CCD Review

What we need	Why we need it
• Gain	• Converts charge to amount of light
• Bias	• Zero point for CCD
• Dark	•
• Flat	•

CCD Review

What we need	Why we need it
• Gain	• Converts charge to amount of light
• Bias	• Zero point for CCD
• Dark	• Remove thermal fluctuations
• Flat	•

CCD Review

What we need	Why we need it
• Gain	• Converts charge to amount of light
• Bias	• Zero point for CCD
• Dark	• Remove thermal fluctuations
• Flat	• Re-Normalize CCD response

Differential Photometry

We would like absolute magnitudes. Local conditions prohibit this. Since the star varies over time, we could simply compare it to another star nearby.

Why does this work?

AN Lyn (δ scuti variable)

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Any variations due to clouds or other atmospheric conditions should affect both stars equally.

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Differential Photometry

AN Lyn - C1 = m1
AN Lyn - C2 = m2
C1 - C2 = m3 (constant?)

We then want to plot:

m1 vs time
m2 vs time

m3 vs time

In the end, we will make some guess of the period and plot m1 vs period.

AN Lyn (δ scuti variable)

Julian Date

- Date system that uses integer days from a given starting point, rather than days, months, and years.
- Developed in 1583 by J.J. Scaliger
- The zero point is noon, 4713 BC
  - This happened to be when several older calender systems converged, and there was no recorded history earlier than this point at the time. (This means no negative dates....)

Julian Date (cont.)

Formula for calculating is a bit complex, but here is the simplified version (valid from 1901-2099):

$$JD = 367Y - INT(7\ (Y + INT(\ (M + 9) / 12)\ )\ /\ 4 + INT(275M / 9) + D + 1721013.5 + UT / 24$$

Y = year
M = month of year
D = day of month
UT = universal time (hours, minutes, seconds elapsed since midnight GMT)

Julian Date (cont.)

Since it starts at noon, observations typically run over one "day". This system is very convenient for Astronomy.

There are many JD calculators on the web

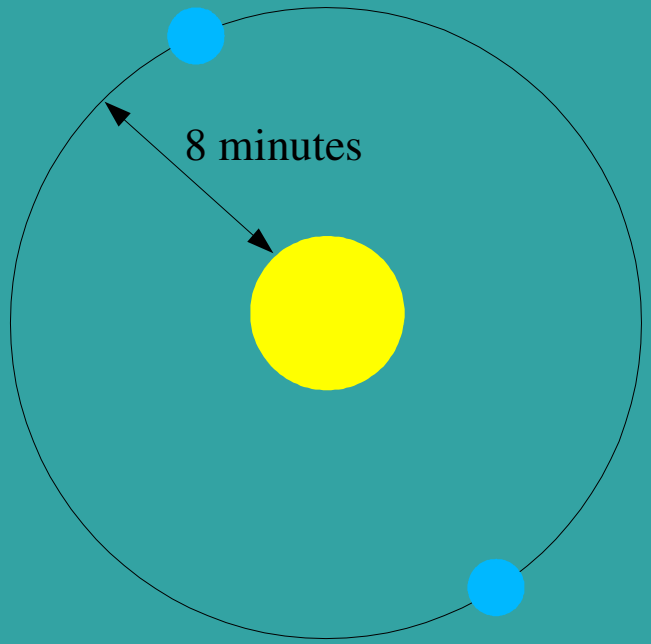
Feed in "real date and time" get back JD:

June 9th, 2001 Noon GMT
JD = 2452070

Heliocentric Correction

Need to correct for light travel time based on the position of Earth in its orbit around the Sun.

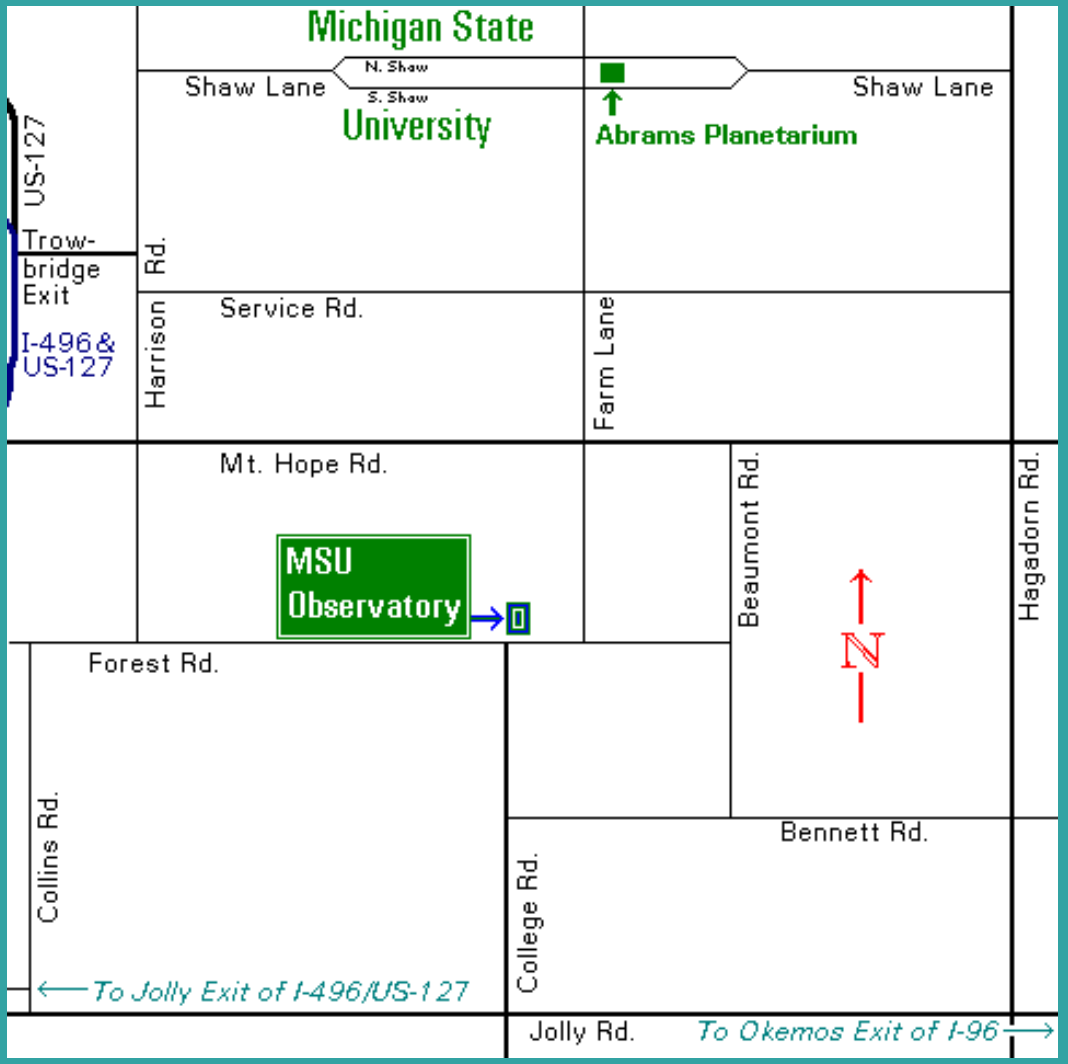
(Assumes that the Sun is "stationary").



Heliocentric Correction (cont.)

- Need to know Julian Date of observation as well as RA and DEC of object.
  - This calculation is a bit more complex. We will use a program to do it, so you don't need to worry about the details right now.

MSU Observatory



Phone 355-SKYS

Observing Projects

- AN Lyn
  - Variable star
    RA 9 14 28.0
    DEC +42 45 42
  - Produce a light curve
- Orion Nebula
  - Emission Nebula
  - Multi-color imaging

We will be observing these on ANY upcoming clear night. Keep and eye on your email and the web site. We know that you can't make it some days and that is fine. We would like you to make it to at least one observing session for each of the two projects.