BP Pegasi

Variable Star observed on October 30, 2007 by
Cooper Reeves, Whitney Tarpy, Elizabeth Tucker
(under supervision of Dr. Tibor Torma)

Light Curve Re-evaluated by
Patrick Lo, Michael Scott, Sarah Gardner

Generalities

BP Pegasi is a quickly pulsating variable star of the DSCT(B) type. Delta Scuti variables vary in their magnitude due to pulsations in the photosphere of the star. Variable stars of this type generally have a period of 0.01 - 0.2 days. The typical δ Scuti star has an amplitude of 0.003 - 0.9 magnitudes (if it is a typical one, it cannot have a wide range!), their spectral types typically range from A0 to F5. The combination of a shorter period and an amplitude of approximately half a magnitude make variable stars of this type good choices for observation.

Format:
line lengths

The General Catalogue of Variable Stars lists the following data for BP Peg:

Type: DSCT (B)

Period: 0.1095*($\sim 2^h 47^m$)

Spectrum: A0

Max - Min: 11.69 - 12.28

Cross Identification:
GSC 2188:591 / HIP 106417

We chose three comparison stars in the field of the image that had magnitudes close to that of our variable star. The image to the right indicates the location of the three comparison stars chosen:

C1: GSC 2188:71; Magnitude: 12.4

C2: GSC 2188:225; Magnitude: 11.8

C3: GSC 2188:561; Magnitude: 12.2

Observations

The observation of BP Peg was carried out on October 30, 2007 by Cooper Reeves, Whitney Tarpy, and Elizabeth Tucker. These three students took numerous images of the variable star over a period of around 3 hours.

The images were taken through a ST-10XME camera using the university's Meade 12-inch Schmidt-Cassegrain telescope with a JMI focuser with motofocus and digital readout. Unfortunately, little information was recorded as to their methods and the atmospheric conditions during the time of the observation.

We were asked to re-evaluate the information gathered by the aforementioned group and to construct a new light curve with the re-evaluated information.

The Evaluation

Our initial objective was to determine exactly which star was BP Peg, a process complicated by the fact that TheSky had mislabeled the star. We used the GCVS catalogue located on the internet in order to determine the cross-identification listing (HIP 106417). Using this identification, we were able to locate the proper star in TheSky (GSC 2188:591). Tracking down this star in TheSky allowed us to accurately determine which star was the variable within the recorded images.

Then, we created a "medianed" master dark frame using the dark frames taken at the time of the observation. We also created a "medianed" master flat frame using the flat frames taken at the same time. In order to create the "medianed" master flat frame, our group had to correct for a mistake made when photographing the original flat frames which caused a problem with the average brightness varying between frames. We used CCDSoft to adapt the brightness of each frame to a common level. This allowed us to median the images and create a master flat frame.

Using this master dark frame and master flat frame, we used CCDSoft to reduce the folder of our images by the master frames. The resulting images were then pre-analyzed by CCDSoft in order to create an .SRC file which could be read in Microsoft Excel. We then utilized Excel in order to find the difference between our variable star and the average of two of our comparison stars. The remaining comparison star (GSC 2188:71) was not used because there was a much lesser amount of light extinction due to its redder color. (Give more detail how the color of the comparison stars was determined; quote numbers.)
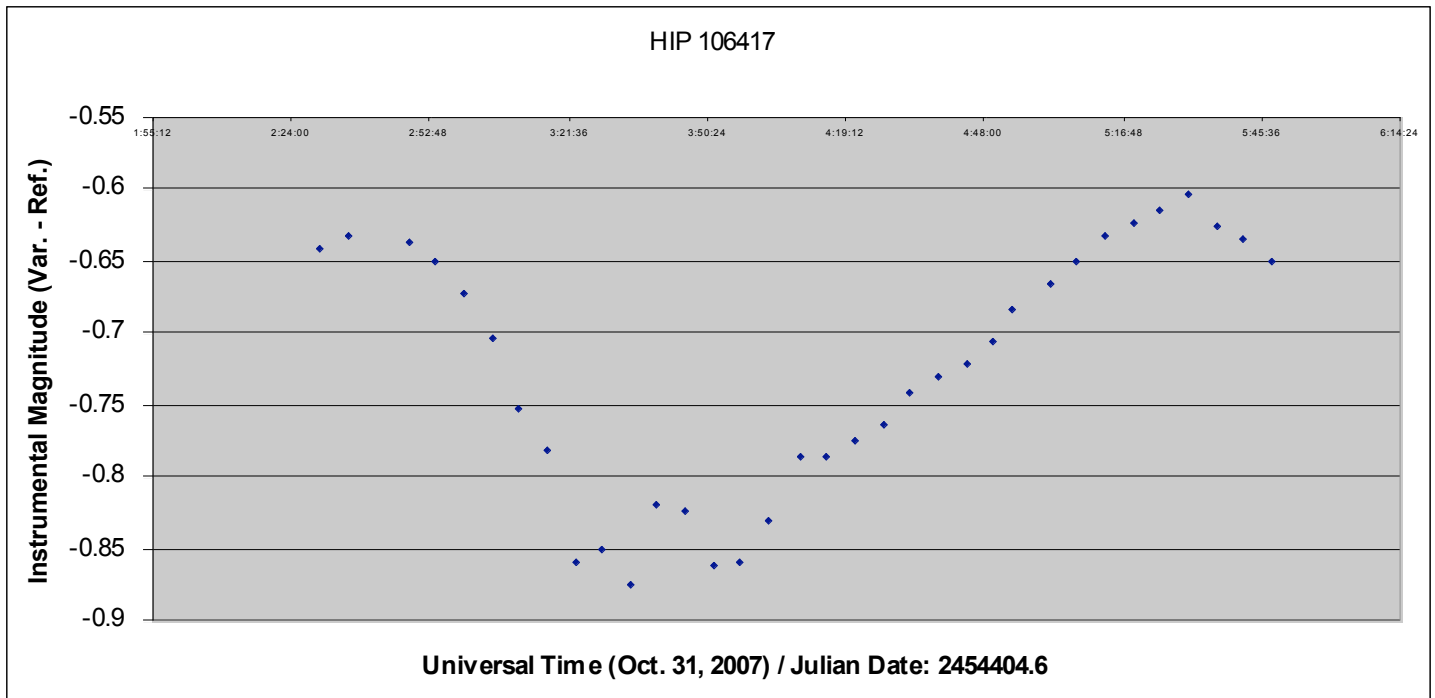
The general accuracy of our measurement was determined by finding the standard deviation of each of our plotted points. (Explain which plot – and why those points tell the accuracy of the measurement.) The RMS accuracy was determined to be **+-0.0046 mg**.(use ±)

Explain what each plot is, and why it is plotted, and what its significance is. (The vertical labels are illegible – fix fonts.) Explain what statistical and systematic errors you are finding, and which of the two seems more signigicant. Explain why color dependence of extinction cannot be the source of the systematic errors.
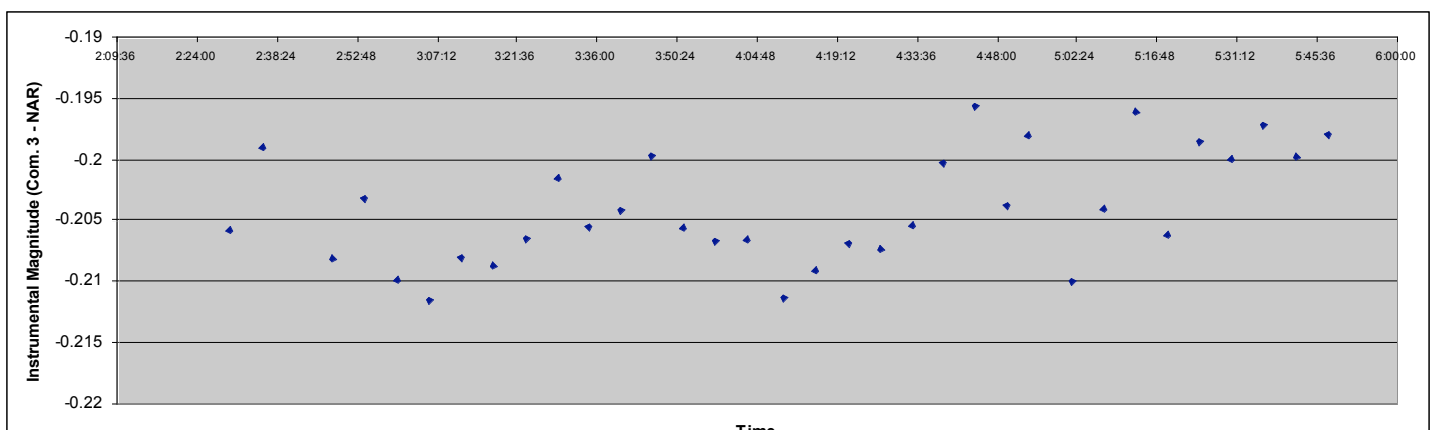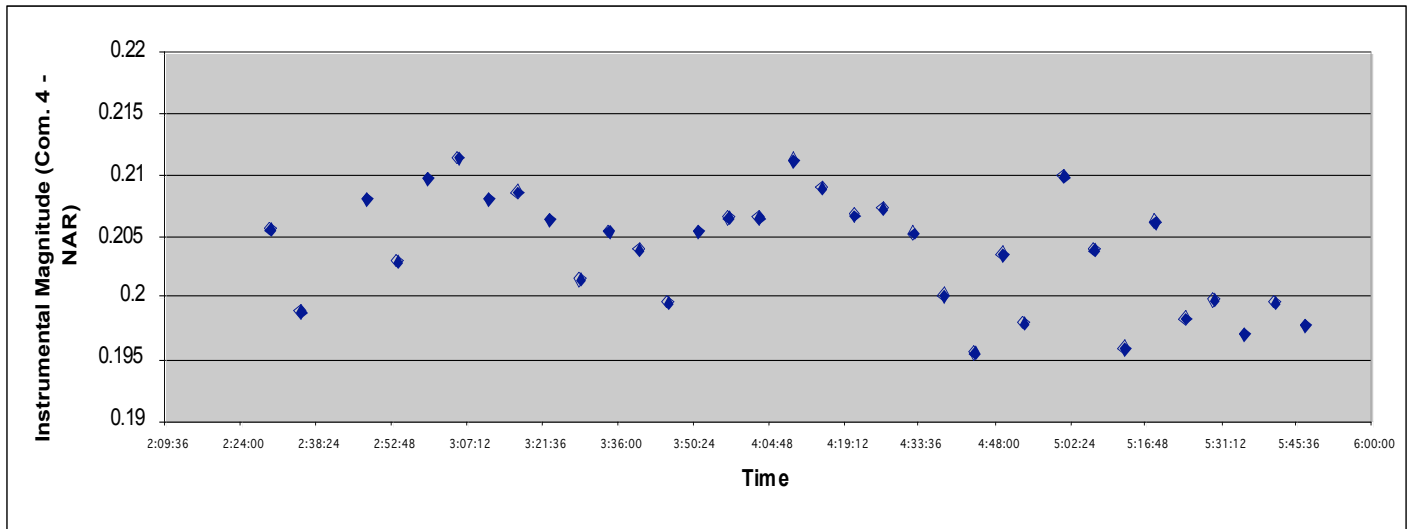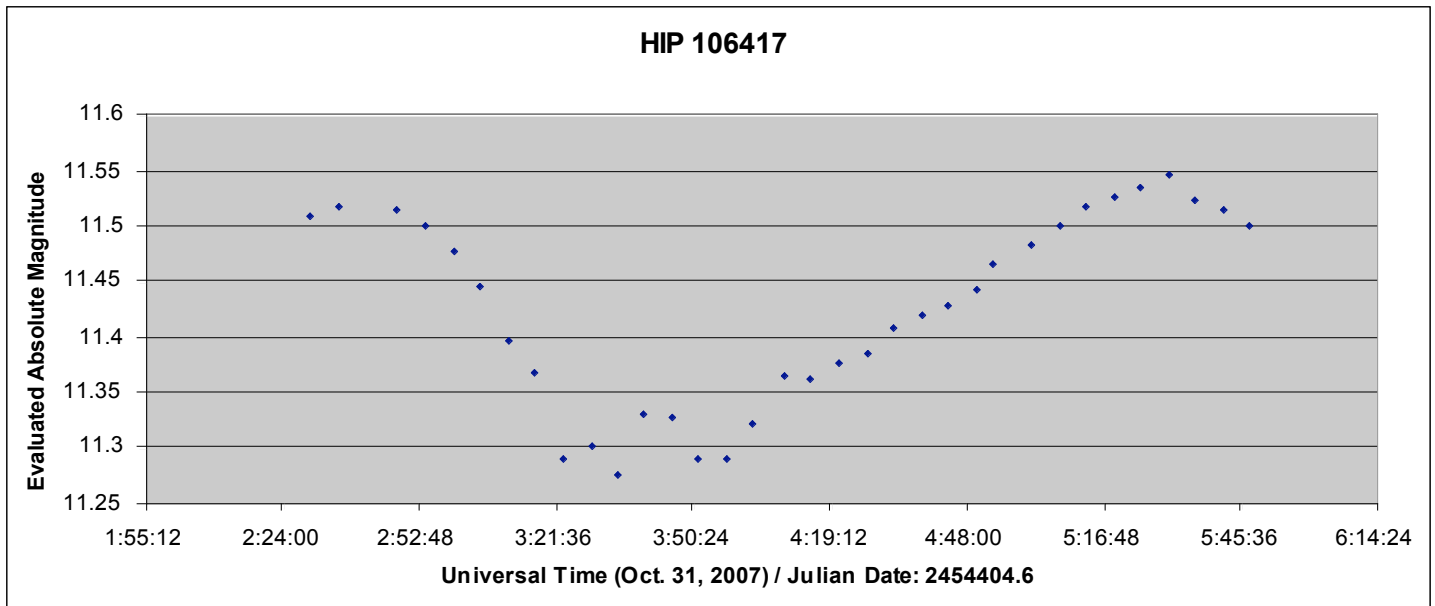
There is some small tendency of change between (unclear language?) our two comparison stars. However, the change is small (how small? Quantify.), and the average of the two stars renders this small change inconsequential.

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Instrumental Magnitude (Var. - Ref.)

Universal Time (Oct. 31, 2007) / Julian Date: 2454404.6

  Our group used TheSky to determine the recorded magnitude for our star (HIP 106417). We then added that value to our instrumental magnitude to give us our evaluated absolute (surely not *absolute*) magnitude. (Explain that "Ref." means the average magnitude of Comp #? and Comp #?; What you used is not "TheSky" but the Guide Star Catalogue – explain what it is.) Explain why this procedure provides the true apparent magnitude of the variable.

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(chart: *Evaluated Absolute Magnitude* (y-axis, 11.25 to 11.6) vs. *Universal Time (Oct. 31, 2007) / Julian Date: 2454404.6* (x-axis, 1:55:12 to 6:14:24))

<u>Conclusion</u>

  Our group found that it is possible to create a light curve using these images taken over a span of approximately three hours. The determined accuracy of our measurement (+-0.0046) is sufficient to establish the variation of this variable star. We believe that much of the error is systematic. However, we are unable to determine the main source of this systematic error. We had believed that this error was due to one of our three original guide stars being too red, but after further examination, we decided to throw out aforementioned star altogether (more detailed explanation needed; see above). We do believe that the statistical error could be improved by making another observation of the variable (we would then have more data to evaluate and refine), but time constraints prevent us from doing so. (Notice that this statement is incorrect!)

Missing: what did you learn about the star? Determine its period; determine its amplitude, (include values and ± error bars.) Compare these measured values with the values in the GCVS.

OVERALL: THE LIGHT CURVE HAS BEEN DONE CORRECTLY. The possible conclusions from the light curve have not been drawn. The write-up is not (yet?) worked out properly.