X Cygni: Observations from 1886 until today

Working on a visual sky survey in 1886 in Cambridge (Mass.) US astronomer Seth Carlo Chandler (1846-1913) discovered the variability of this bright star, which can easily be reached with a handheld optic. Today we regard X Cygni as a classical cepheid. The light curve shows a hump in the rising branch and the O-C-Diagramm a considerable scatter. I discuss, how to read old reports of a maximum time. Rigorous selection admits 27 reliable historical observations between 1897 and 1939. Together with another 27 precise modern data these yield a revised linear ephemeris.

Before 1900 reports of a maximum time usually were won with the traditional normal lightcurve method. The observer put a pattern light curve on transparent paper upon the paper with his observed data points, looked for the best graphical fit and took a mark on the pattern curve as new time of maximum. If the pattern lightcurve showed too little details or a wrong asymmetry, this procedure yielded biased results, The first observers of X Cygni used pattern curves, that underrated the asymmetry of the light varation, and won systematically belated maximum times. This explains the bias to positive O-C-values before 1900 (Figure 1).

A slow and complicated light variation like the one of X Cygni needs at least 100 visual data points and requires a long observation period of several years. Even when only a small fraction of points near maximum will be needed to calculate the maximum time, data must show all details in order to differentiate properly the steep linear rise to maximum and the even, undisturbed part of decline after maximum. Reports of original observations give the reader the opportunity to inspect data sets and to derive own times of maximum. These subsequently derived times are reliable and deserve the greatest weights. Reported data, that have been mathematically processed and summarized in order to save printing place (e.g. all kinds of means and "normals") must be read cautiously and get reduced weights. Simple communications of a maximum time give no information on the number and distribution of the data points and deserve no weight.

I reviewed 208 times of maximum light of X Cygni and adopted 54 reliable observations, marked red in figure 1. Before 1948 (epoch 0 in the O-C-diagram) all adopted observations are visual or photographic, after that photoelectric. A linear fit yields new elements:

JD(max) = 2432966,10 + 16,38611 * E (n=54; 1897OKT...1996AUG; weights 1, 10 and 100)
± 10 6

These elements represent the selected data better than the reported GCVS-ephemeris (Diff.-t-test, alpha 0,05). The quadratic term of a parabolic fit comes with considerable mean errors. Applying the errors to the value of the term, I find possible term values on both sides of 0 and therefore cannot decide, whether the period is increasing or decreasing. 100 years' observations of X Cygni produce no evidence of a period change.

Figure 2 shows three data sets phased with the new elements. The ordinate is scaled in magnitudes. The individual zero point of each set has been moved to a graphically convenient place, but the spread of values has been left unchanged. As we would suppose, Dziewulski's photographic data cover a considerably greater range of magnitudes than Pickering's old visual and Kiss' recent photoelectric-(V).

References:
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SZABADOS: Comm.Konkoly Obs. Hung.Acad.Sci Nr. 77

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Figure 1

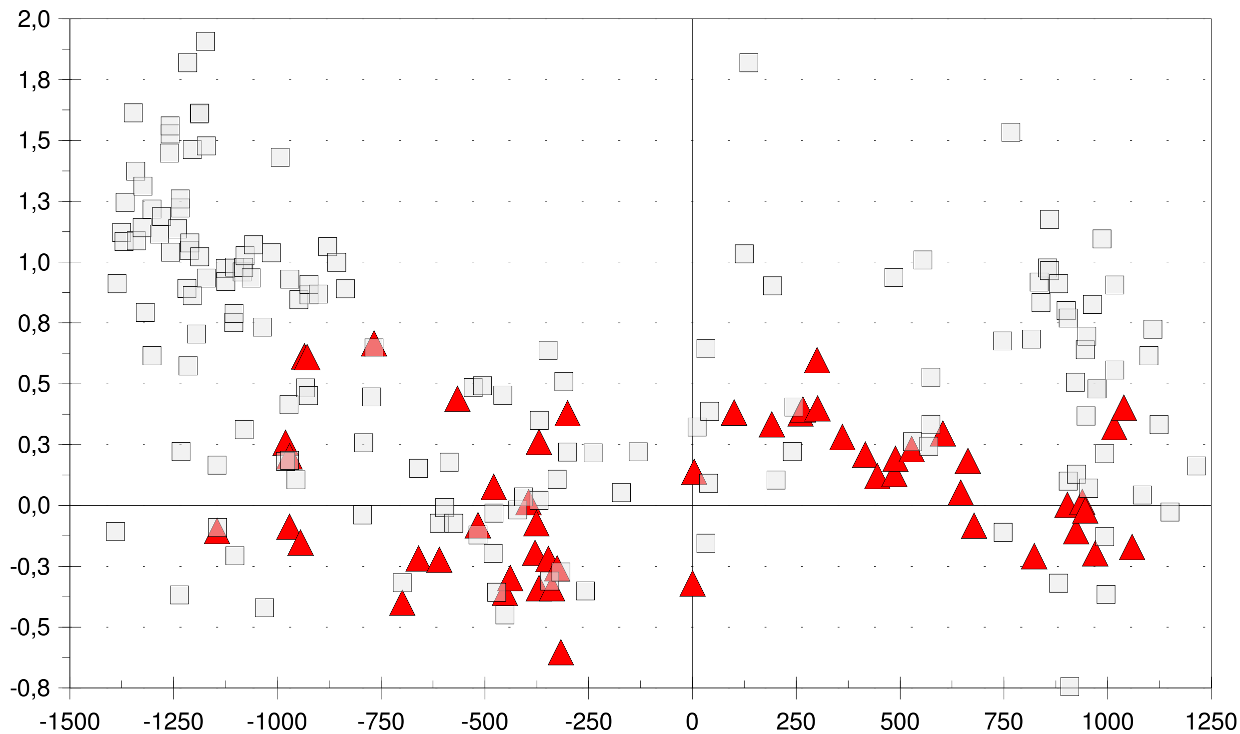

Figure 2