FOURIER TECHNIQUES FOR BINARY STAR ORBIT DETERMINATION

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The use of the Fourier transform in the computation of binary star orbits has many advantages over traditional (configuration space) analysis. The method can be applied to visual, spectroscopic and astrometric binaries, as well as to visual binaries where only the separation or position angle is known. While this technique requires the use of a digital computer, the algorithms for implementation of the solutions for the various types of binary star motion are quite similar. A description of the implementation of the astrometric binary solution will be presented along with a discussion of the various estimators for the significance of the derived orbital elements obtained in the course of the solution. If time permits, a summary of some Monte Carlo investigations of the effects of observational noise and temporal sampling on the derived orbital elements will be presented.

DISCUSSION

HARRINGTON: I certainly agree that the period problem, if it exists in one method, will exist in all of them.

MONET: One nice thing about going through and filtering sine waves is that you get a plot of essentially all possible periods, and you know when you are in serious difficulty with aliasing, which is something you don't get if you guess a solution and iterate blindly. This is a brute force way, but it does seem to help.

SCARFE: When you say "half an orbit", or "a fraction of an orbit", do you mean half in time, or half the true anomaly range, or something else?

MONET: As far as I could resolve with my rather simplistic approach, it was half the observed radial velocity range in the case of spectra, i.e. going from maximum V to minimum V. It essentially comes down to how well you can fit a sine wave, which will tell you the period. If you think of most of the signal as being in the lowest harmonic for any reasonable eccentricity, you look at the data and see if you have any hope of drawing a sine wave through it. If you have a slanted segment, forget it. If you have something that begins to define what the maximum apparent amplitude is, then the phases are all taken care of.

STRAND: The cases where the latus recti are known from the observations are the cases where the orbit can be determined based upon only the fraction of the orbit between these two points. A typical case is Iota Cas.

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