

Star Position Issues

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Why do these “Issues” matter?

- Invalidates uncertainty statistics for star position
- Invalidates uncertainty statistics for occultation path prediction

Sources of “Issues”

- Known multiple stars
- Proper motion issues

Known Multiple Stars

- Identification of multiple stars
 - Washington Double Star Catalog
 - Interferometry Catalog
 - Occultation records
 - Visual inspection of images

Known Multiple Stars

- “Wide” multiple stars
 - Roughly 5” separation or greater
 - AND no significant orbital movement expected over roughly 20 year timeframe
- Should be a “non-issue” for statistics

Known Multiple Stars

- “Mid-range” multiple stars
 - Roughly 3” to 5” separation
 - If orbital solution exists (rare), MAY be able to generate reasonable SWAG at uncertainty for the position of the components.
 - If no orbital solution, errors could be much larger than formal uncertainty statistics => big problem.
 - Almost always invalidates formal uncertainties.

Know Multiple Stars

- “Close” multiple stars
 - Less than 3”
 - UCAC usually won’t provide positions for separate components.
 - Difficult to generate reasonable uncertainties even when orbital solution exists (very rare).
 - Path shift could be much larger than formal uncertainties.
 - Almost always invalidates formal uncertainties.

Known Multiple Stars

- “Spectroscopic” Multiple stars
 - No orbital solutions
 - Path shift could be much larger than formal uncertainties.
 - Always invalidates formal uncertainties

Known Multiple Stars

- General rule
 - If we don't have an orbital solution for the components of a multiple star system, the formal uncertainties of the star position (and path prediction) are invalid. And therefore we cannot trust the statistics of the overall path prediction. The actual path of the occultation may shift much farther than expected from the formal statistics.
 - NO good fix. No way to reliably estimate path uncertainty.

Proper Motion Issues

- Sources of proper motion issues
 - Input data problems
 - Multiple stars – orbital motion

Proper Motion Issues

- Input Data Problems
 - Older epoch observations
 - Reference frame not accurate due to zonal issues
 - Poor stellar image (particularly for bright stars)
 - Short time frame
 - Too few observations or observations span relatively short timeframe.
 - Star is too dim or too bright for instrumentation.

Proper Motion Issues

- “Unknown” Multiple Stars
 - Orbital motion of multiple star can lead to large errors in proper motion solution unless orbital motion is part of the model.
 - When short term proper motion solutions (Hipparcos) do not match long term proper motion solutions (FK6), this is standard “warning” that the star has more than one component.

Proper Motion Issues

- Unknown Multiple Stars
 - Hipparcos catalog (original) places a notation (acceleration solution) where the Hipparcos observations “imply” a possible orbital motion.
 - HIP2 catalog (revision to Hipparcos) resorts to a “non-standard” solution for stars where the motion does not fit a standard proper motion. This can also indicate a possible double star.

Proper Motion Issues

- Identifying proper motion issues
 - Hipparcos and FK6 catalogs flag some situations.
 - Comparing proper motions across multiple catalogs (UCAC2, UCAC3, HIP, PPMXL, Tycho2) to look for statistically significant variations in proper motion across catalogs.
 - Large variations with no reason to doubt the input data imply a good chance of a multiple star.

Proper Motion Issues

- Estimating uncertainties
 - If proper motion issues indicate a strong possibility of a multiple star, there is no reliable method for estimating uncertainty in the star position or path prediction.
 - If there is less chance of a multiple star and reason to doubt the input data, we can probably pick a “mid-point” and enlarge the uncertainty to include the various catalog positions.

Star Position Issues

- Multiple stars are always a problem and almost always invalidate the formal statistics.
- Proper motion issues are always a problem and often invalidate the formal statistics.

Star Position Issues

- Multiple stars and Proper motion issues are noted in the web page for many of the events posted on asteroidoccultation.com
- I only do a “full evaluation” of these issues if I know that someone is likely to observe the event.
- If you see a notation about an issue with the star, be cautious and ask for more information before observing.