

Terminology for mutual events in binary asteroid systems

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Mutual events in binary asteroid systems

In a binary asteroid system in specific binary-observer-Sun geometries, there occur events when one body occults the other for the observer or casts a shadow from the Sun onto the other. Such events are collectively called **mutual events**. In lightcurve observations of the unresolved binary, they produce brightness attenuations.

Mutual events are generally of 4 types:

Primary/Secondary Eclipse/Occultation

Primary Eclipse – The secondary casting a shadow on the Primary.

Secondary Eclipse – The primary casting a shadow on the Secondary. (In other words, the Secondary is passing through the shadow of the primary.)

Primary Occultation – The secondary passing in front of the Primary (obscuring a part of it) for the observer.

Secondary Occultation – The primary passing in front of the Secondary for the observer.

Events can be **Total** or **Partial**. Total event is when the projected profile of the secondary is fully within the projected profile of the primary as seen from the Sun (for total eclipse) or by the observer (for total occultation).

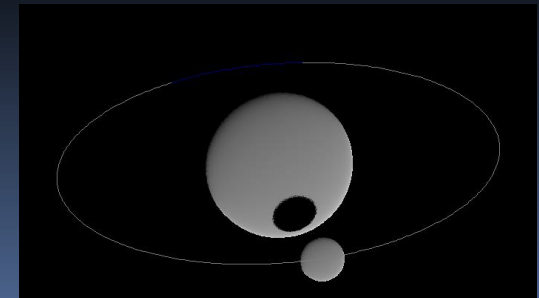
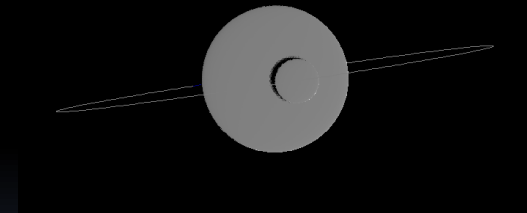
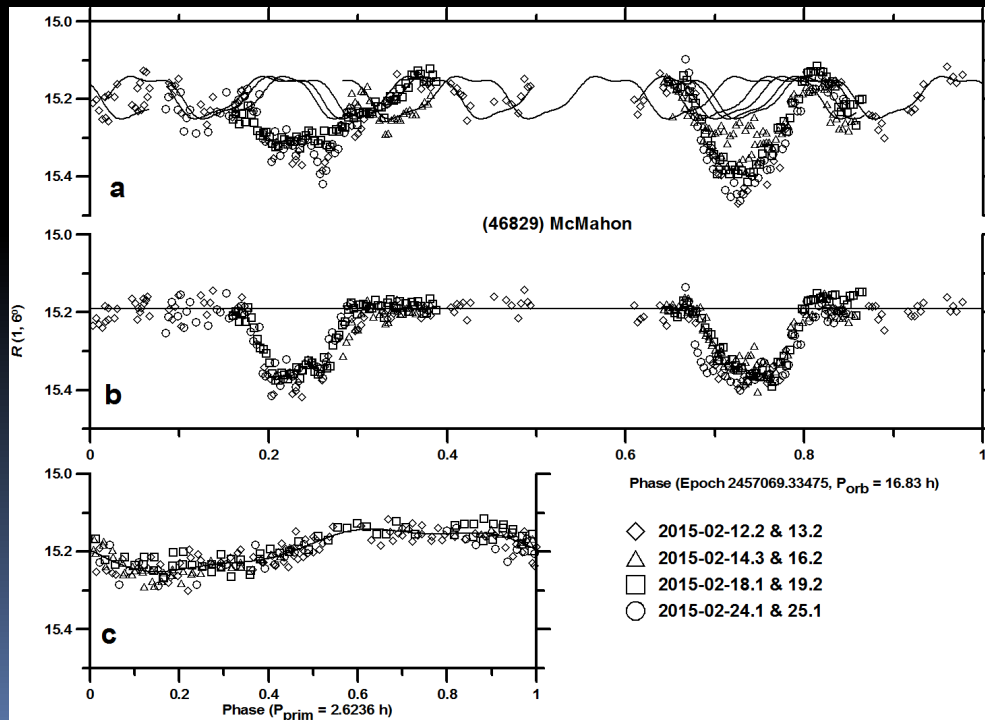
Examples

Single-type mutual events

Occultations or eclipses occur, but not both types.

Seen either at zero solar phase, or at (relatively) large solar phases with the binary in event configuration for only the observer (for occultations) or only the Sun (for eclipses).

Primary and secondary events have same (or similar) depths and shapes. We usually cannot resolve directly which of the two events that occur per one orbit period is primary and which is secondary with observations in such geometry.

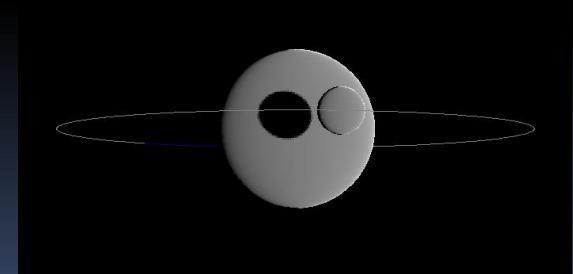
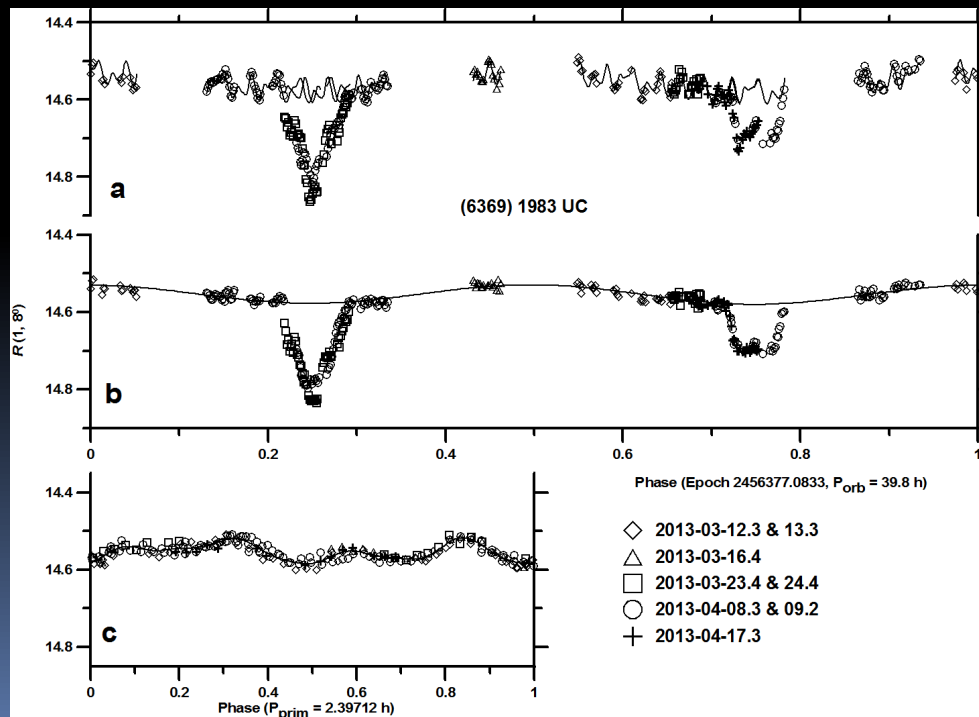


(Pravec et al. 2019)

Two/Double-type mutual events (medium solar phases)

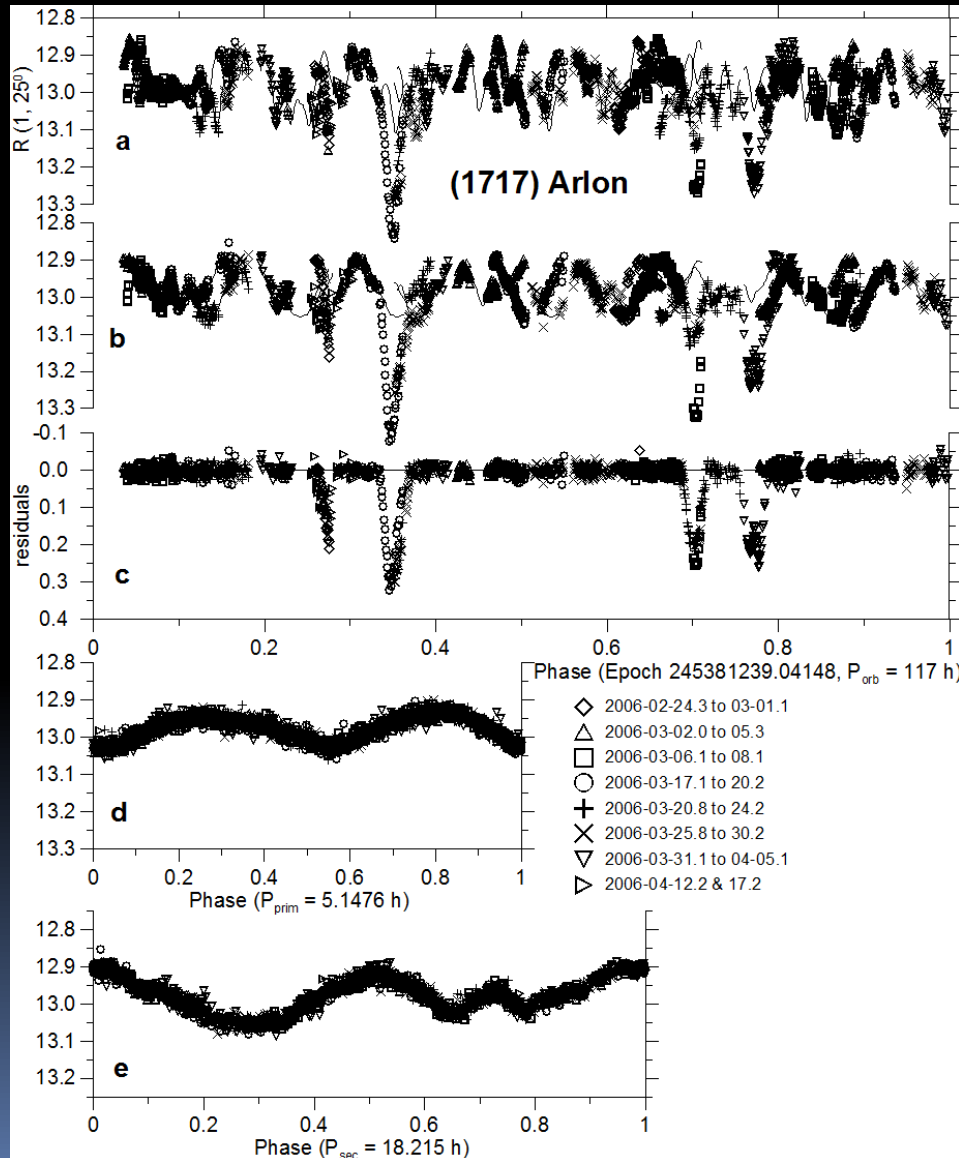
Both occultations and eclipses occur, overlapping one each other.

Primary events are deeper than the secondary events, as the total projected area of the primary that is obscured by or in a shadow from the secondary is greater than the total projected area (cross section) of the secondary.

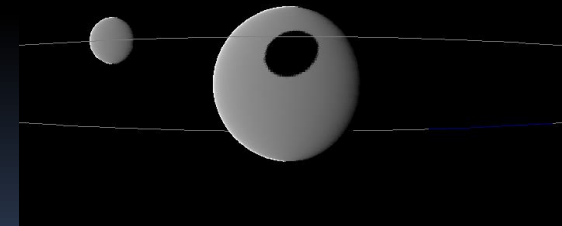


(Pravec et al. 2019)

Two/Double-type mutual events (large solar phases)

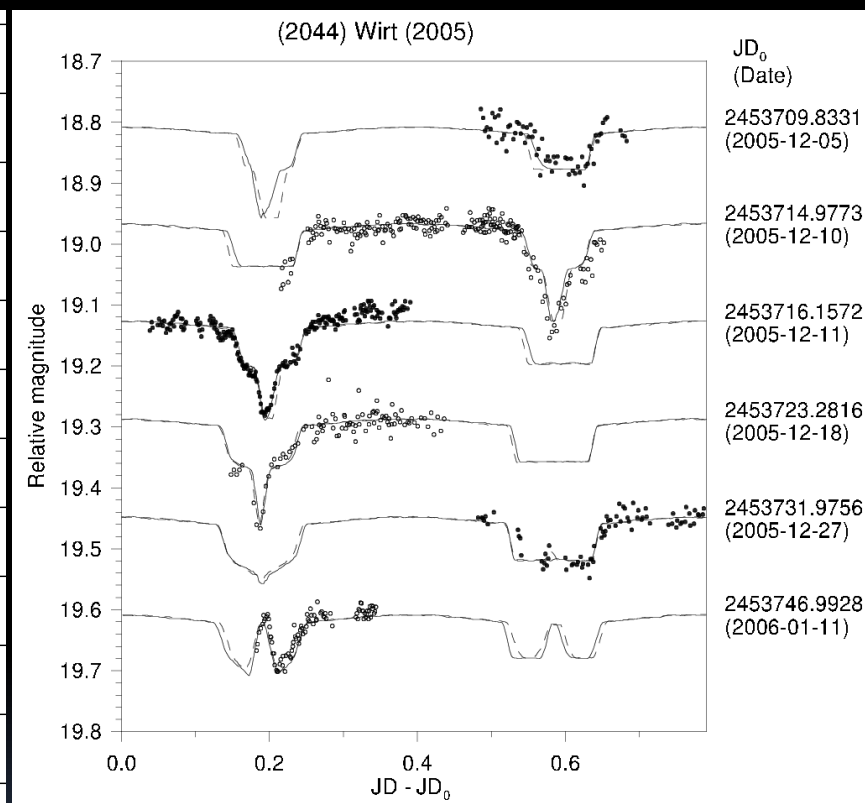
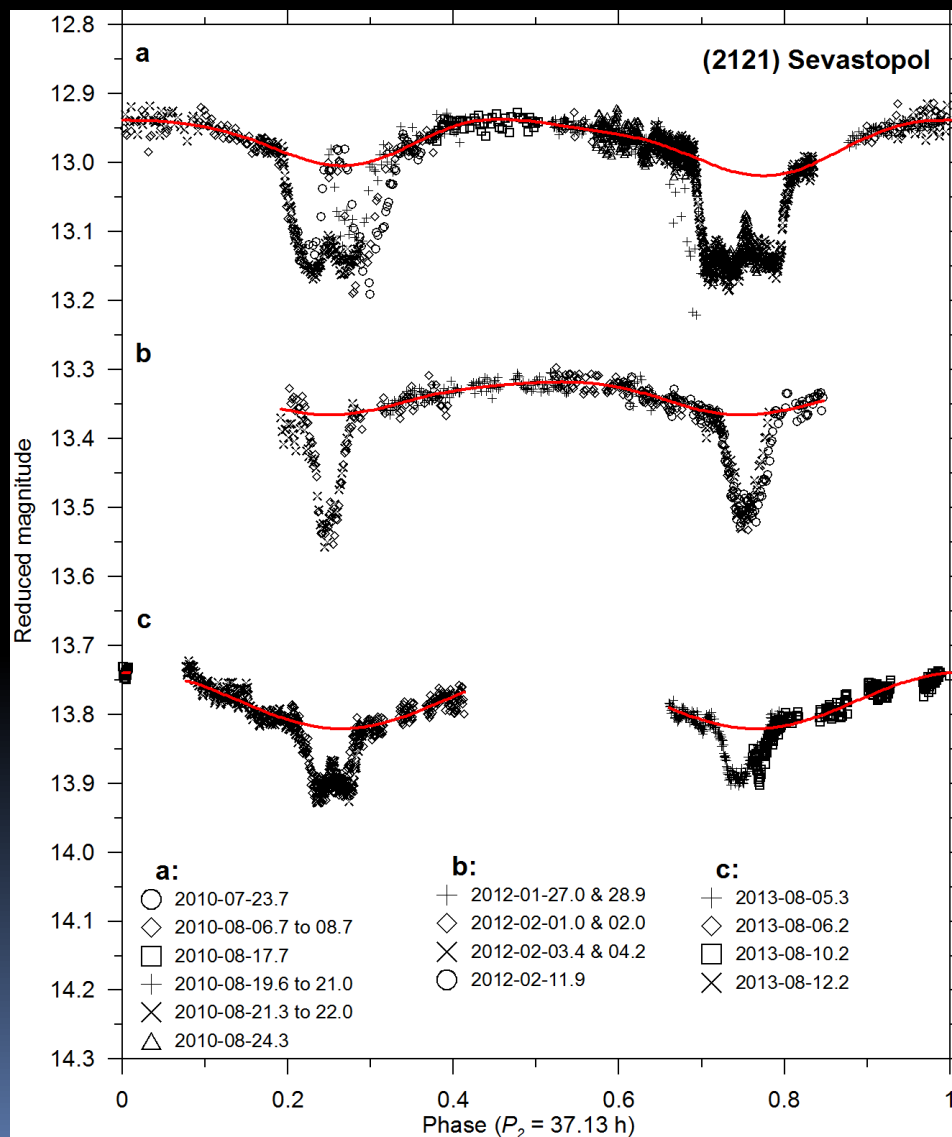


Both occultations and eclipses occur, but they are spatially/temporally separated.



Note: At medium-large solar phases, the occultations and eclipses may be only partly separated, showing a W-shaped double event, with the central peak having lower height.

Evolution of mutual events with changing binary-observer-Sun geometry



(Pravec et al. 2012)

(Pravec et al. 2016)