The Fascinating World of The Short Arc Binaries

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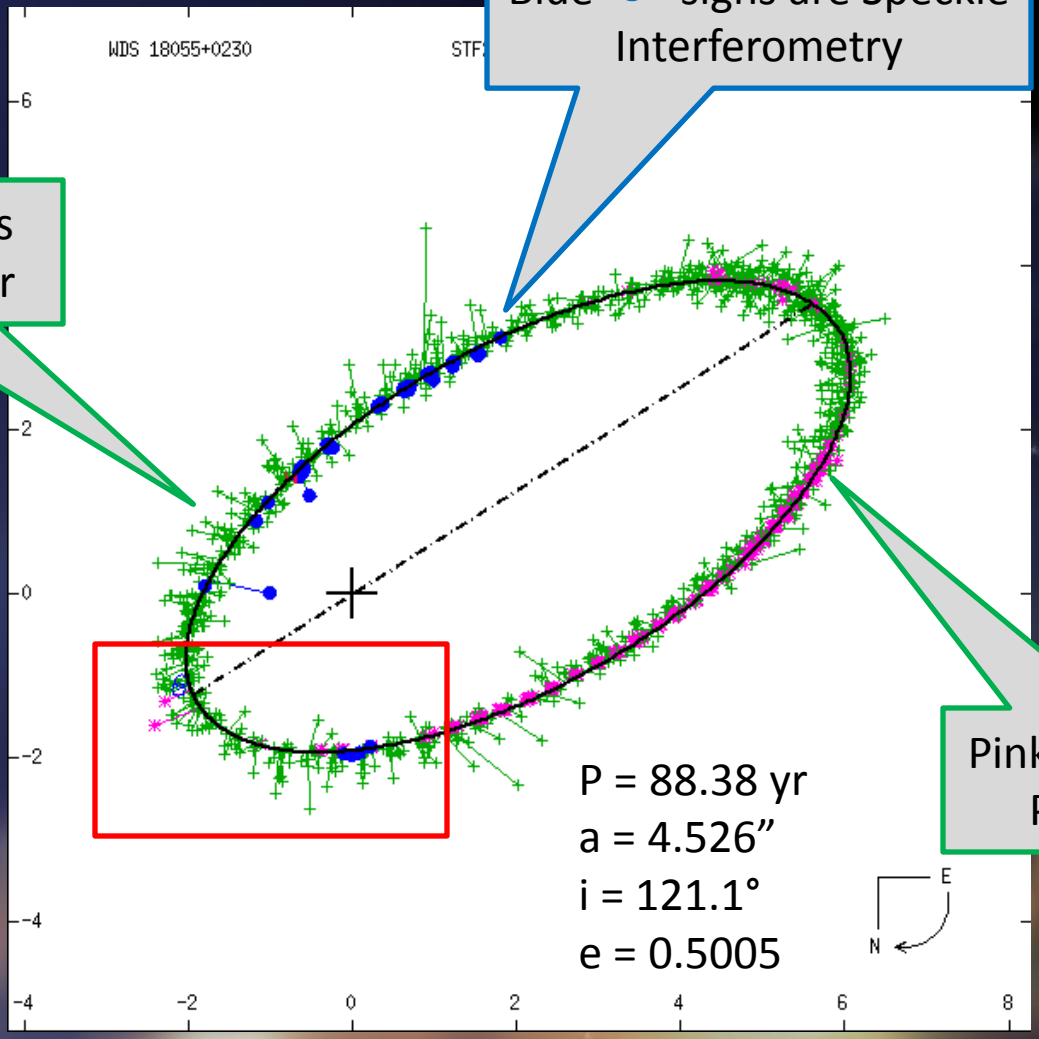
What is a Short Arc Binary?

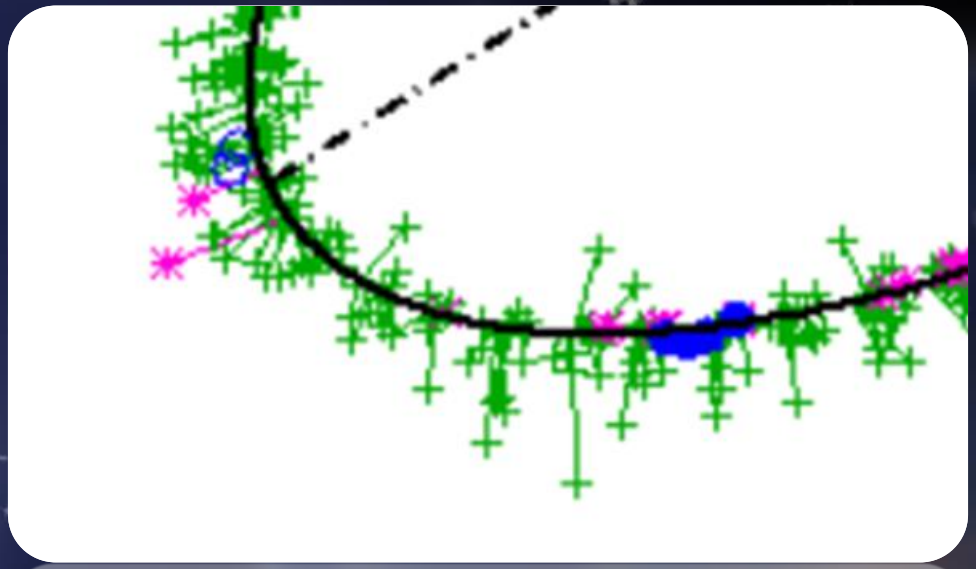


Blue“●” signs are Speckle Interferometry

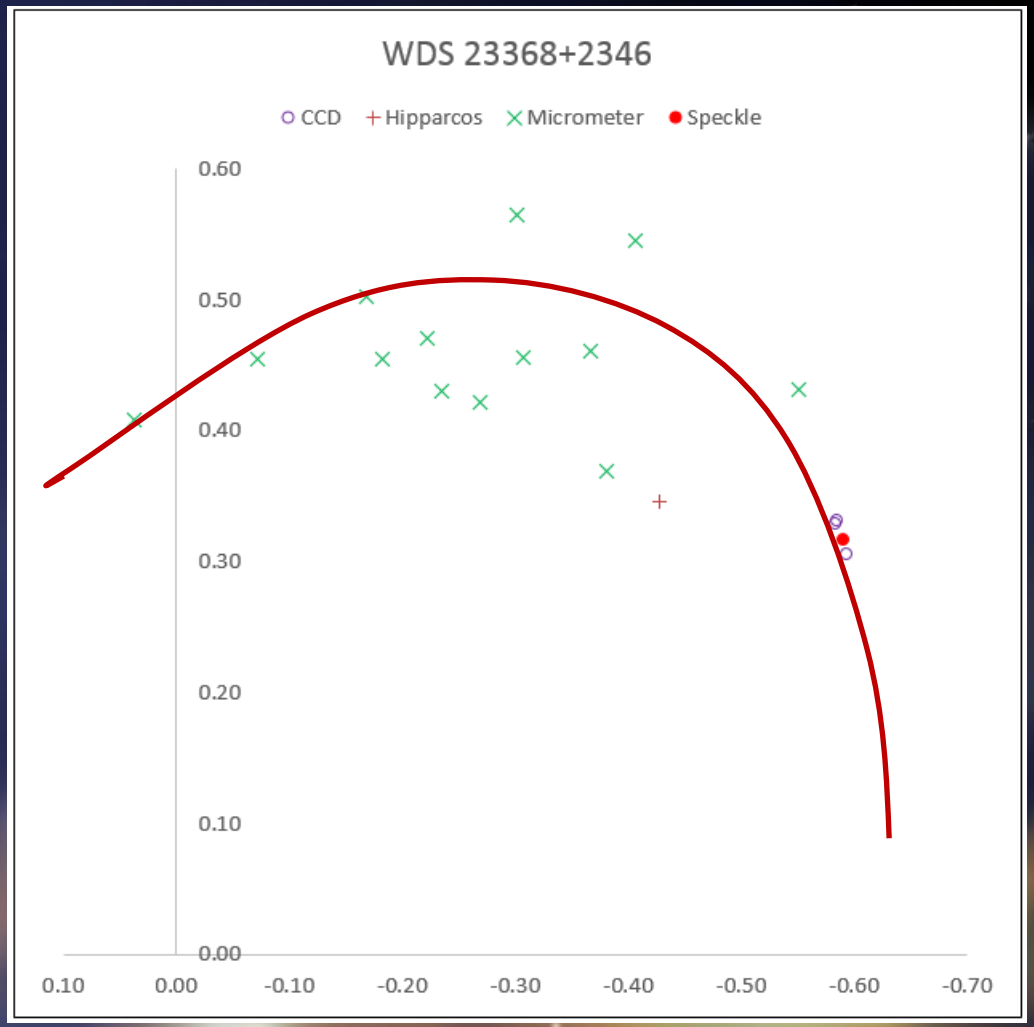
Green “+” signs are Micrometer

Pink “●” signs are Photograph

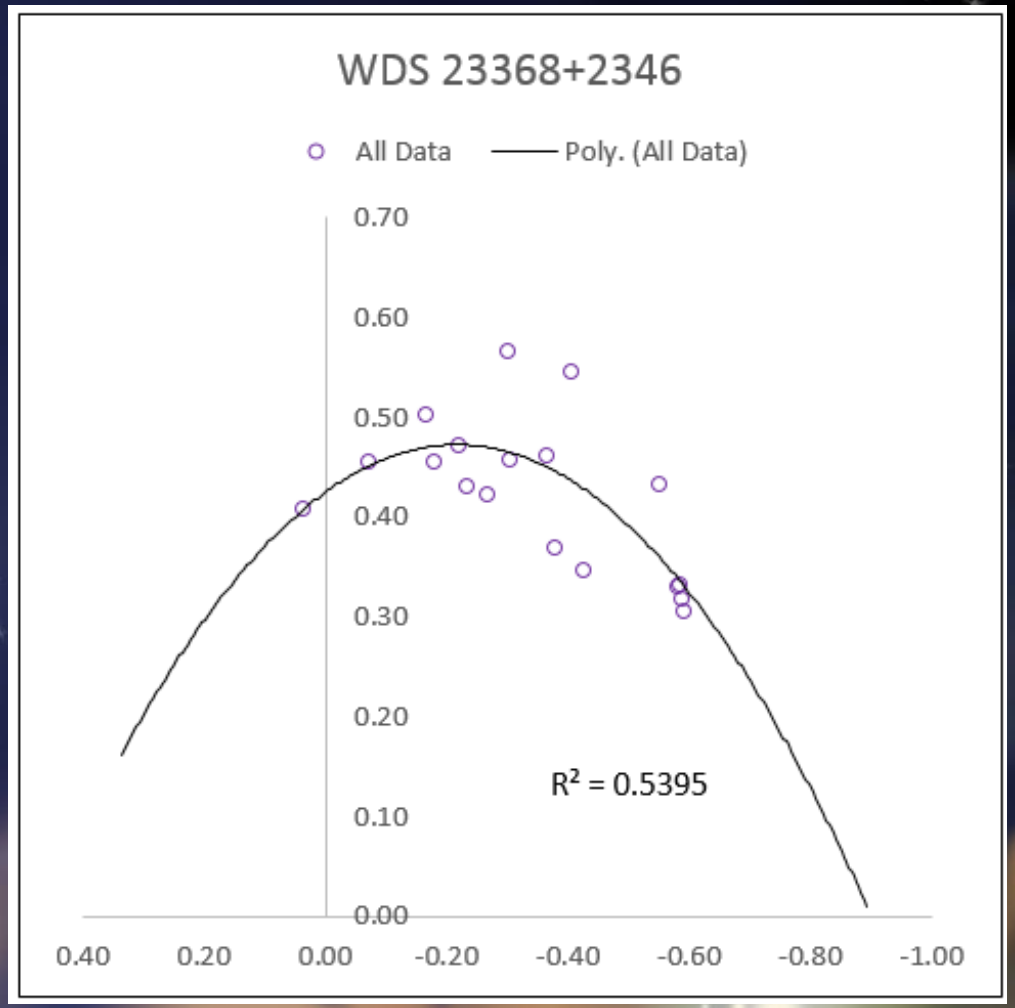
See the “Short Arc?”



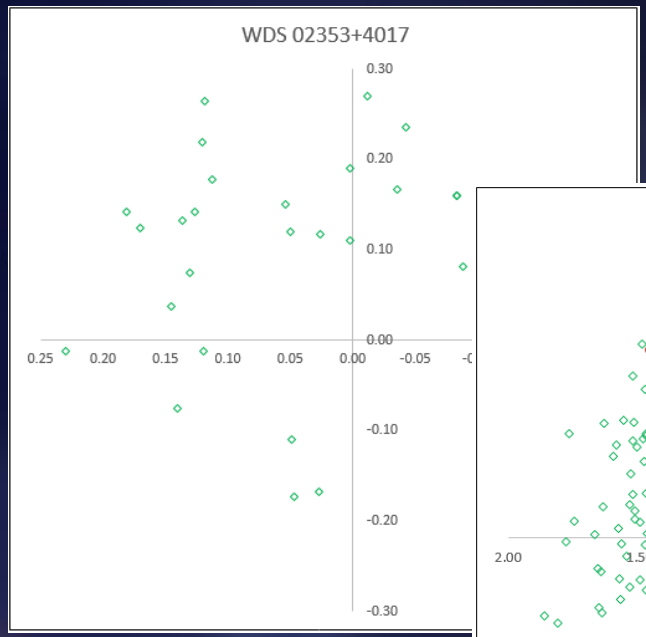
Classic Example

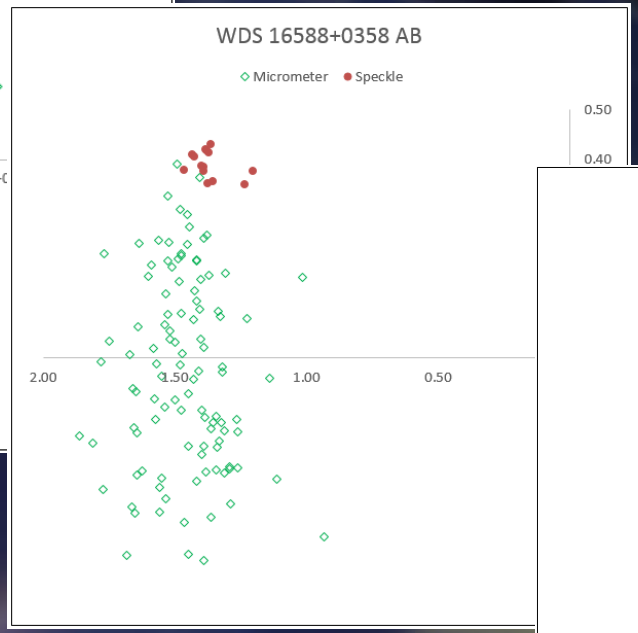


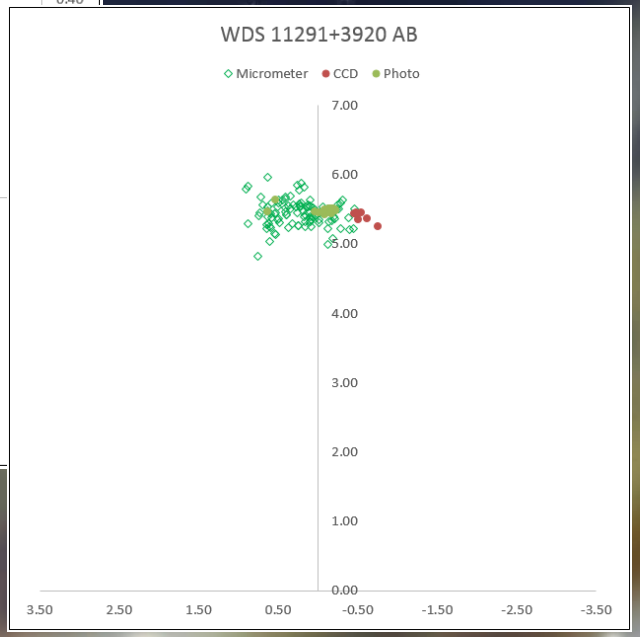
Actual Plot


WDS 23368+2346
All Data
Poly. (All Data)
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
R^2 = 0.5395
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00

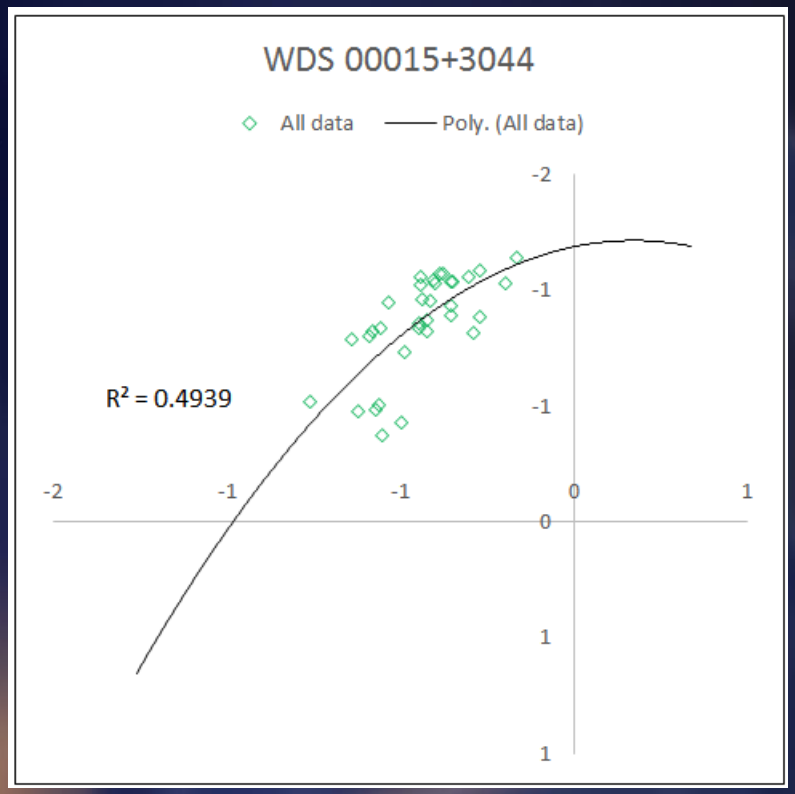
Varying Degrees of Arcing

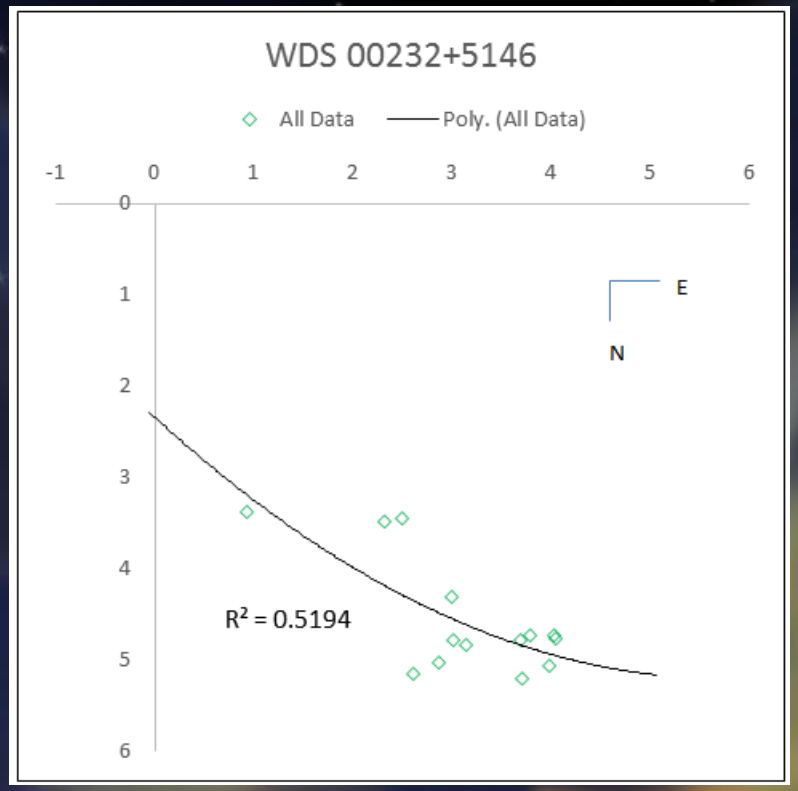






Not Always Short Periods!

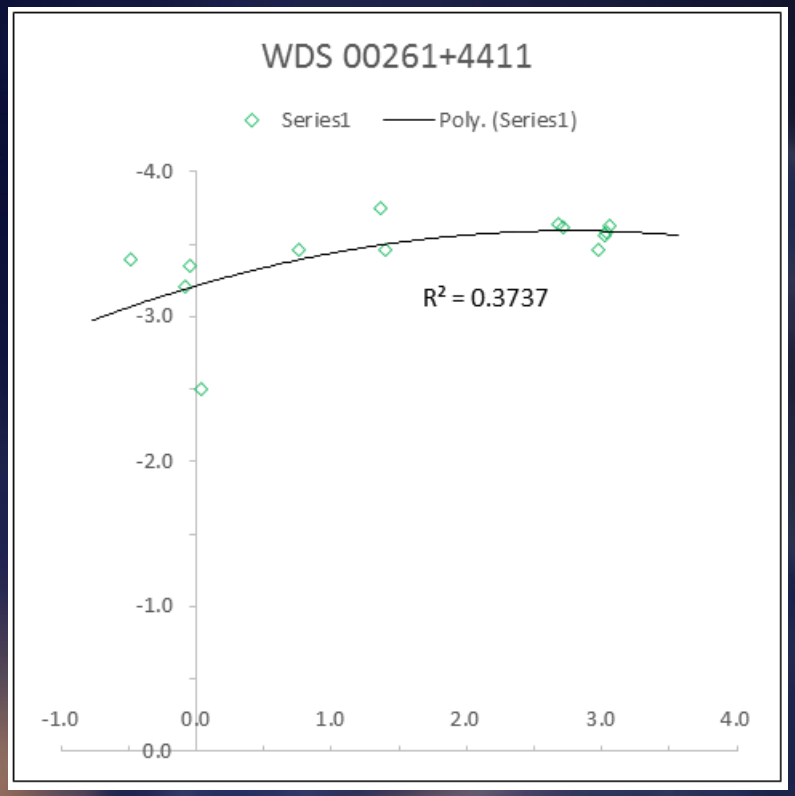




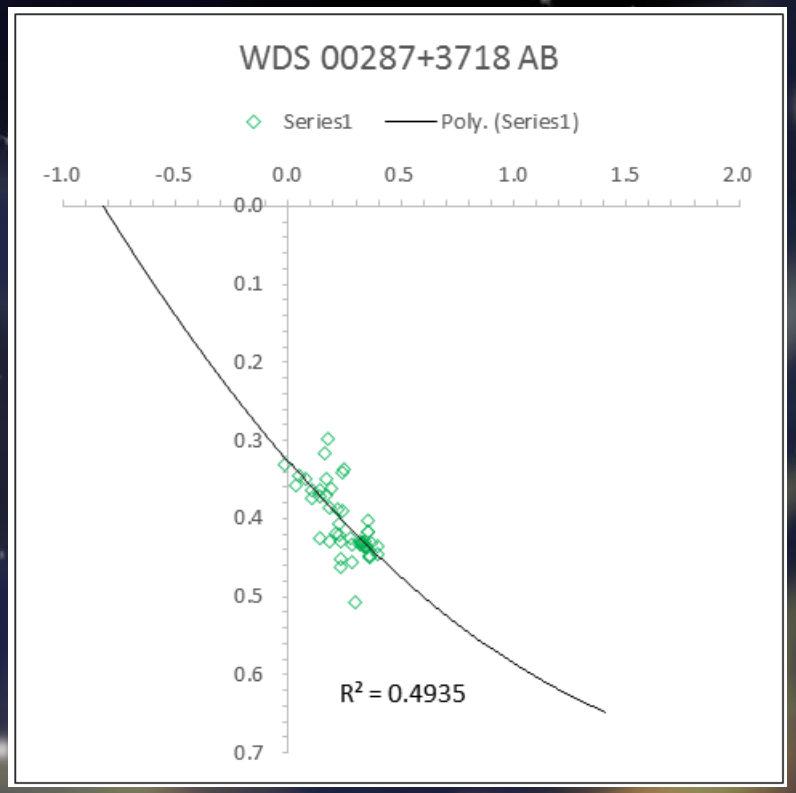
1884 to 2009
125 years of data

1828 to 2011
183 years of data

More examples



1878 to 2007
129 years of data



1908 to 2008
100 years of data

The Most Interesting Binaries

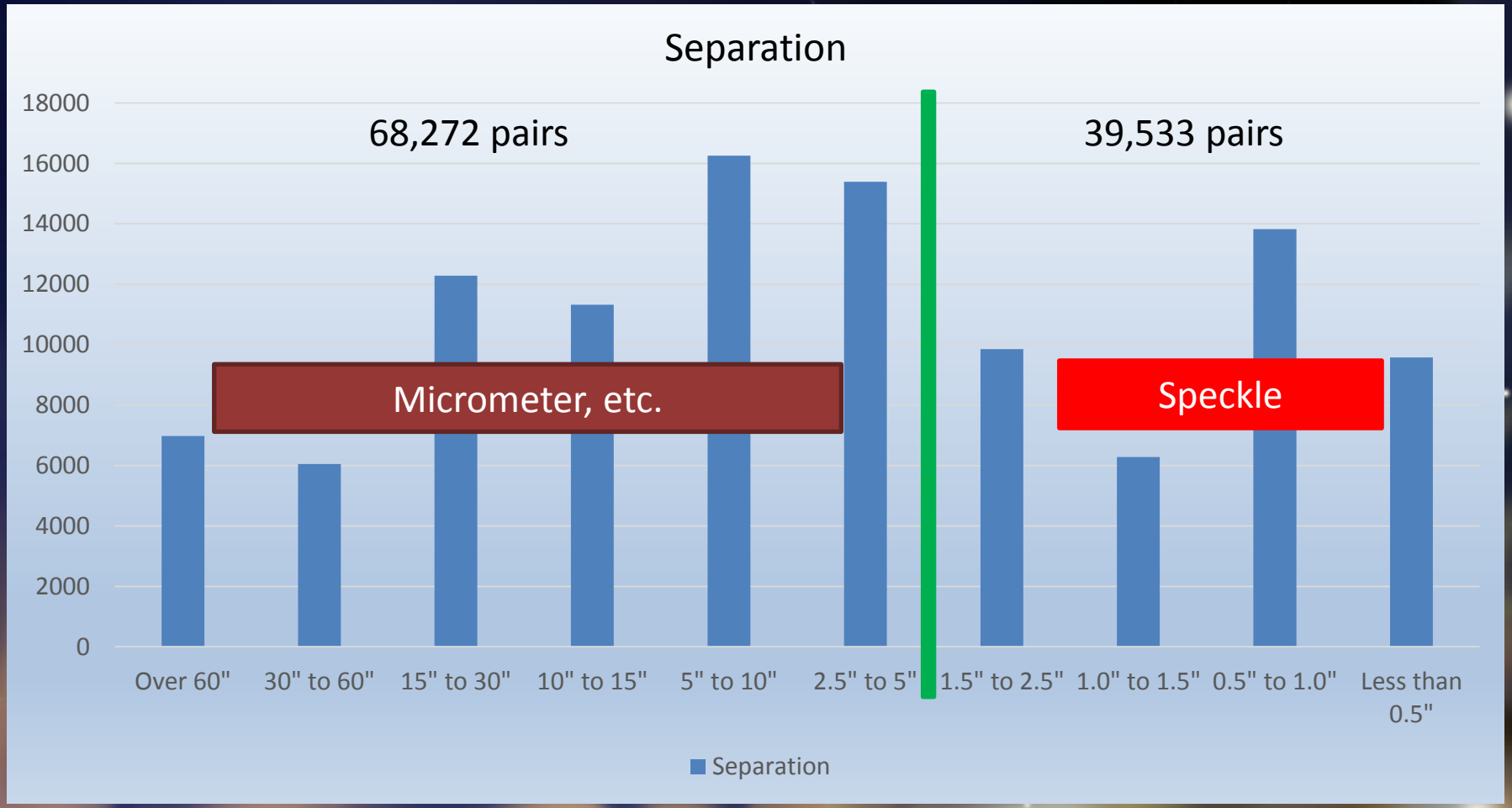
Need to have relatively short periods so we can “weigh” the stars

This in turn lets us fine-tune the H-R Diagram

Short periods imply very close separations

Wide pairs may take up to a million years to orbit; it may take millennia to gather enough data to solve the orbit

The Stats on the WDS



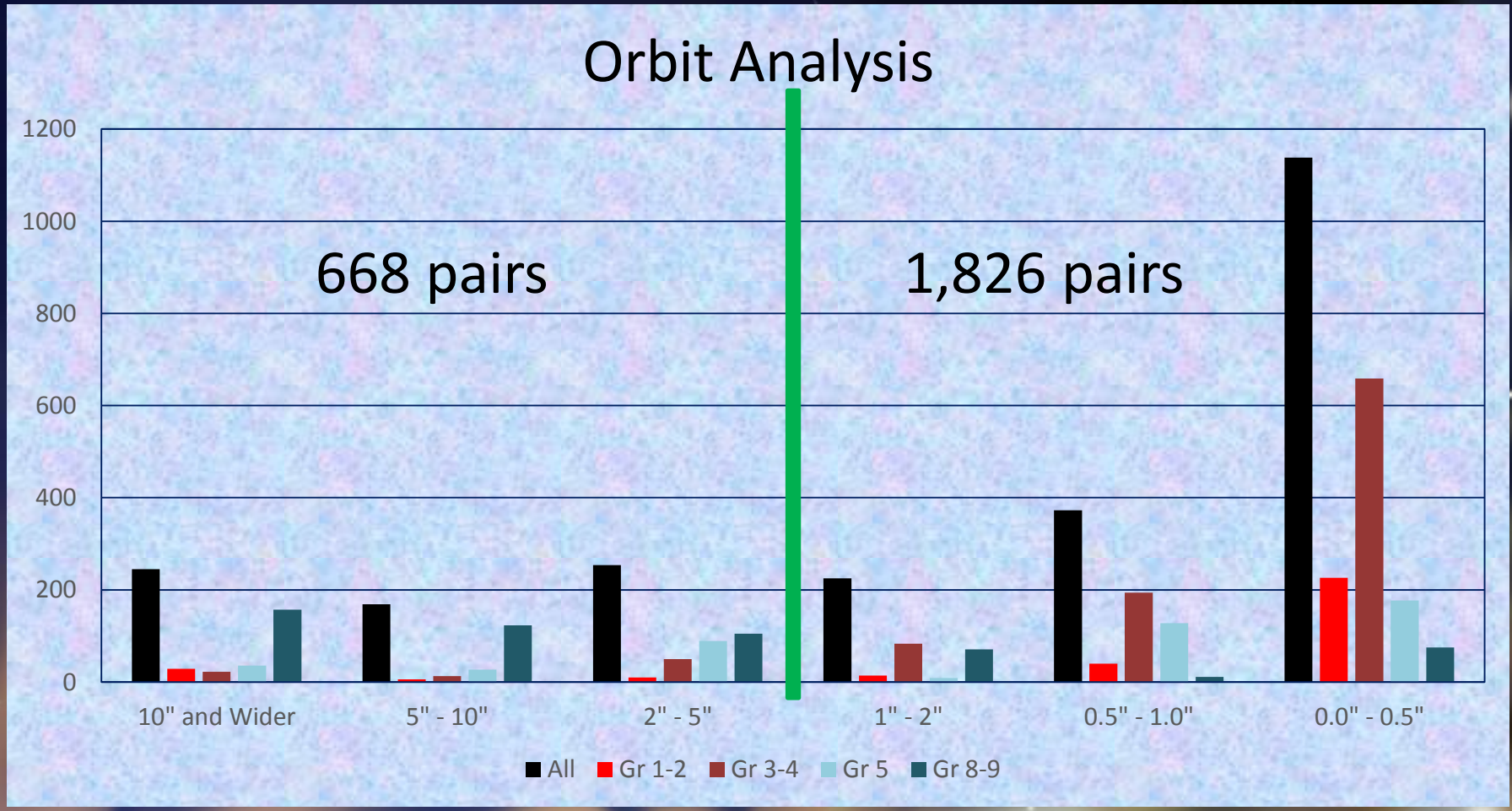
The 6th Catalog of Orbital Elements

2,494 Orbits

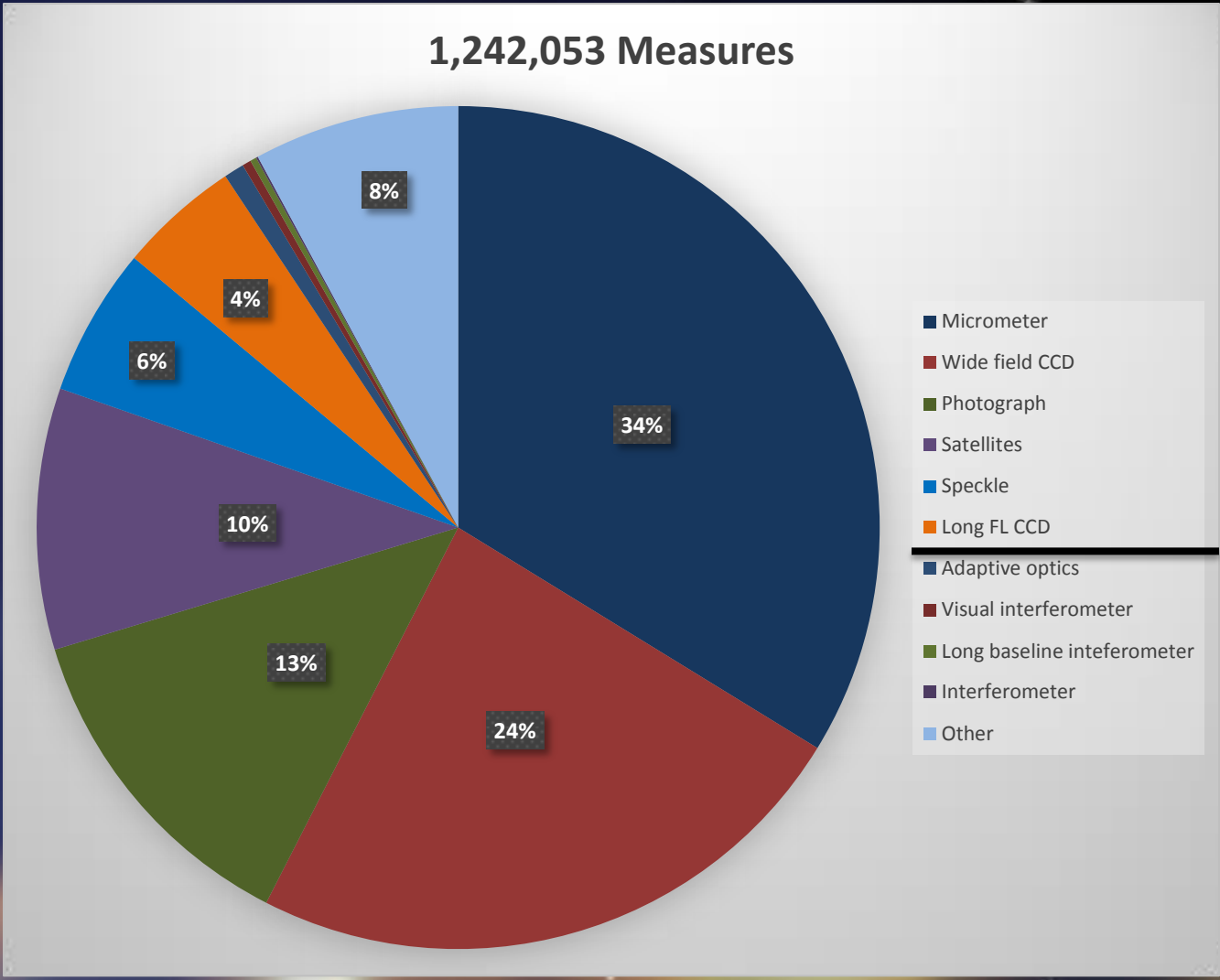
Masses computed on several hundred stars

Orbits are graded from 1 (very good) to 9 (very iffy)

The 6th Catalog of Orbital Elements



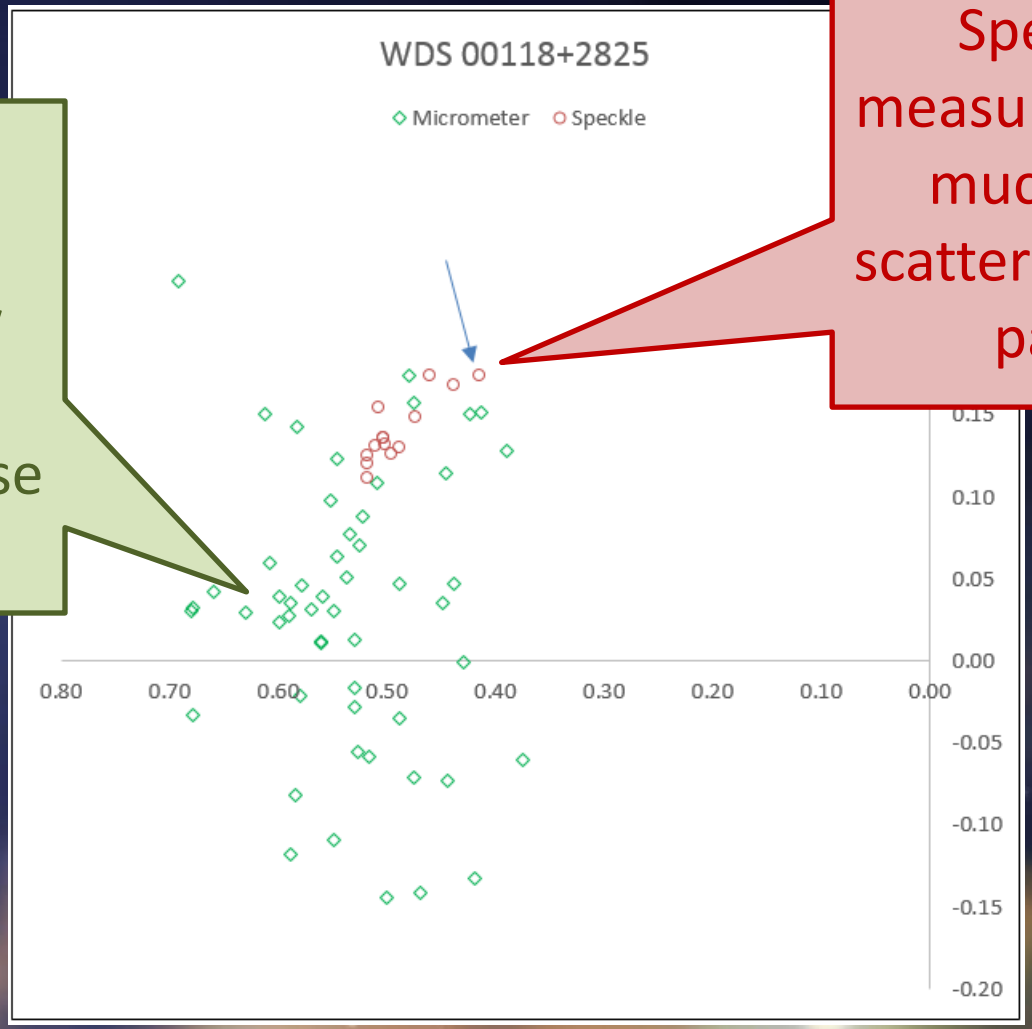
Summary of Measures



Useful Range by Method

Method	Mean ρ
Visual interferometer	**0.21**
Interferometer	**0.27**
Long baseline interferometer	**0.45**
Speckle interferometry	**1.23**
Adaptive optics	3.85
Micrometer	10.09
Long FL CCD	23.08
Photograph	29.39
Wide field CCD	49.25
Satellites	78.24

Why Speckle is Important



Micrometric measures always show significant scatter on close pairs

Speckle measures show much less scatter on close pairs

Great! We have an arc. Now what?

Collect more measurements until an orbit can be computed.

May take lots of time– even generations!

The closer the pair the more likely it is to have a relatively short (~few hundred years) orbital period if it is binary at all.

Another Method

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Criteria to Determine the Nature of Double Stars: the Stellar Masses

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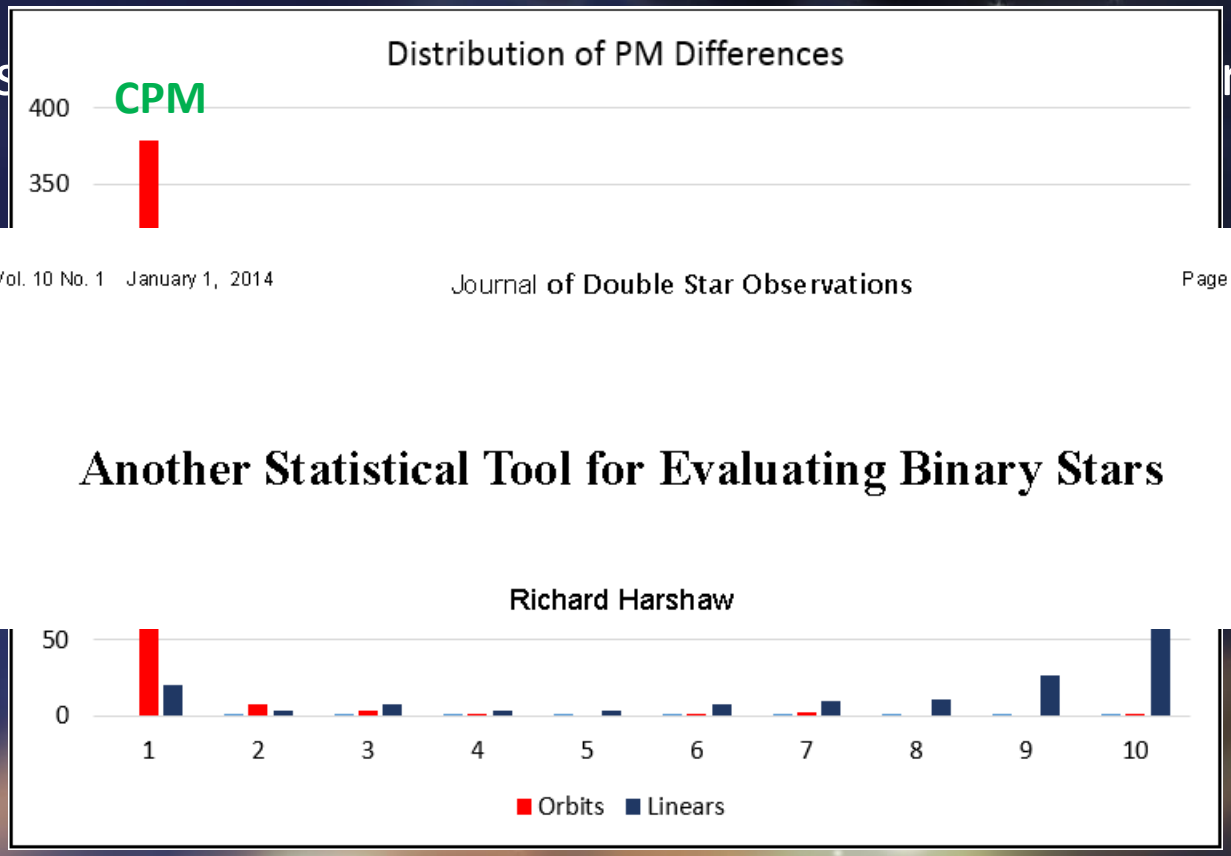
Escape velocity

Abstract: In this article several works that relate projected separations (in AU) and stellar masses of double stars are reviewed. The plots made in this work could be used to detect optical pairs, especially when there is no other way to determine the nature of a pair of stars.

Other Clues to Binality

Common proper motion (GAIA will hopefully be a huge help here)

Parallaxes rcos)



Questions?