Planetary Collisions around Low-mass Stars:
Constraining the Timescale for Collisions and Testing the Origin of the *Kepler* Dichotomy

2019 NHFP(b?) Symposium

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UC San Diego
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The “*Kepler* Dichotomy”

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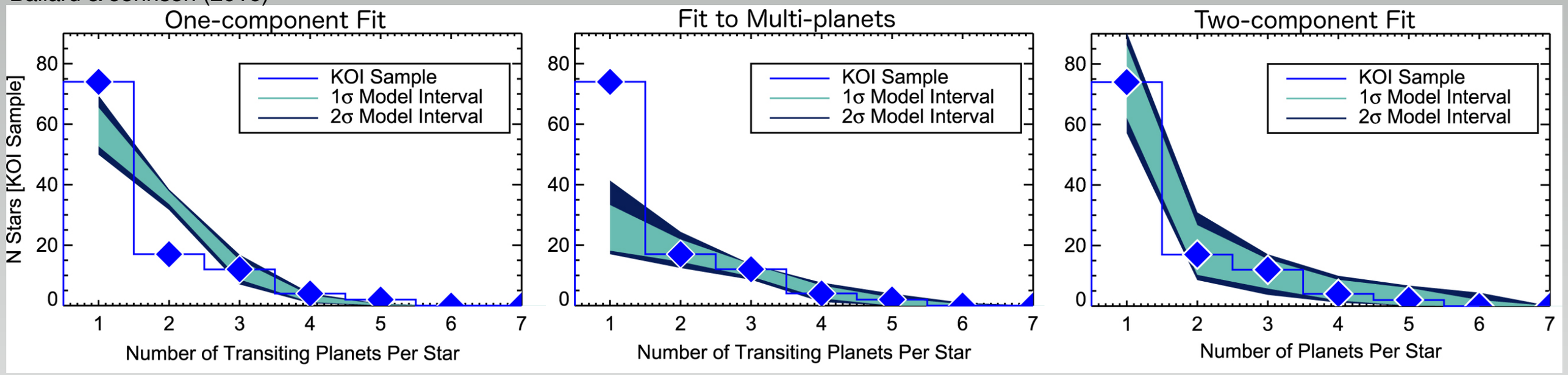
to the number of multi-planet systems. When we fit only for observed numbers of multi-planet systems, the number of singly transiting systems is underpredicted, and the additional single planet systems that would be needed to make up this deficit are not included in f_p. In contrast, when we use a non-zero Poisson distribution for the true number of planets per star hosting at least one planet, then some stars are assumed to host one planet, and these are included as planet hosts in computing f_p.

Lissauer+ (2012)

The "*Kepler* Dichotomy"

Ballard & Johnson (2016)



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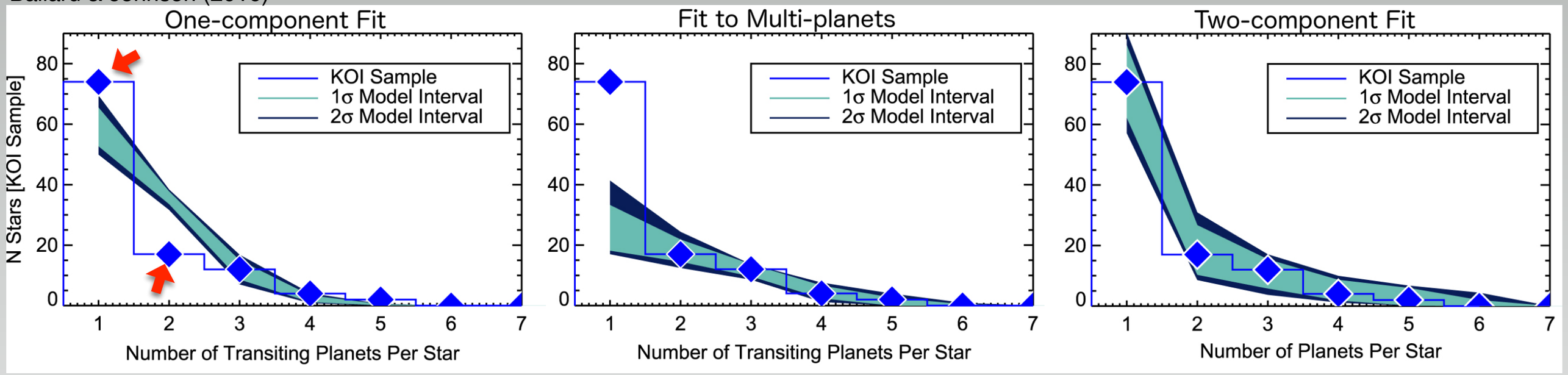

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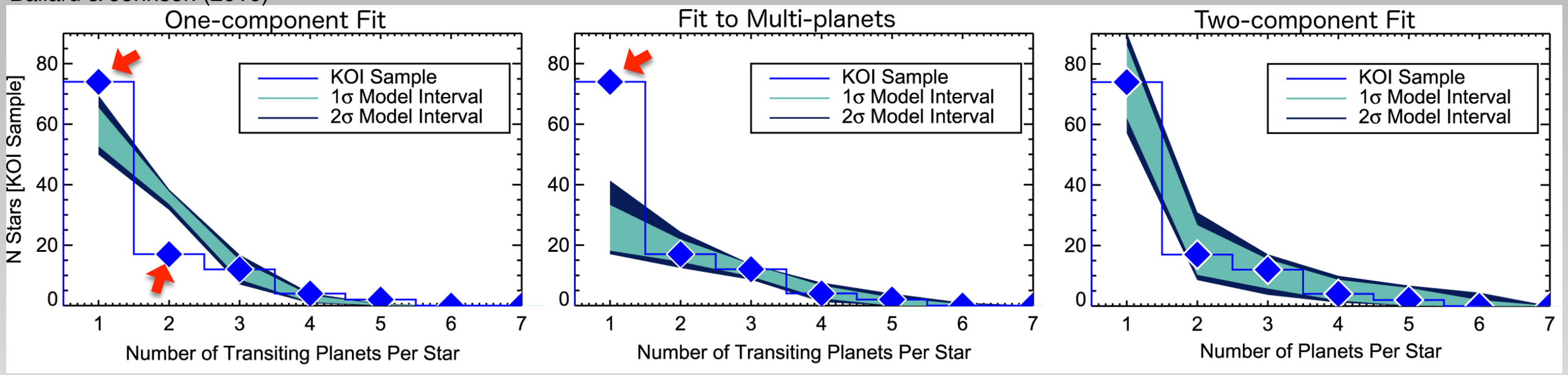

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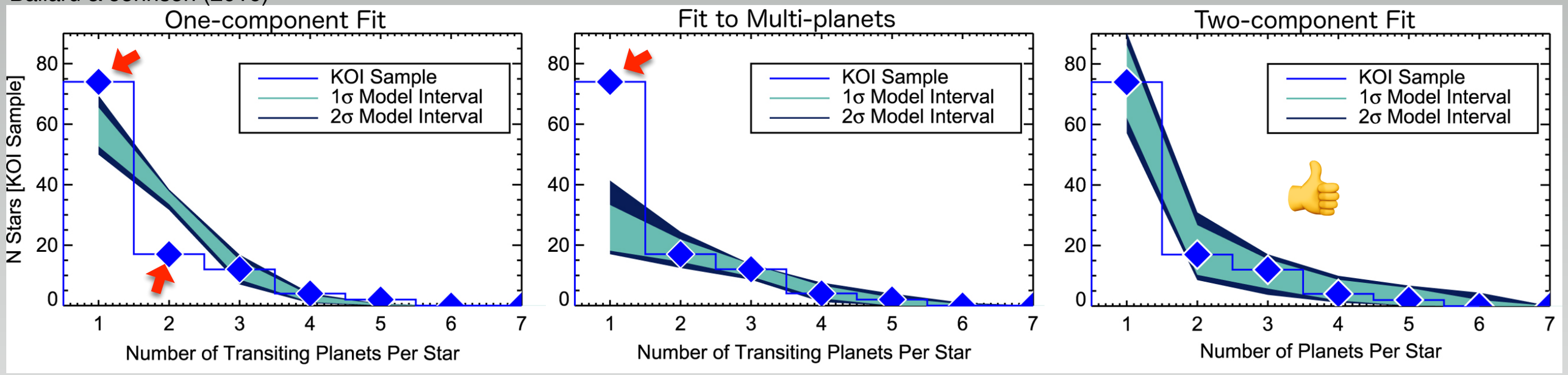

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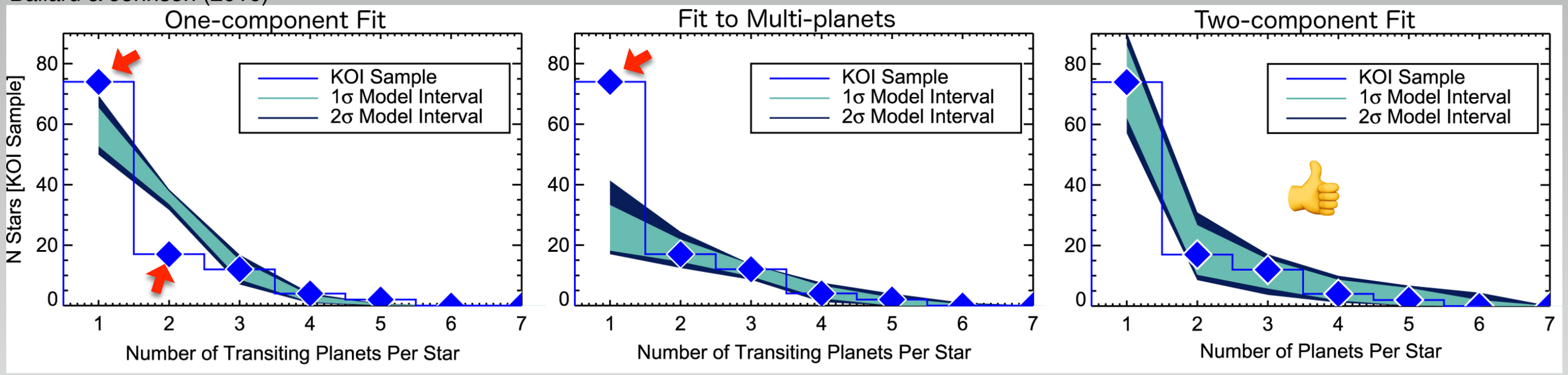

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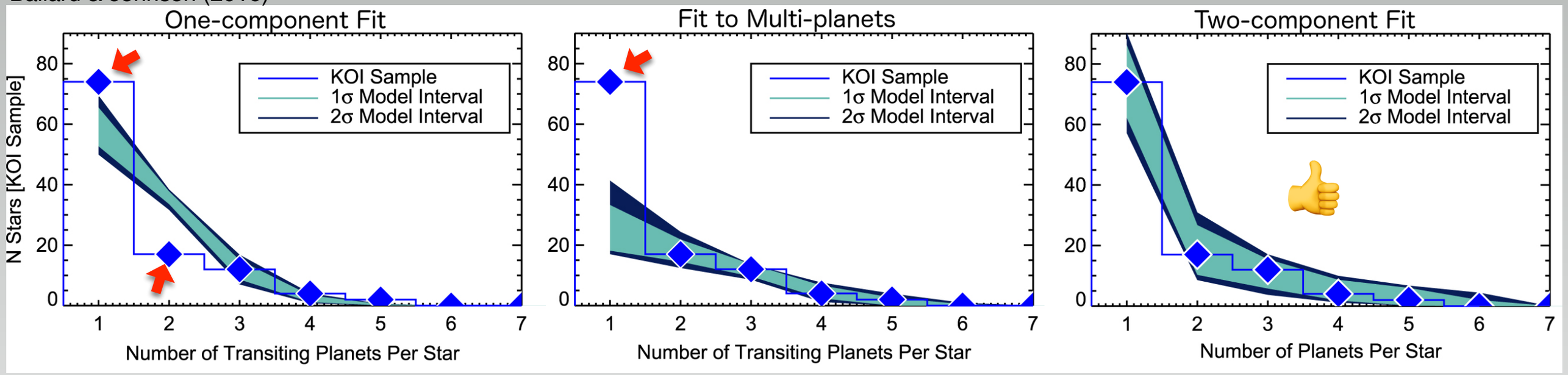

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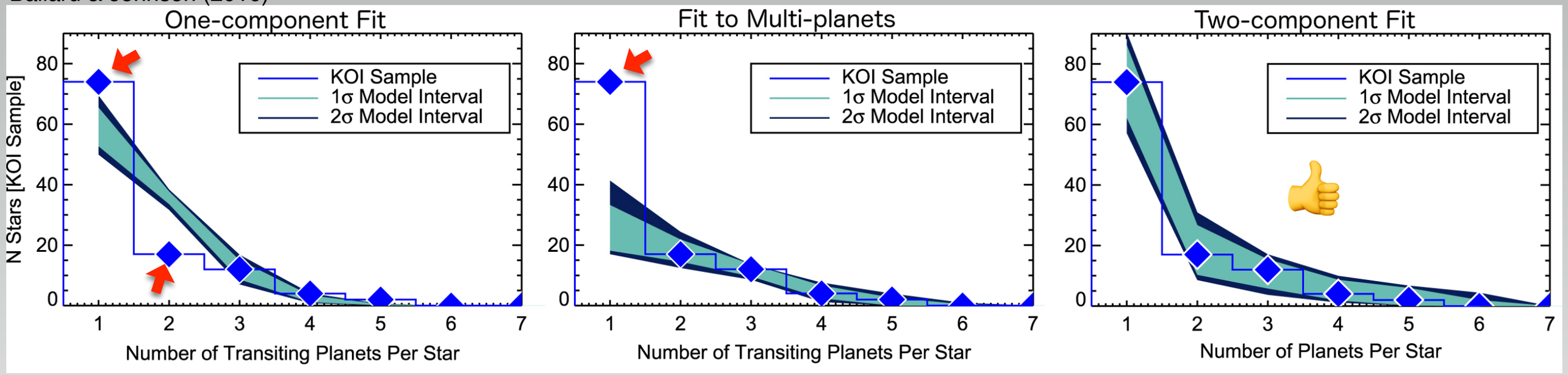

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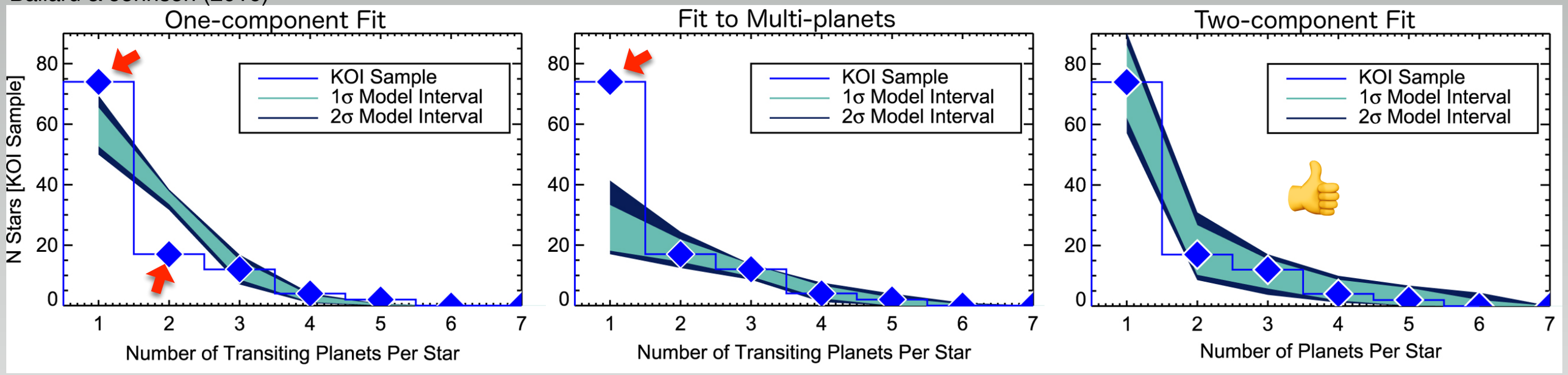

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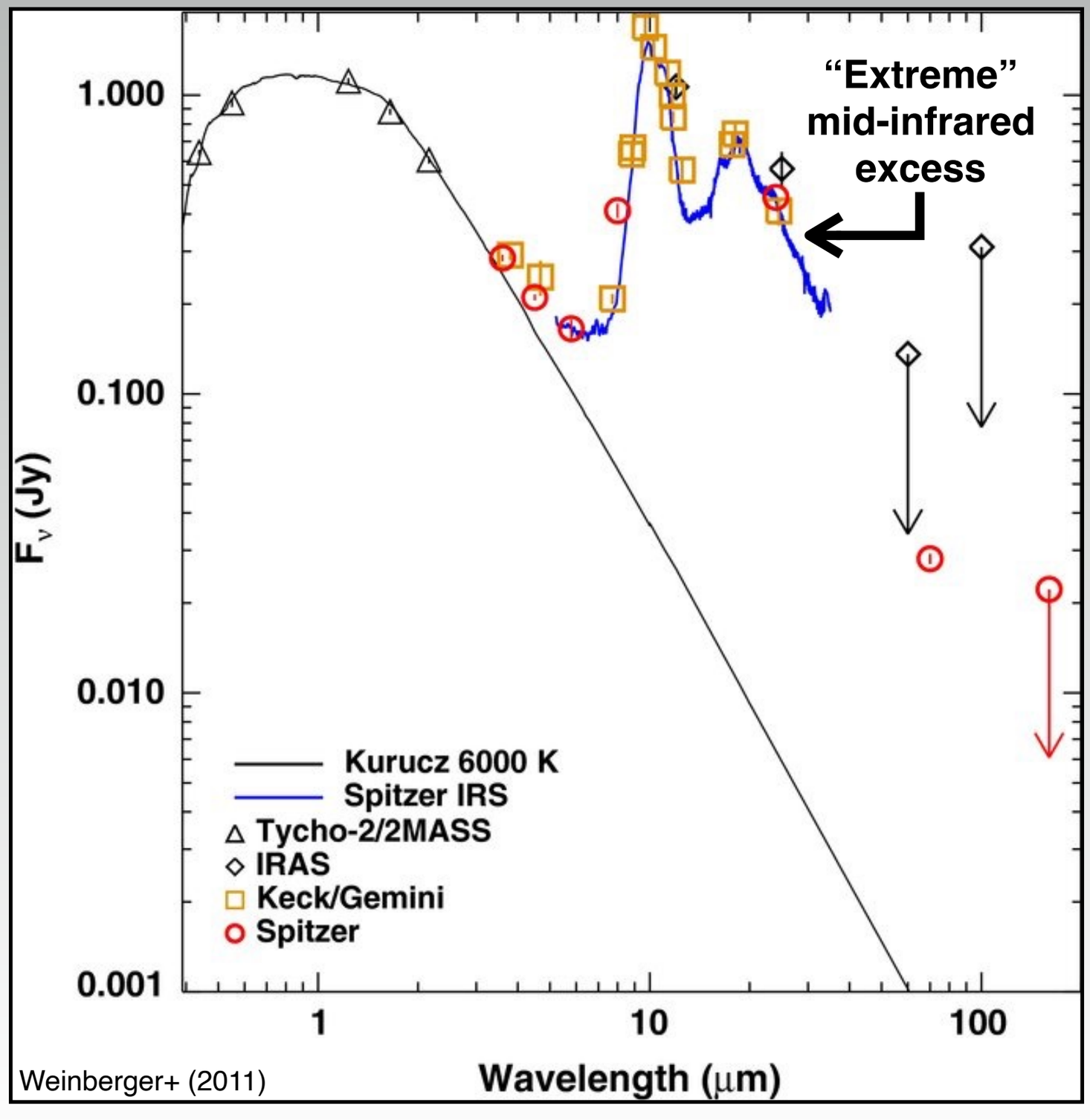

Weinberger+ (2011)

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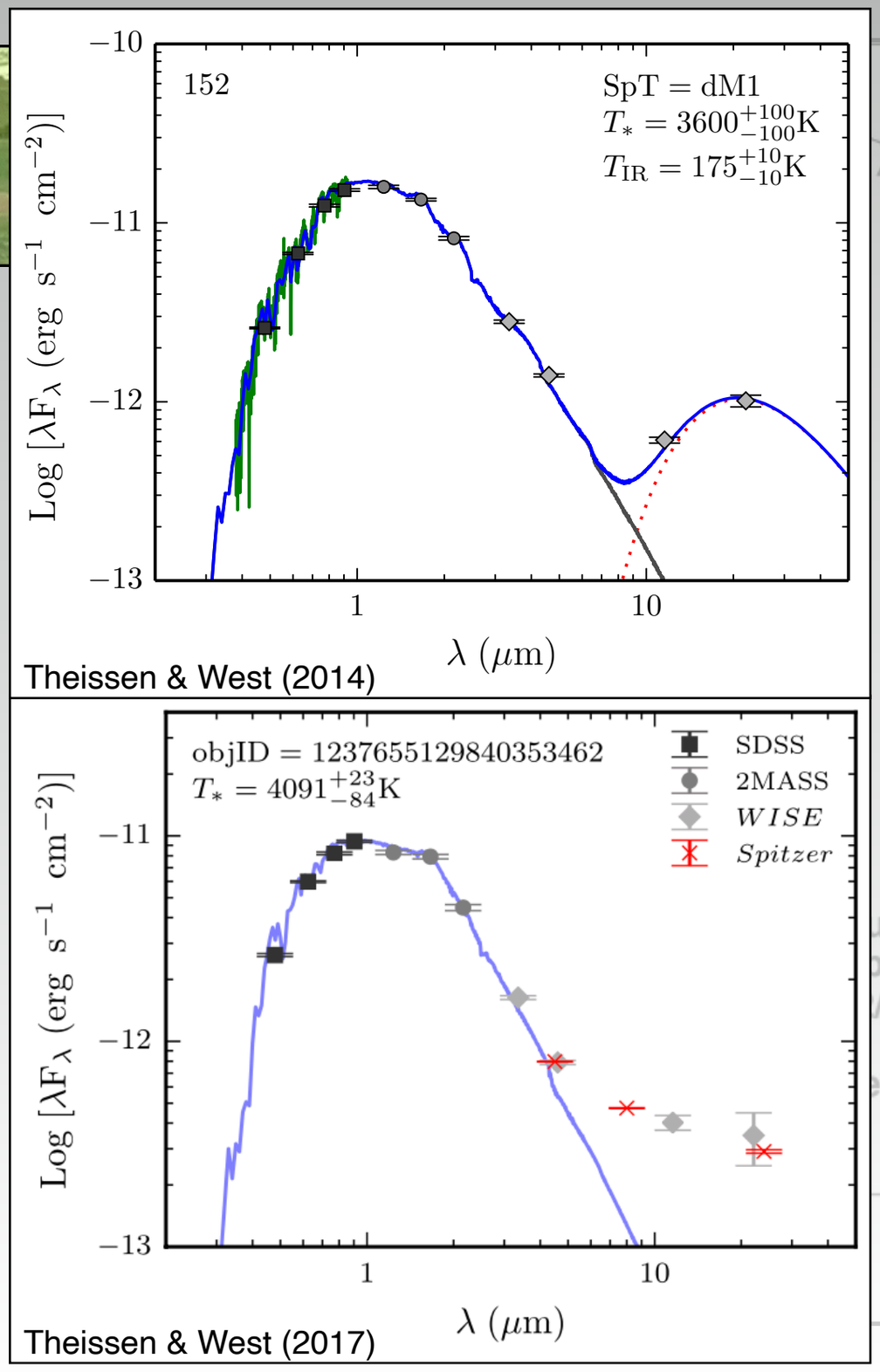

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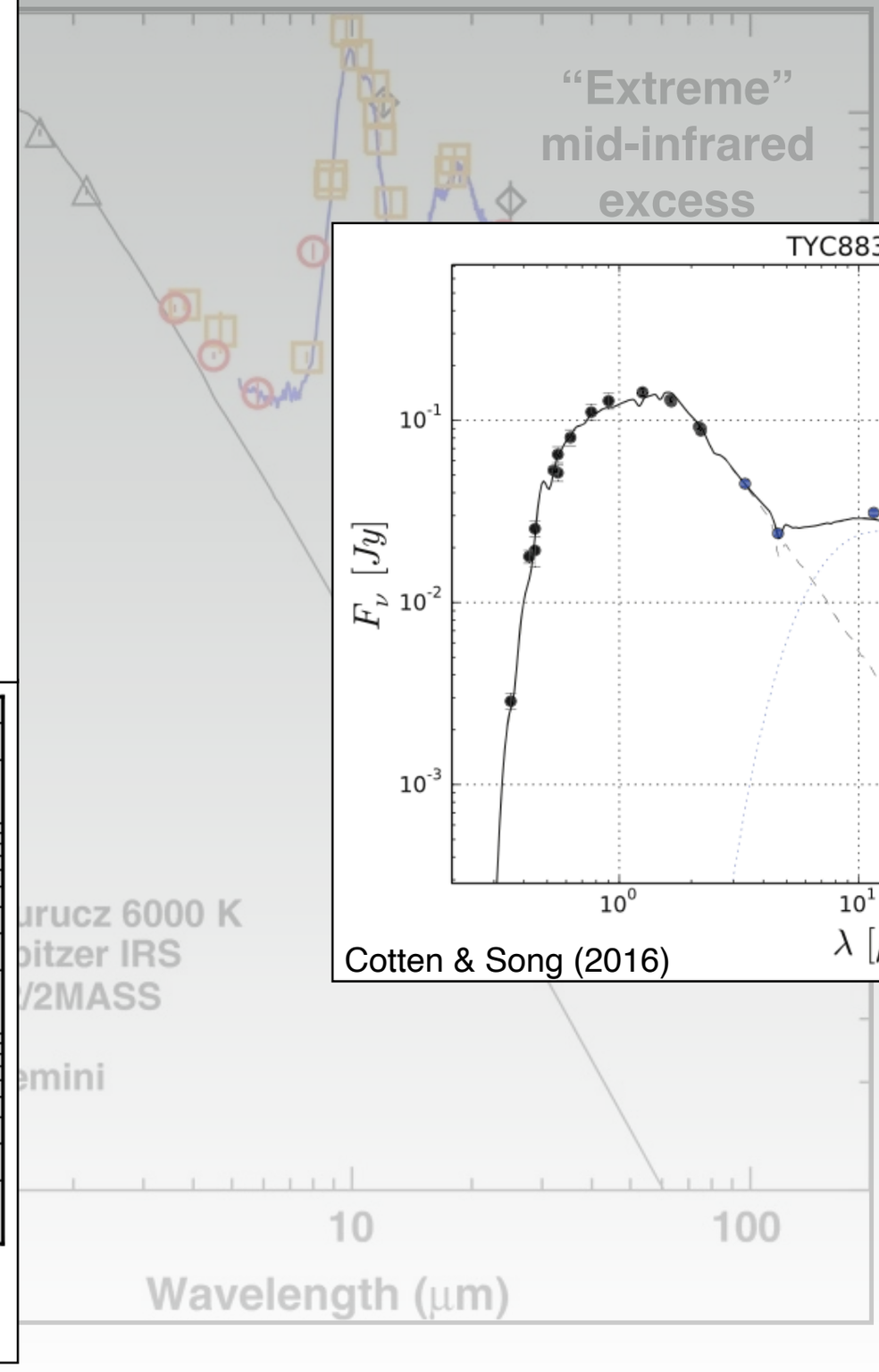

Cotten & Song (2016)

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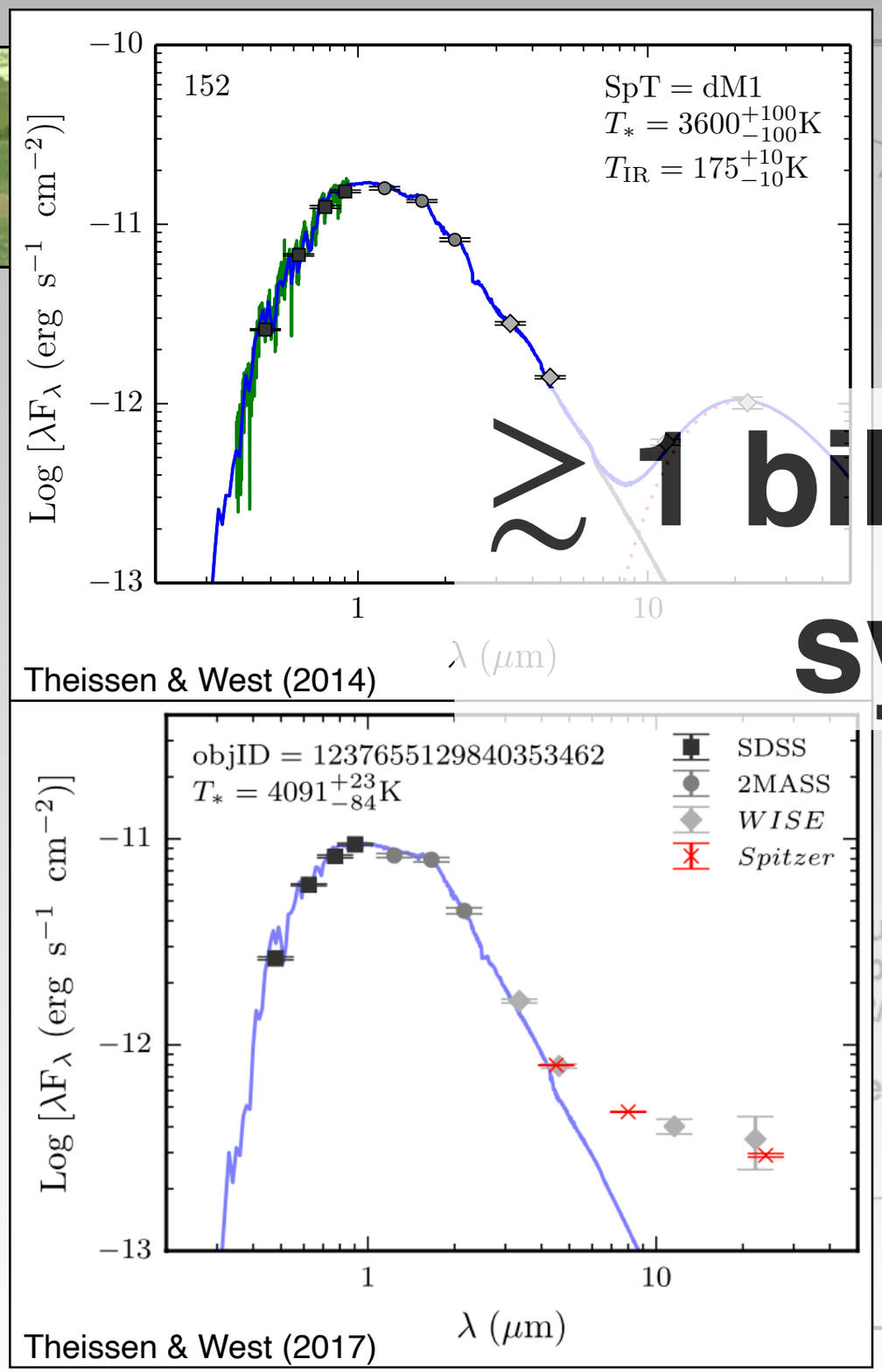

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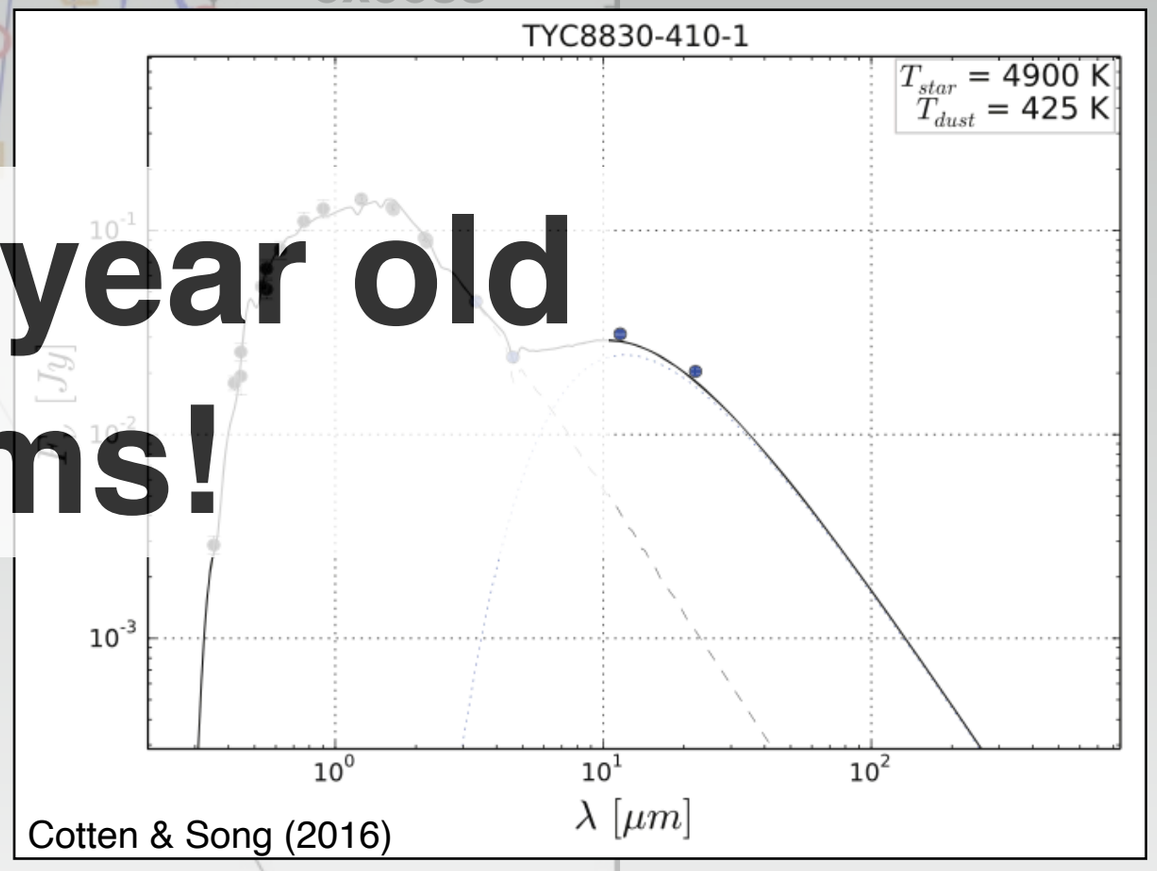

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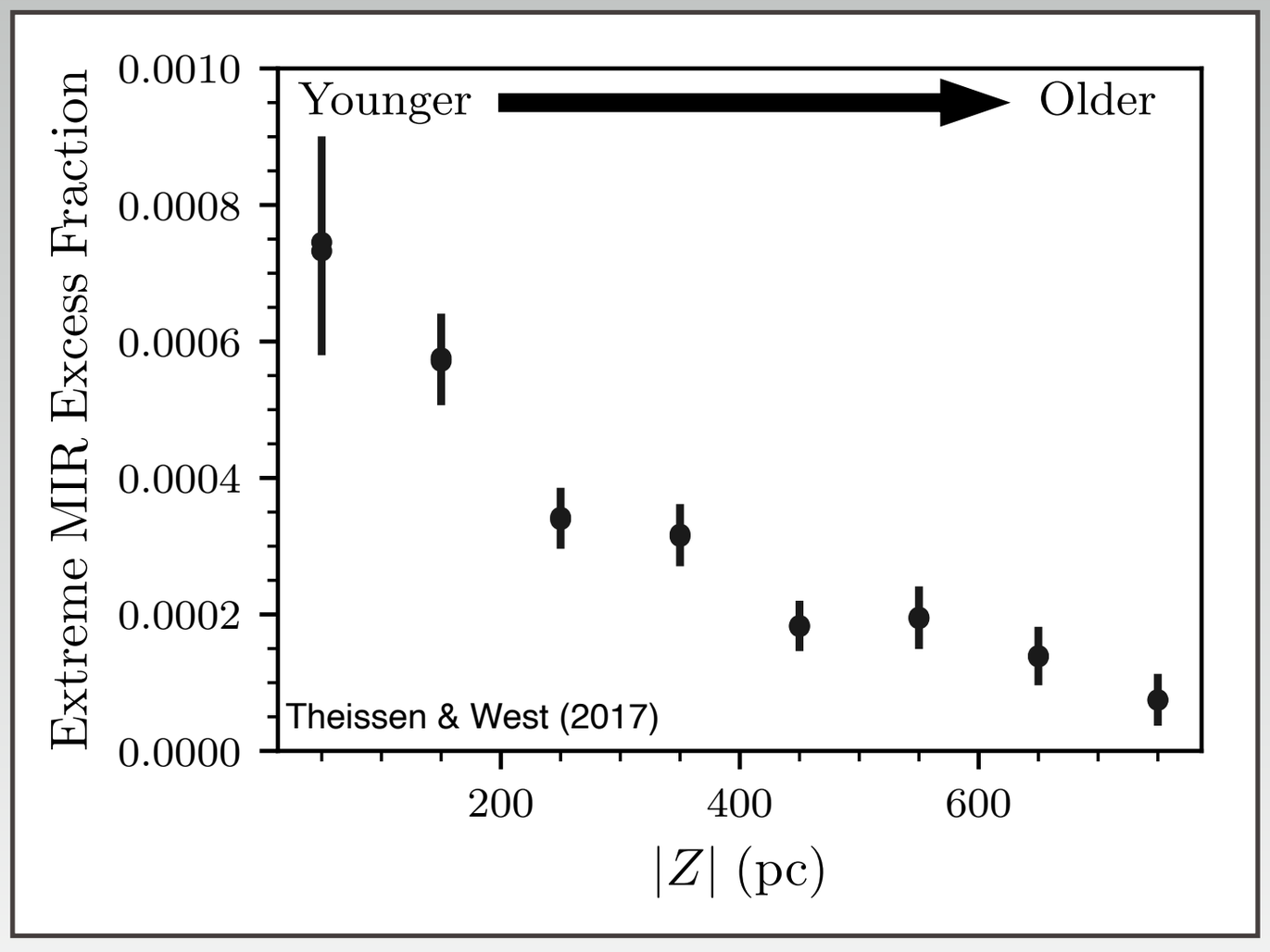
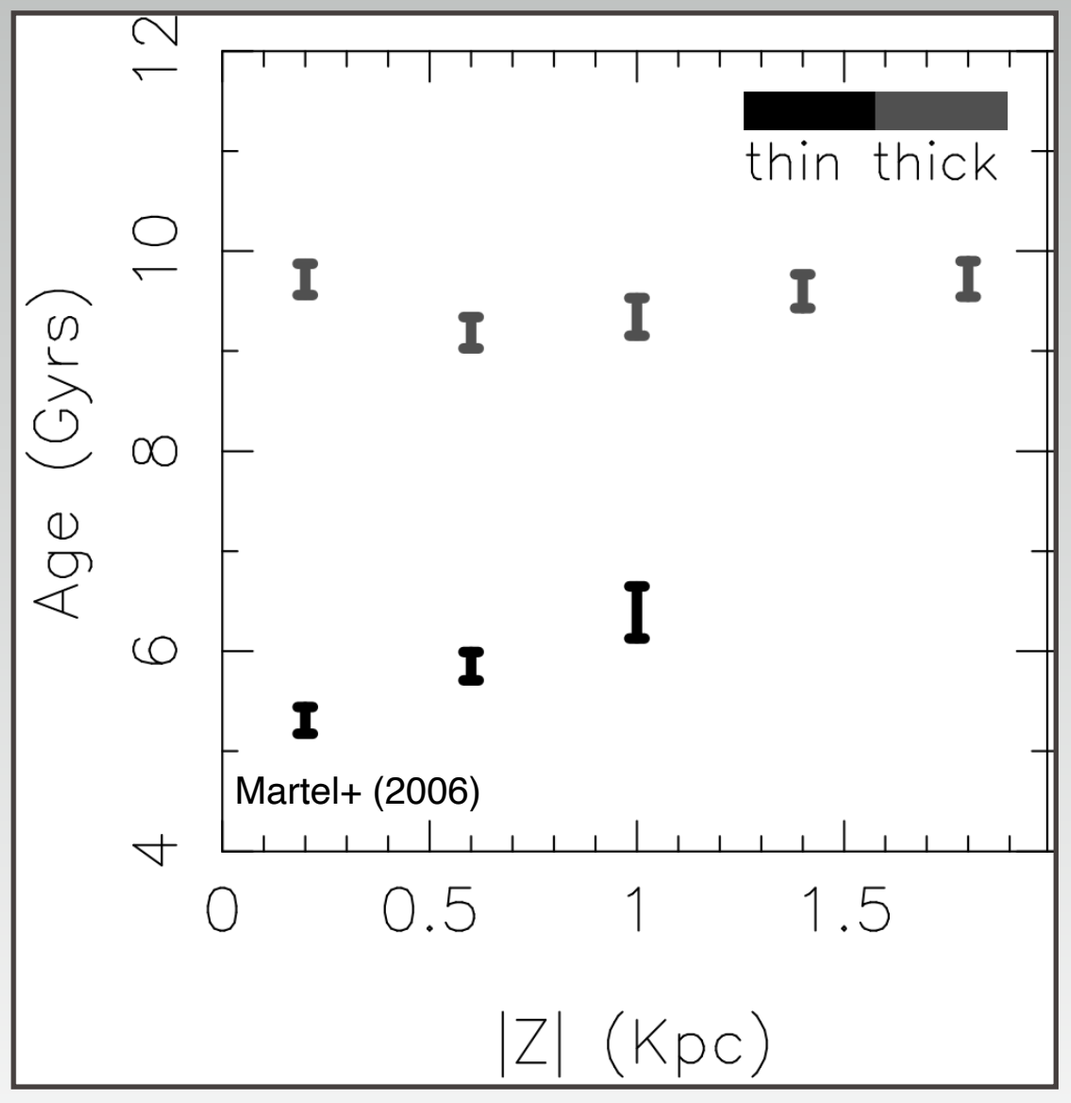
$\gtrsim$1 billion year old systems!

Low-mass Stars as Laboratories

Age trend observed with collisional signature.

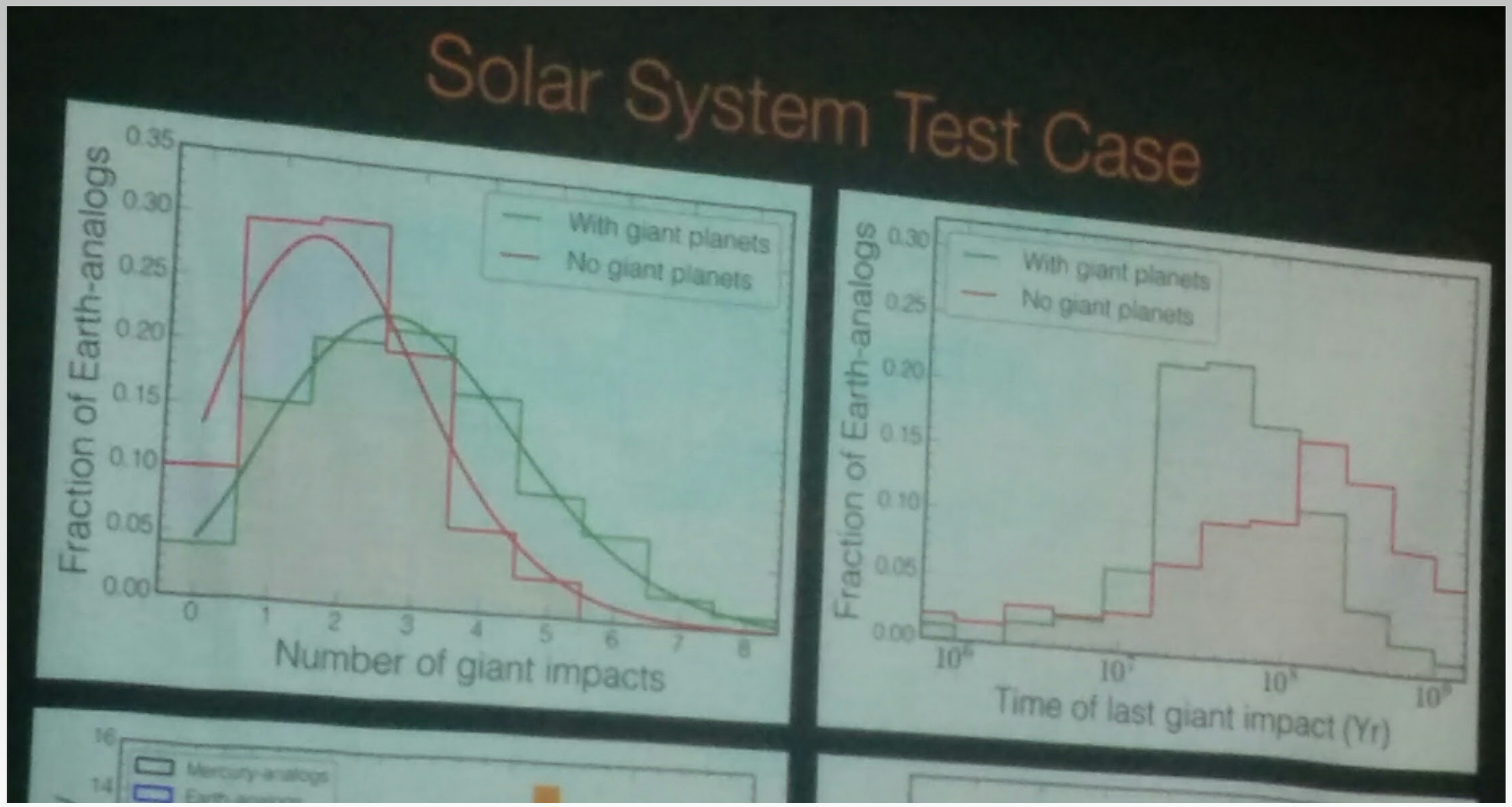




May indicate a possible timescale for collisions.

Low-mass Stars as Laboratories

Inhibiting giant planet formation can yield late time planetary collisions, and at a higher rate



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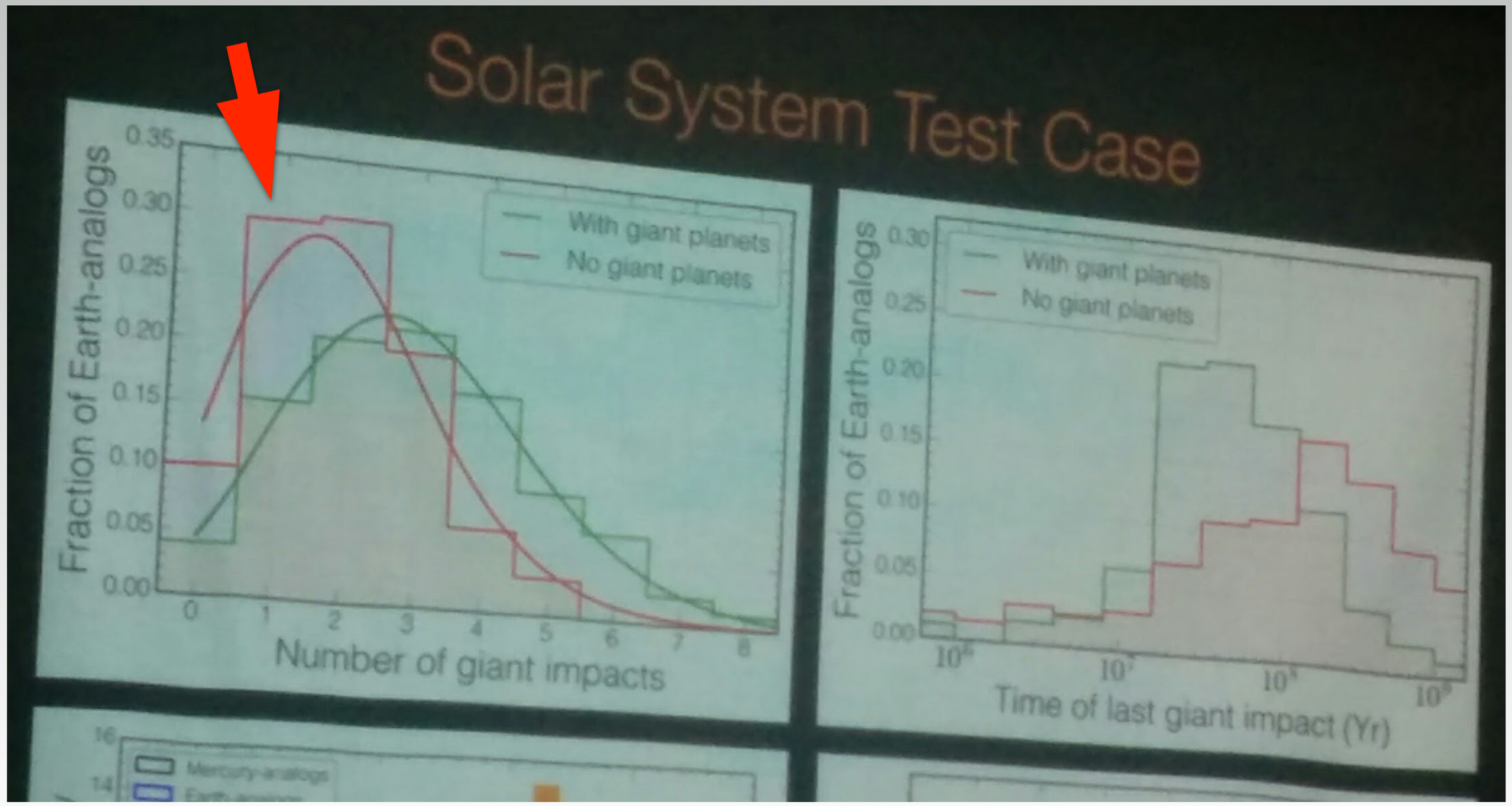

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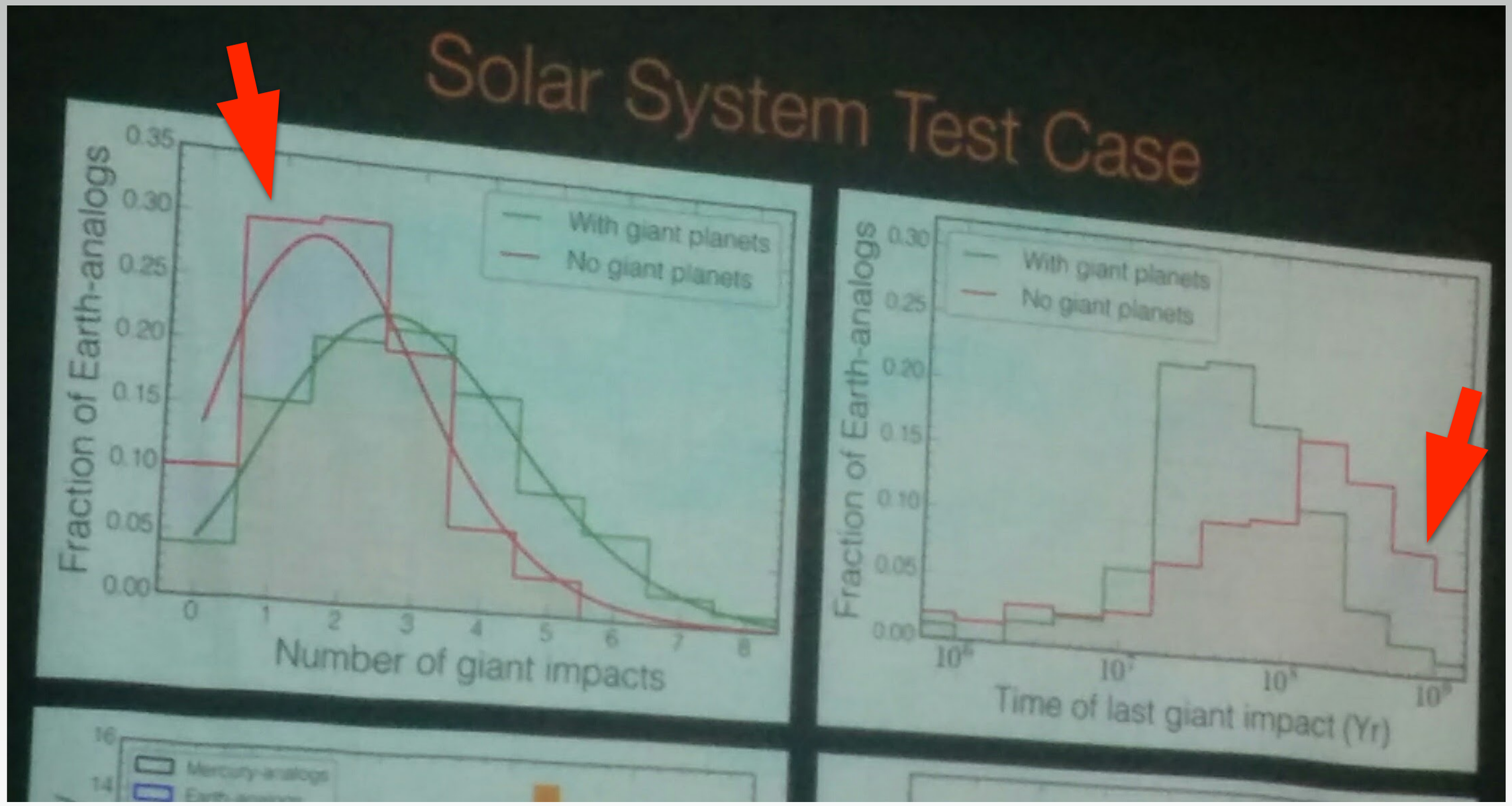

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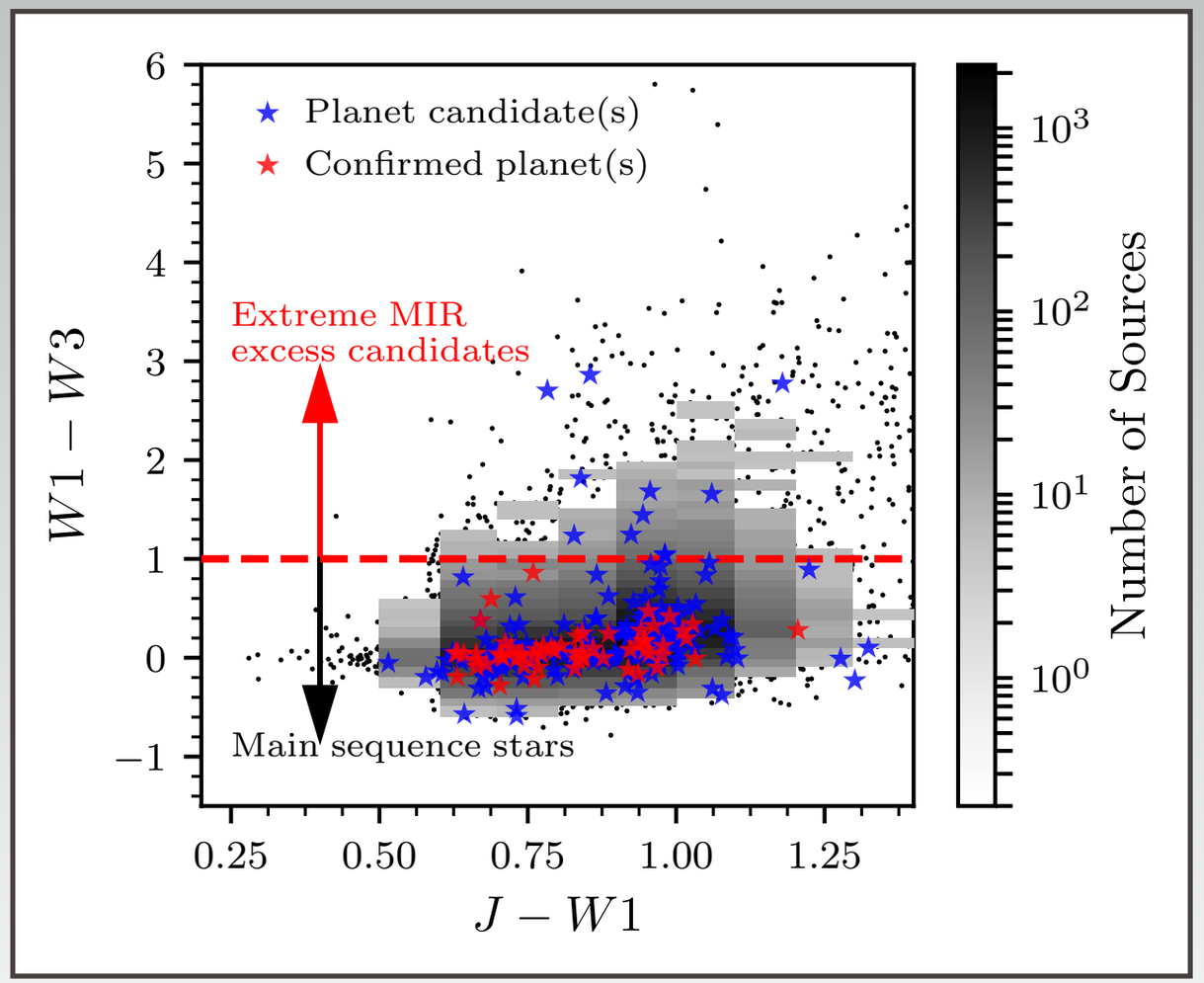
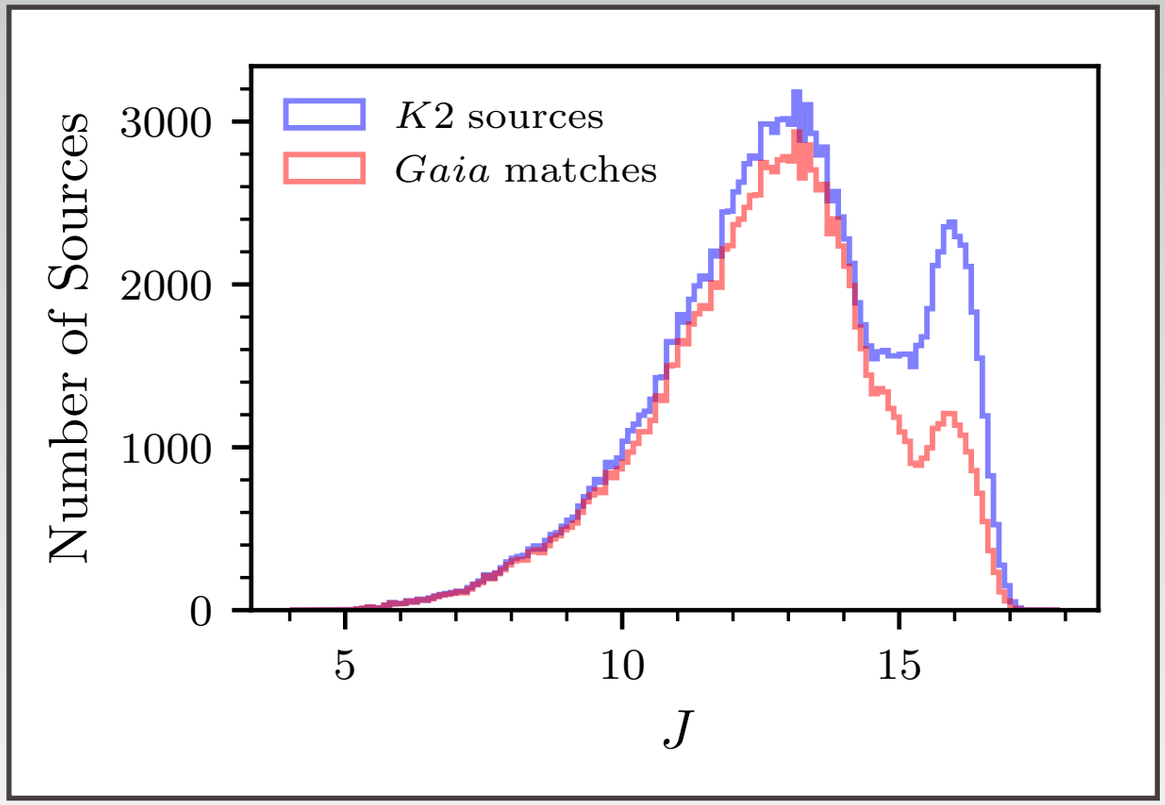
We can search for MIR excesses in already known planetary systems using *Kepler* and K2!





***Gaia* will provide distances and kinematics for age tracers**

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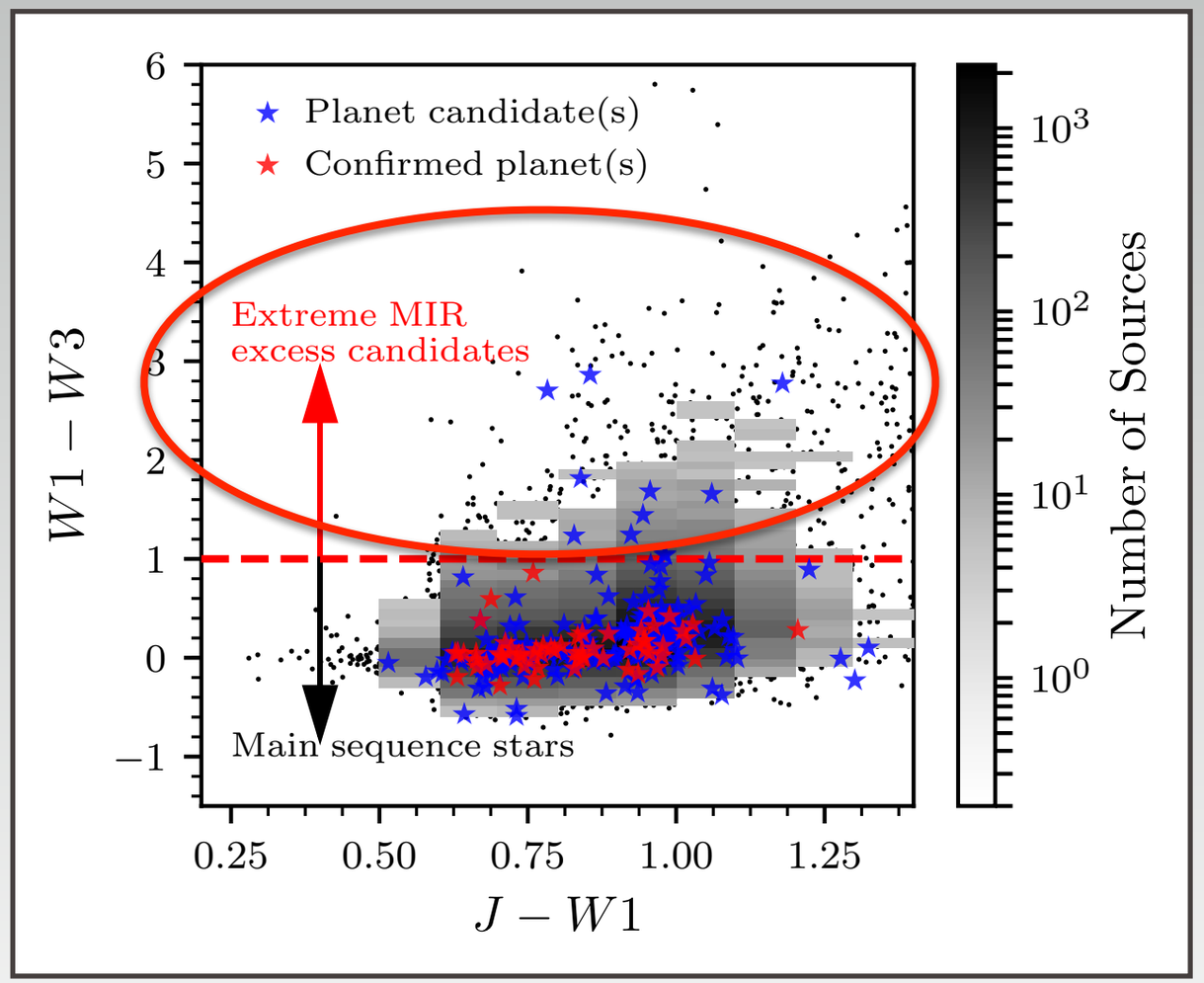

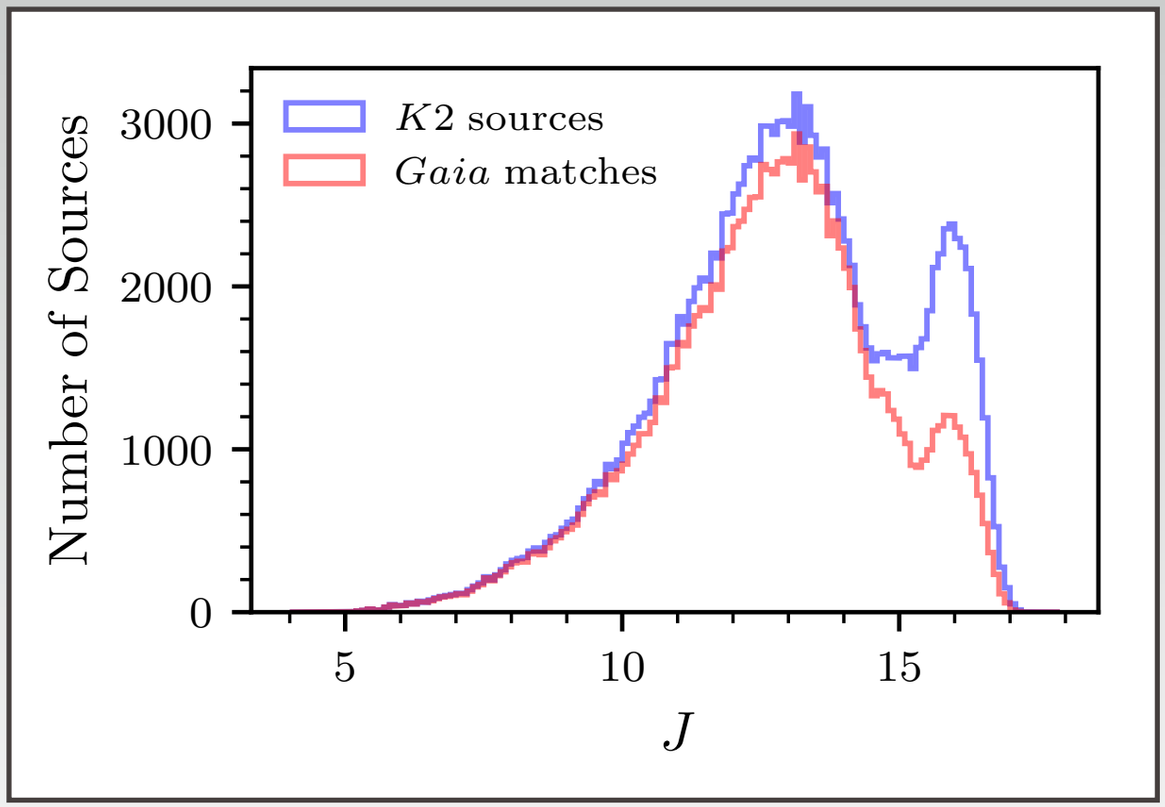

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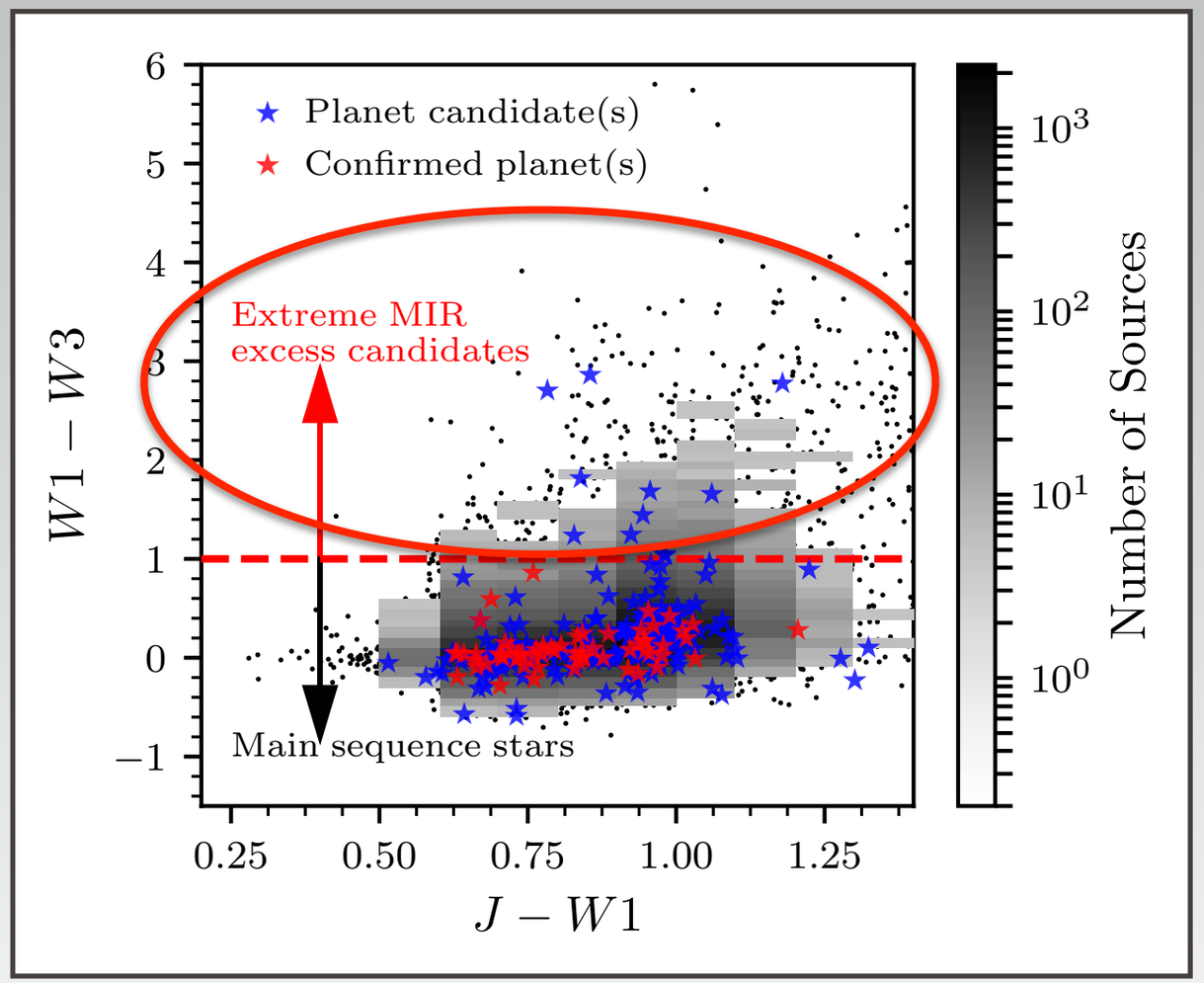

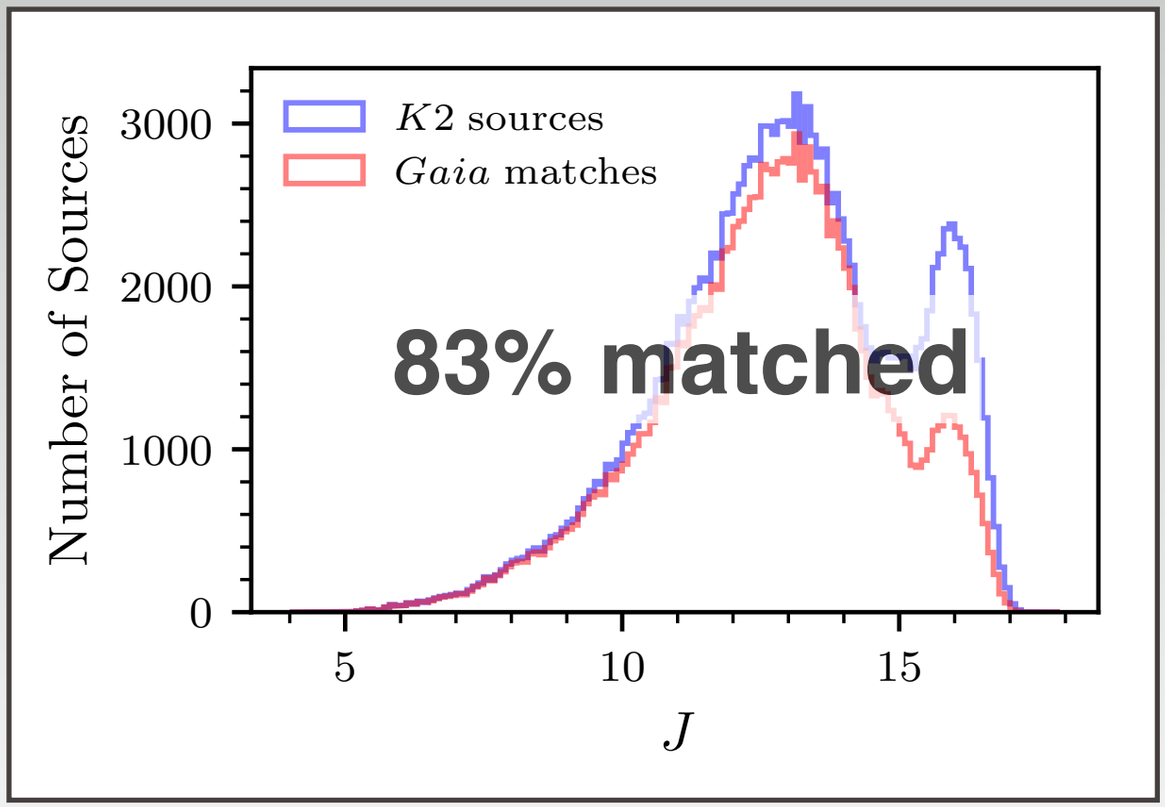

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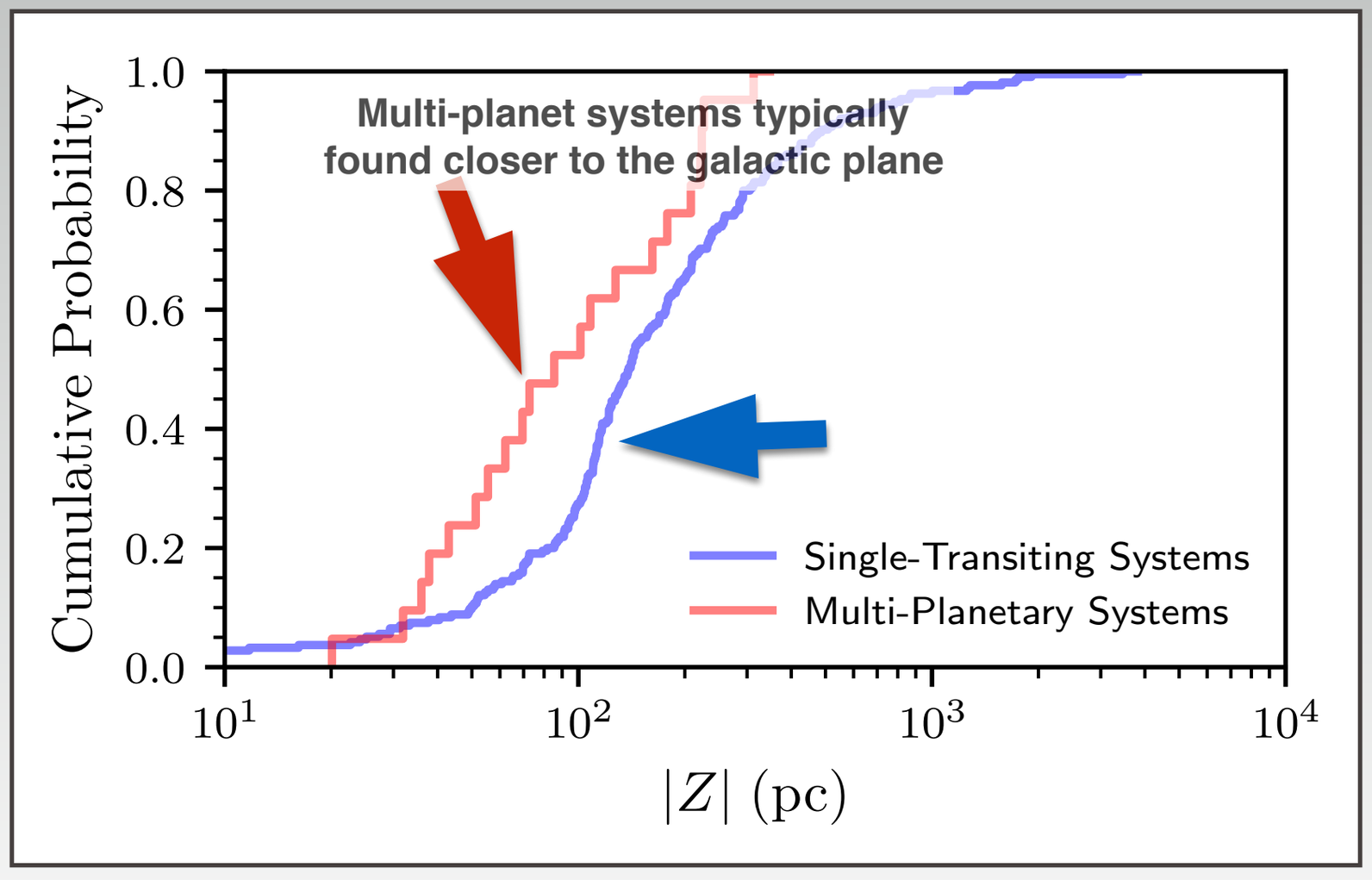
Initial results may indicate that multi-planet (transiting) systems are younger than singles



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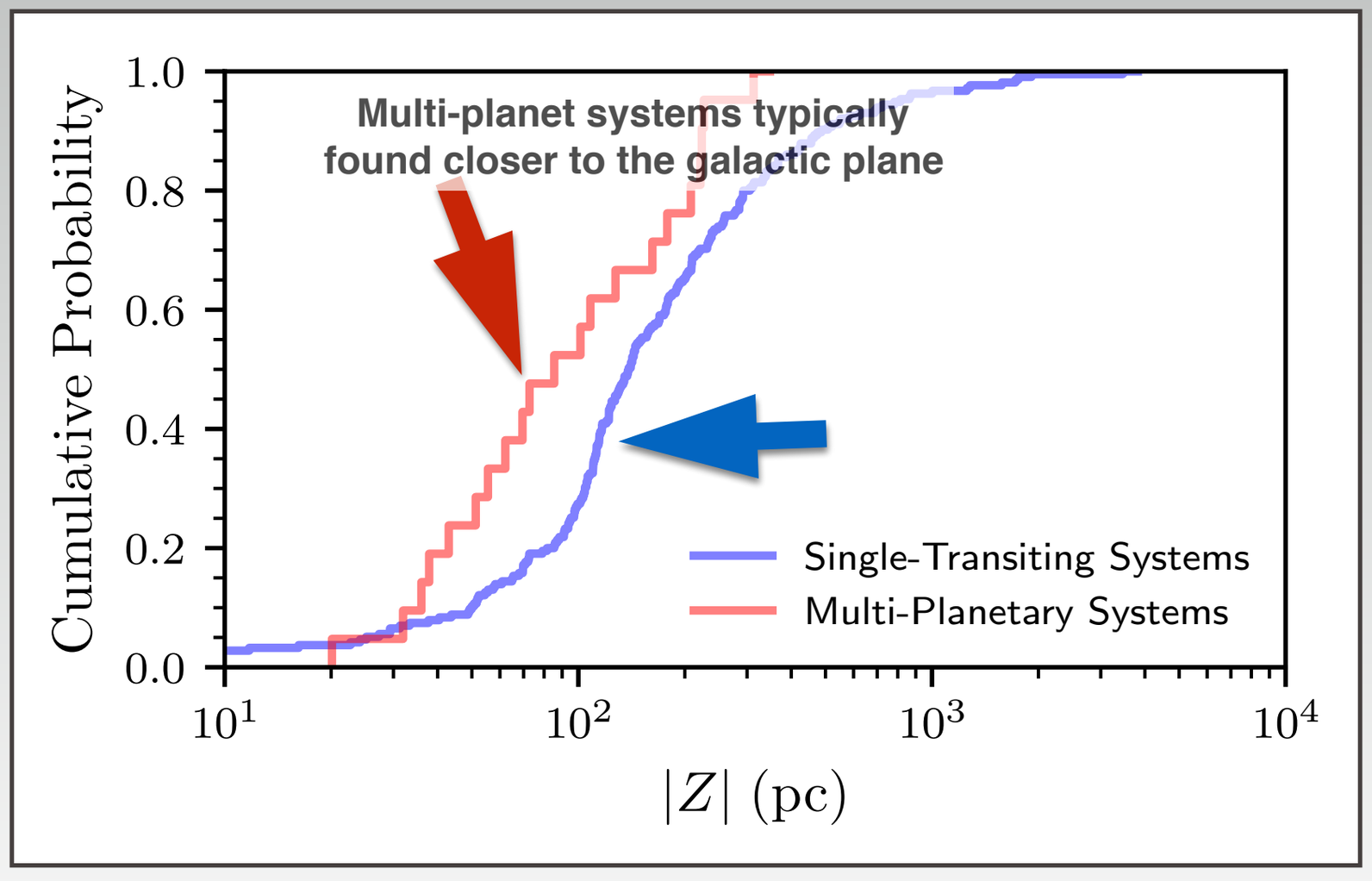
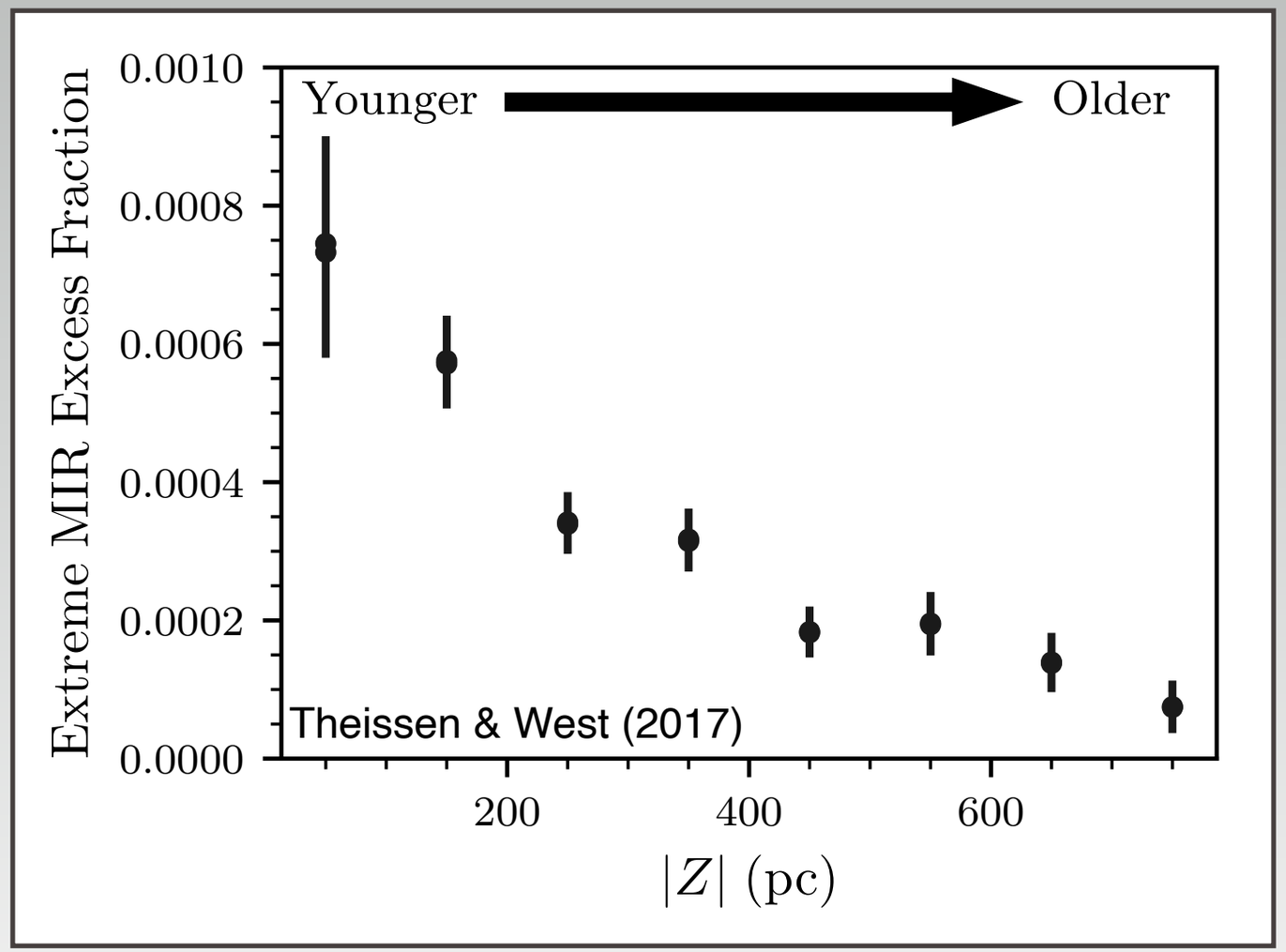


Lots of biases in this plot, but more results to come!

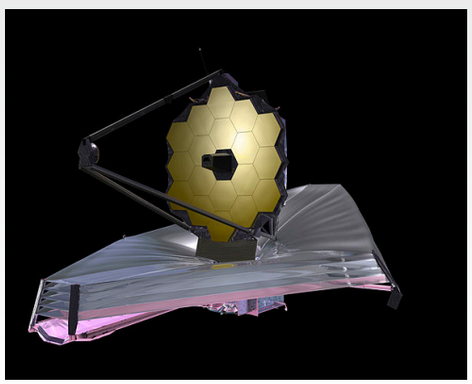
Constraining the Timescale for Collisions

We can model this trend to estimate a timescale for collisions



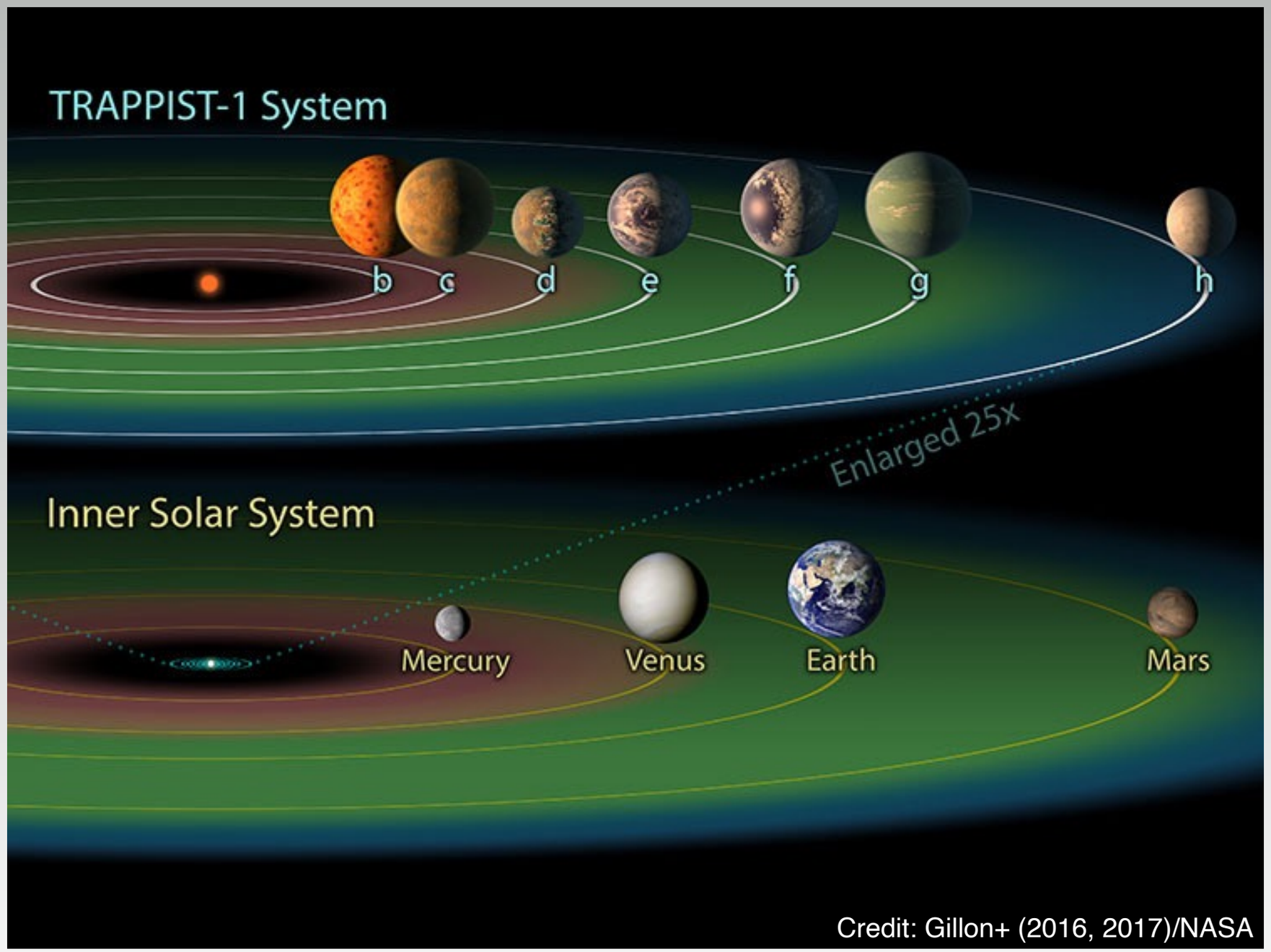
***Kepler* + *Gaia* will give us further age constraints for MIR excess candidates (rotation rates, kinematics, galactic placement)**

***JWST* will allow us to study the mineralogy of the disks to assess the collisional theory (e.g., looking for silicate dominant disks)**



Credit: NASA/ESA

Planets orbit close-in!



Thanks!