Two Case Studies of Warm Jupiters Suggesting Different Origins

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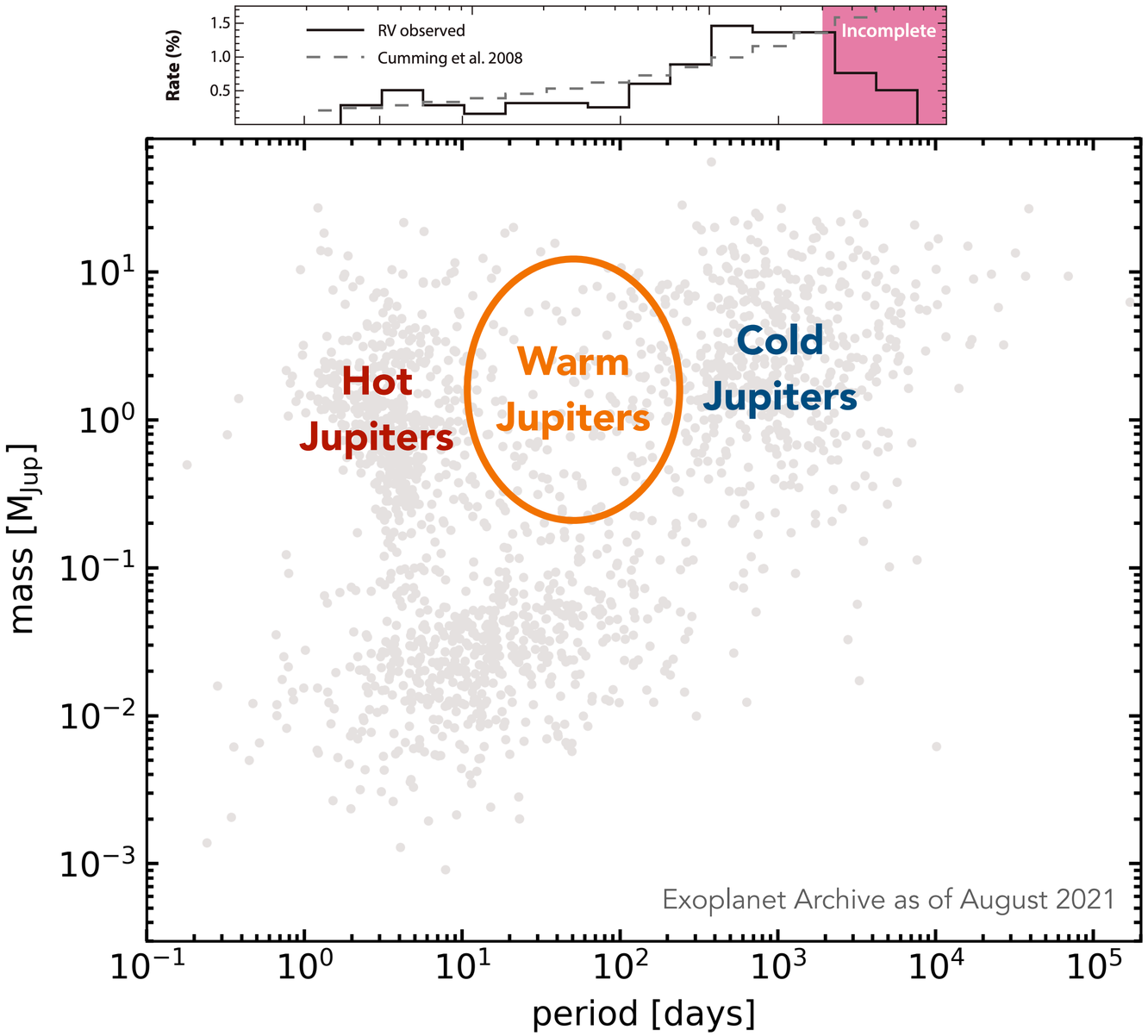


Warm Jupiters, giant planets with orbital periods ~10-200 days, are a missing piece in our exoplanetary exploration.

Warm Jupiters' limited sample size

Transit survey: period ↑, transit probability ↓
RV survey: low occurrence rates

We don't understand their origins.

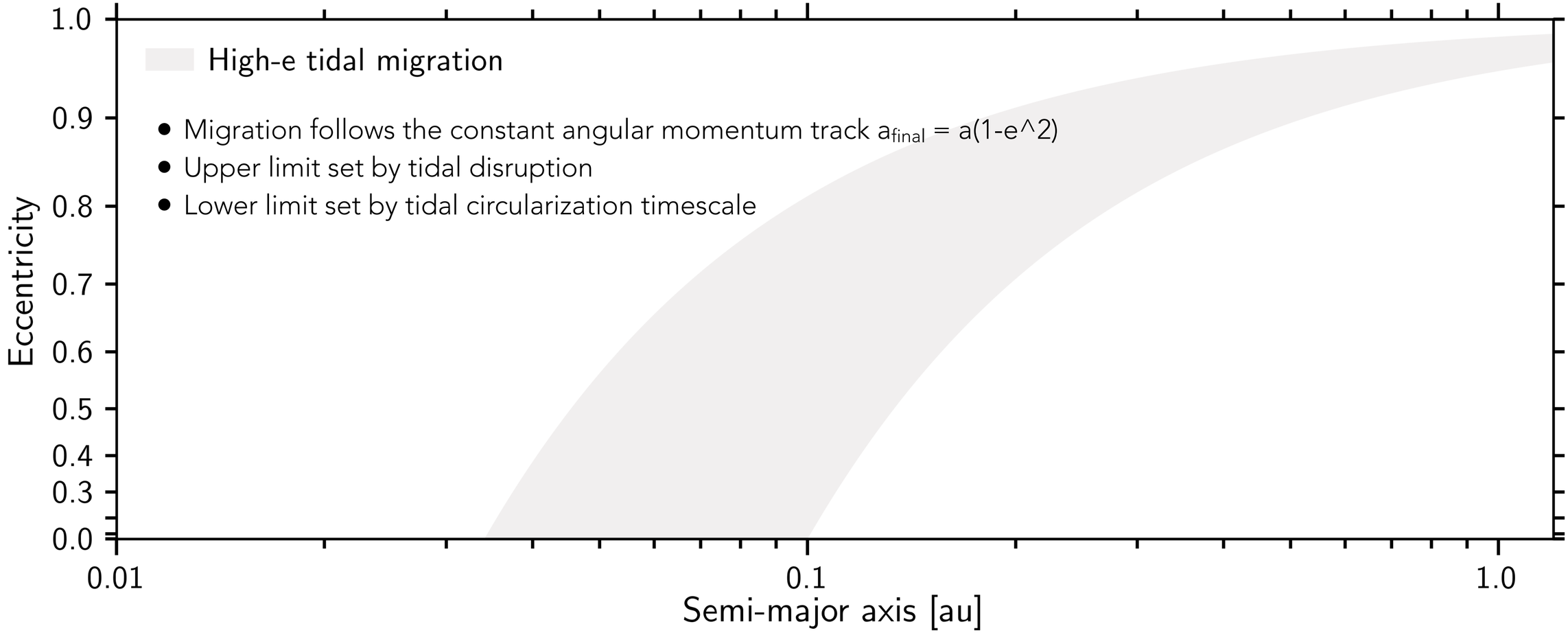
Are Warm Jupiters Hot Jupiters in migration?
Do Warm Jupiters have different origins?

In this talk, I will…

- Introduce a catalog of Warm Jupiters discovered by the TESS mission
- Present two Warm Jupiters suggesting different origins

Eccentricity as a Dynamical History Tracer

Three proposed Warm Jupiter origin channels
high-eccentricity tidal migration, in situ formation, disk migration



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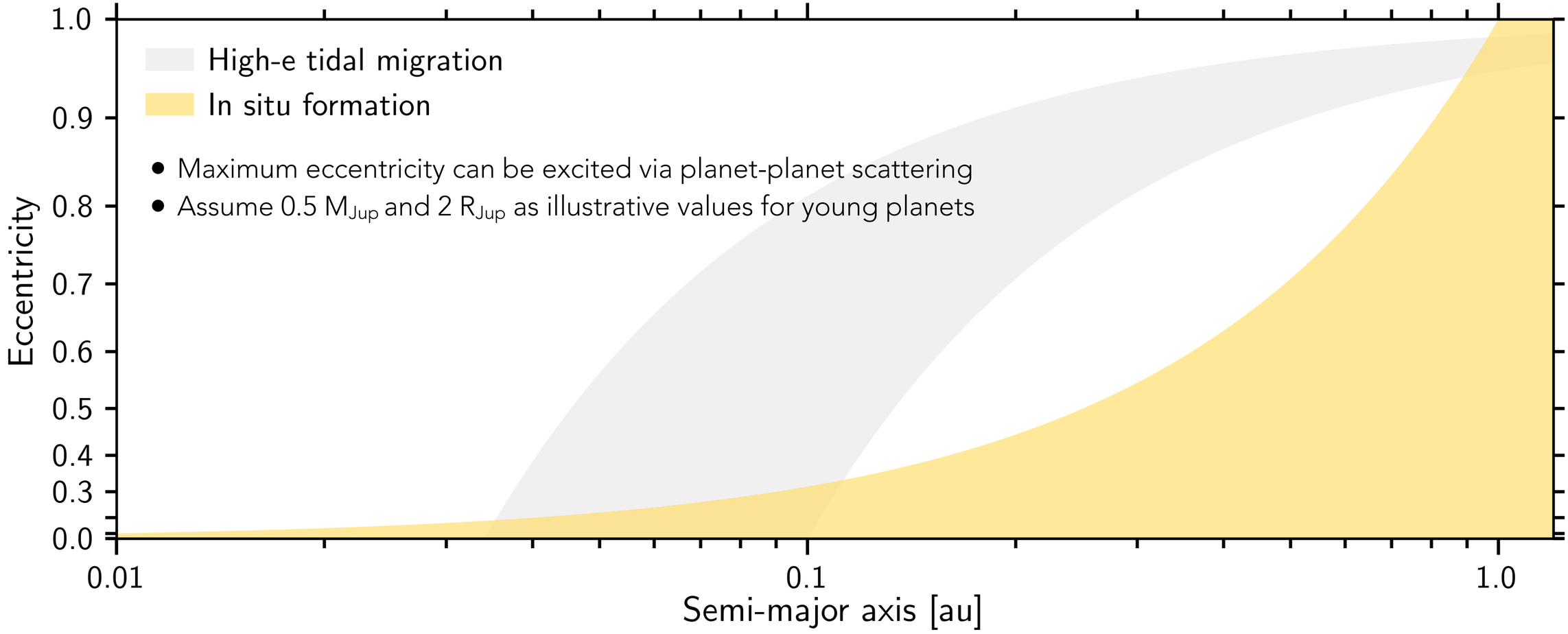

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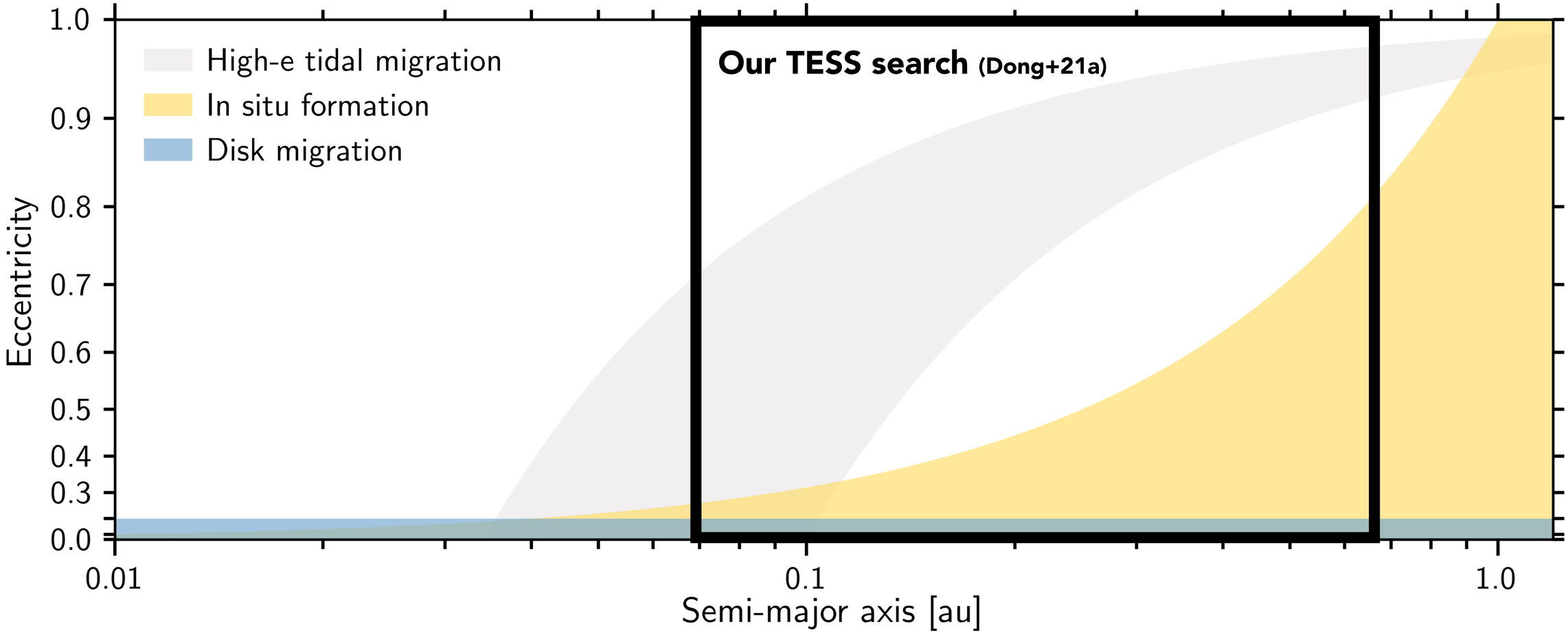
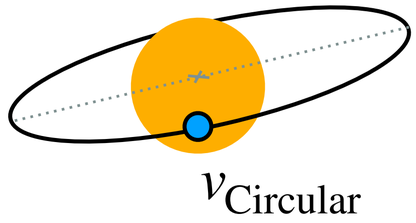


Eccentricity Inferred from Transit Light Curves

Circular Orbit

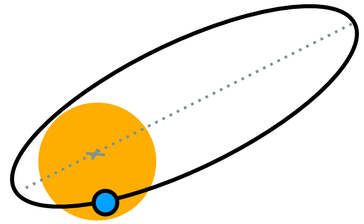
planet transits at v_{Circular}



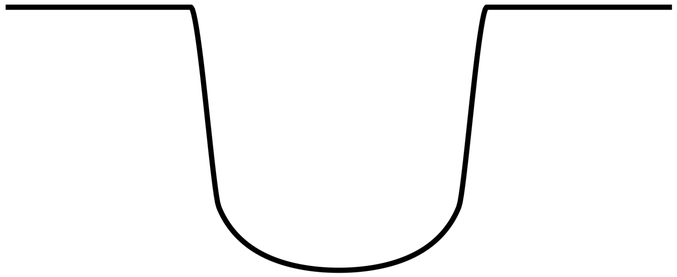
v_{Circular}

Eccentric Orbit

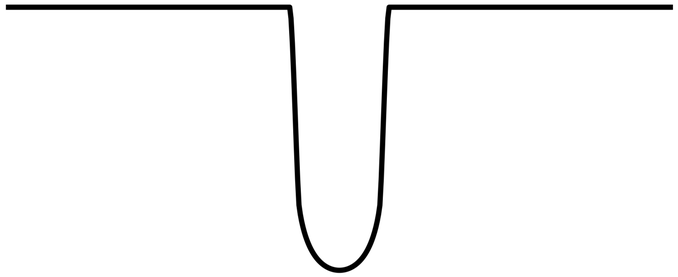
planet transits at $v_{\mathrm{Circular}} + \Delta v$



$v_{\mathrm{Circular}} + \Delta v$

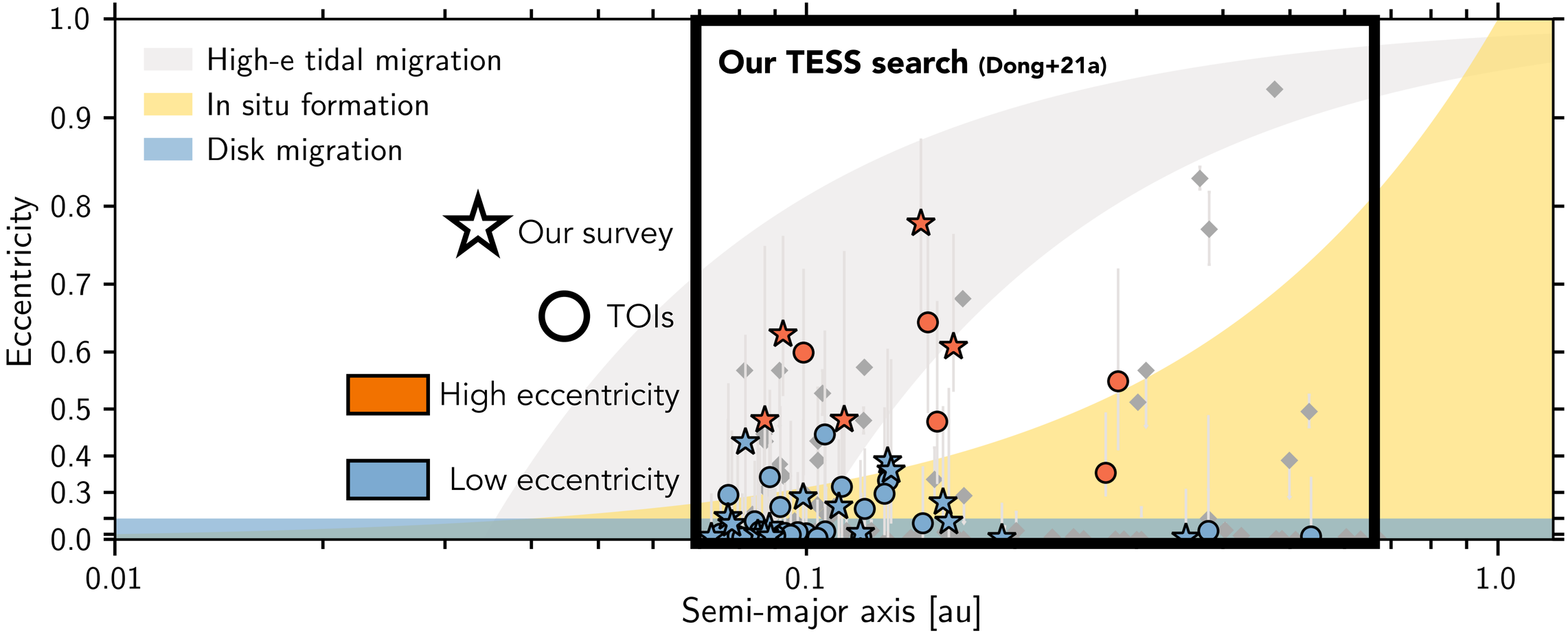


Same period, different eccentricities lead to different transit shapes



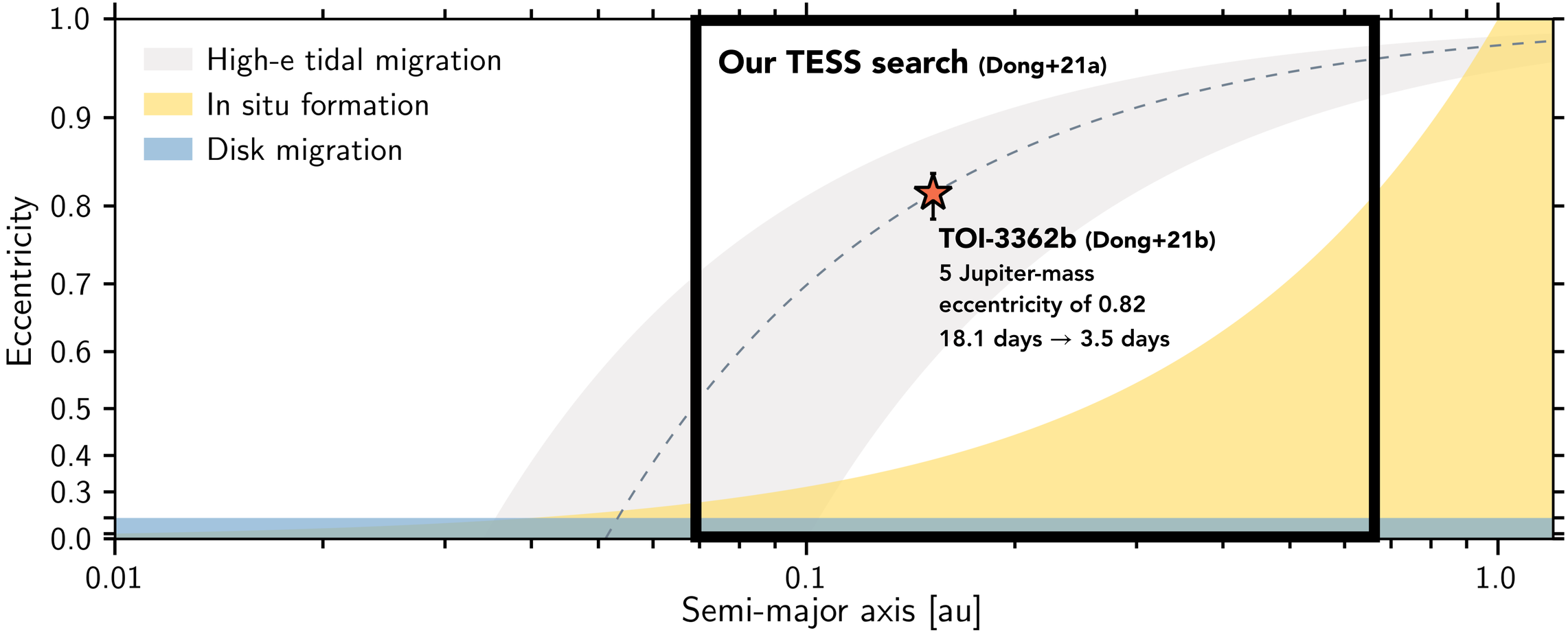
Eccentricity as a Dynamical History Tracer

A Warm Jupiter catalog from Year 1 TESS Full-Frame Images



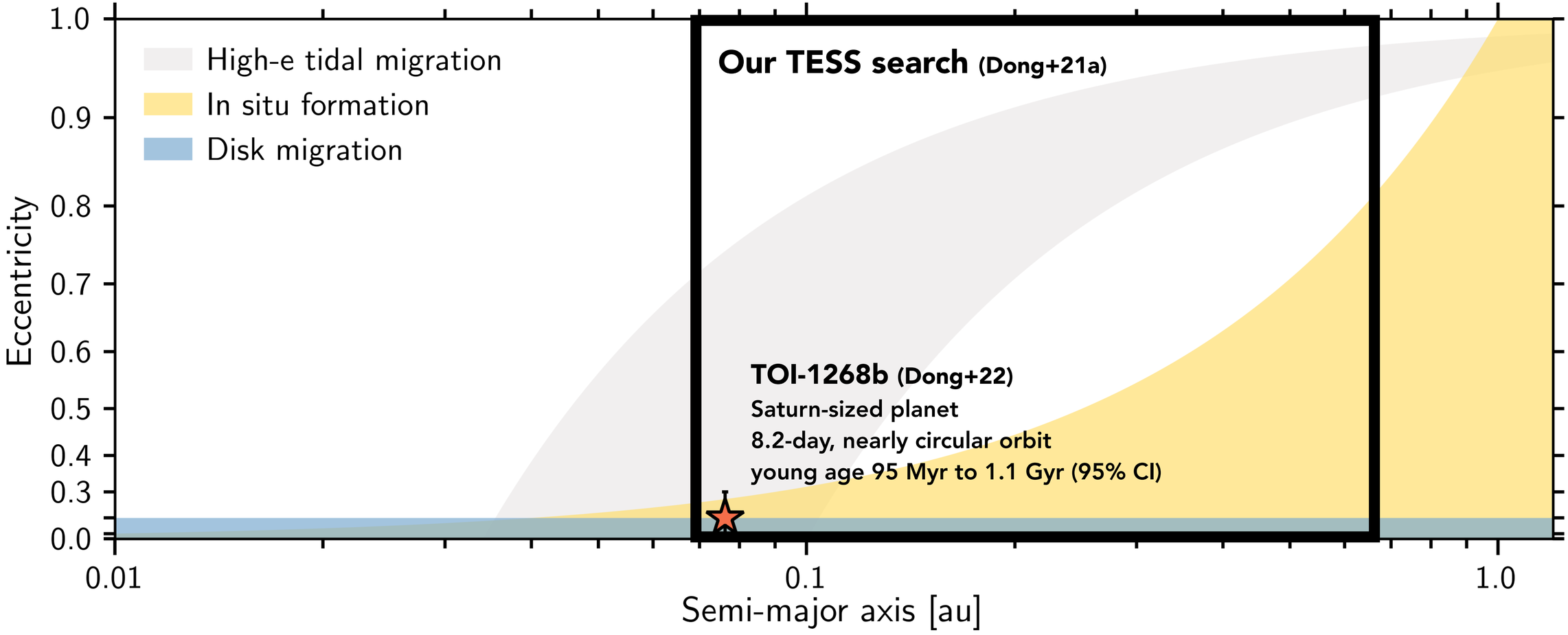
A Super Eccentric Warm Jupiter: TOI-3362b

In support of high-eccentricity tidal migration origin



A Young and Circular Warm Jupiter: TOI-1268b

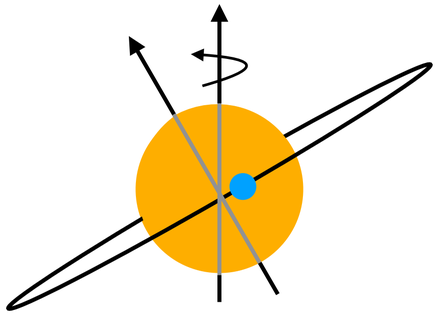
In support of disk migration and in situ formation origins



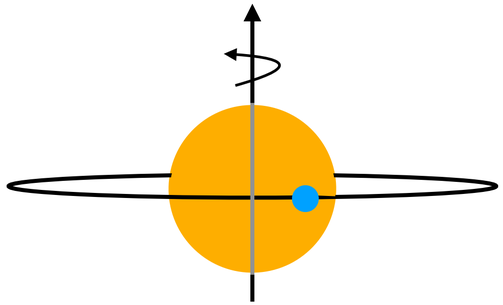
Stellar Obliquity as another Dynamical History Tracer: TOI-1268b

In support of disk migration and in situ formation origins

Misaligned: high-e tidal migration

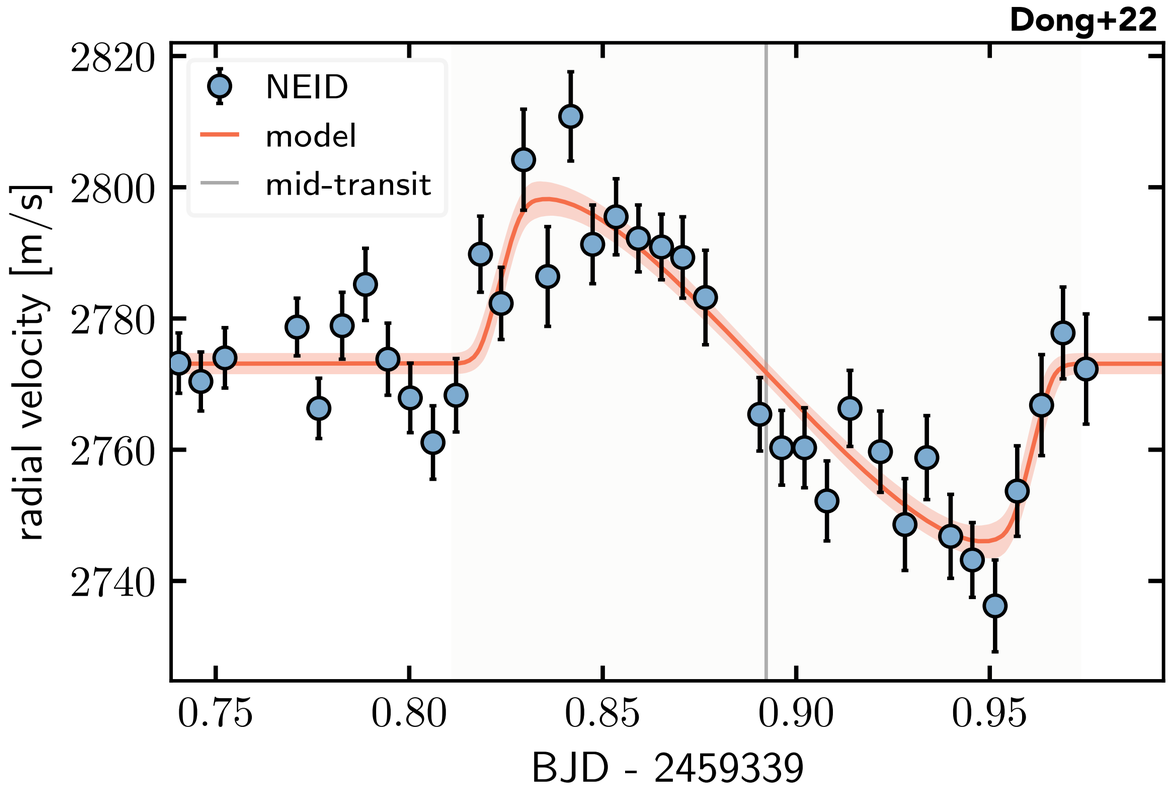


Aligned: disk migration/in situ formation



Caveats: primordial misalignment, planet-star tidal realignment, coplanar high-e migration, etc.

Rossiter-McLaughlin measurement on the NEID spectrograph
TOI-1268b's orbit is **aligned** with its host star spin axis.



Summary

Warm Jupiters are likely coming from **multiple origins**,

suggested by individual targets

- TOI-3362b is likely a proto-Hot Jupiter undergoing high-eccentricity tidal migration.
- TOI-1268b is a young, aligned Warm Saturn likely originated from disk migration or in-situ formation.