Warm Jupiters in *TESS* Full-Frame Images

A catalog and observed eccentricity distribution for Year 1

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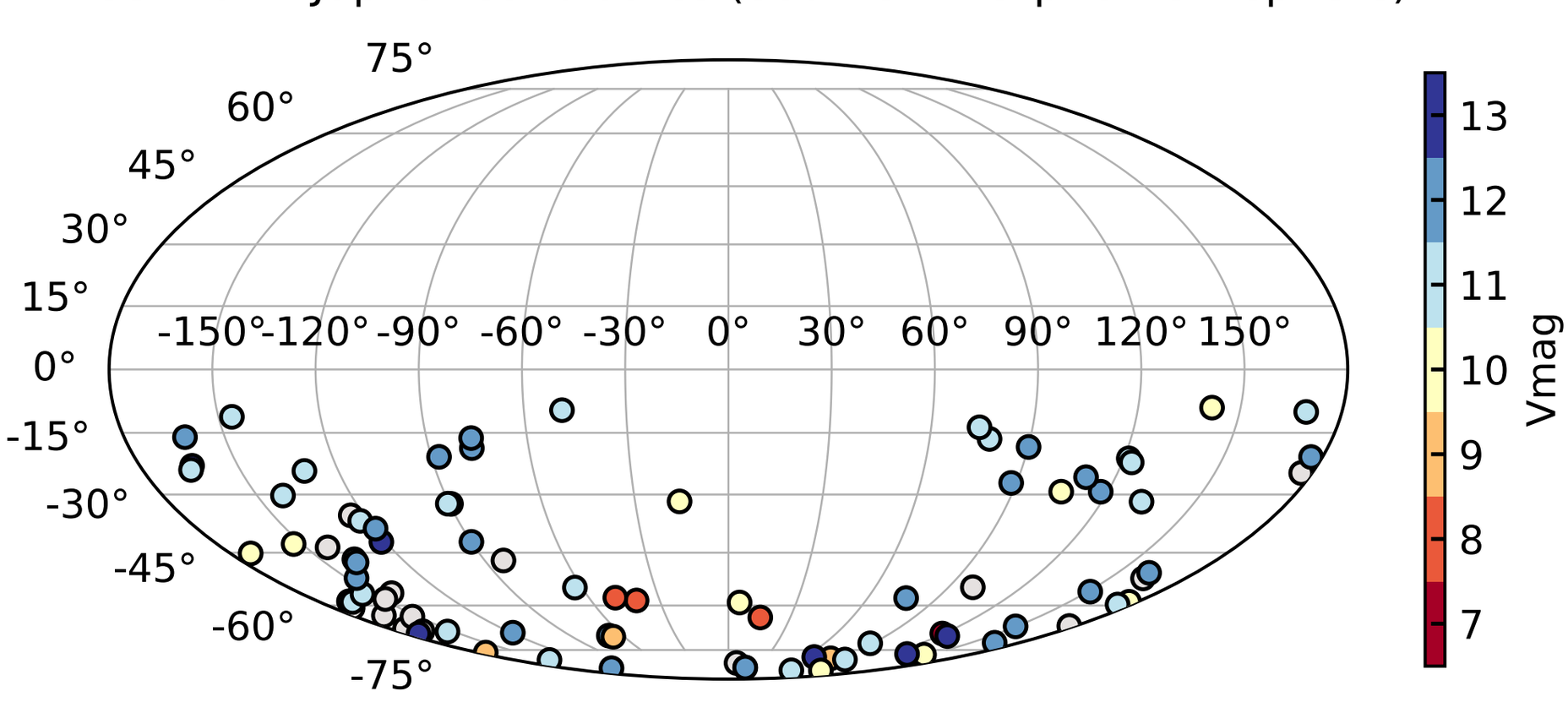


Highlights

- Systematically search for Warm Jupiters (WJs) in Year 1 *TESS* FFIs
- Work with TFOP SG1/2 on target validation
- Identify a catalog of 57 WJ candidates
- Conduct preliminary eccentricity distribution study using hierarchical Bayesian modeling

We systematically search for WJ candidates in *TESS* Full-Frame Images.

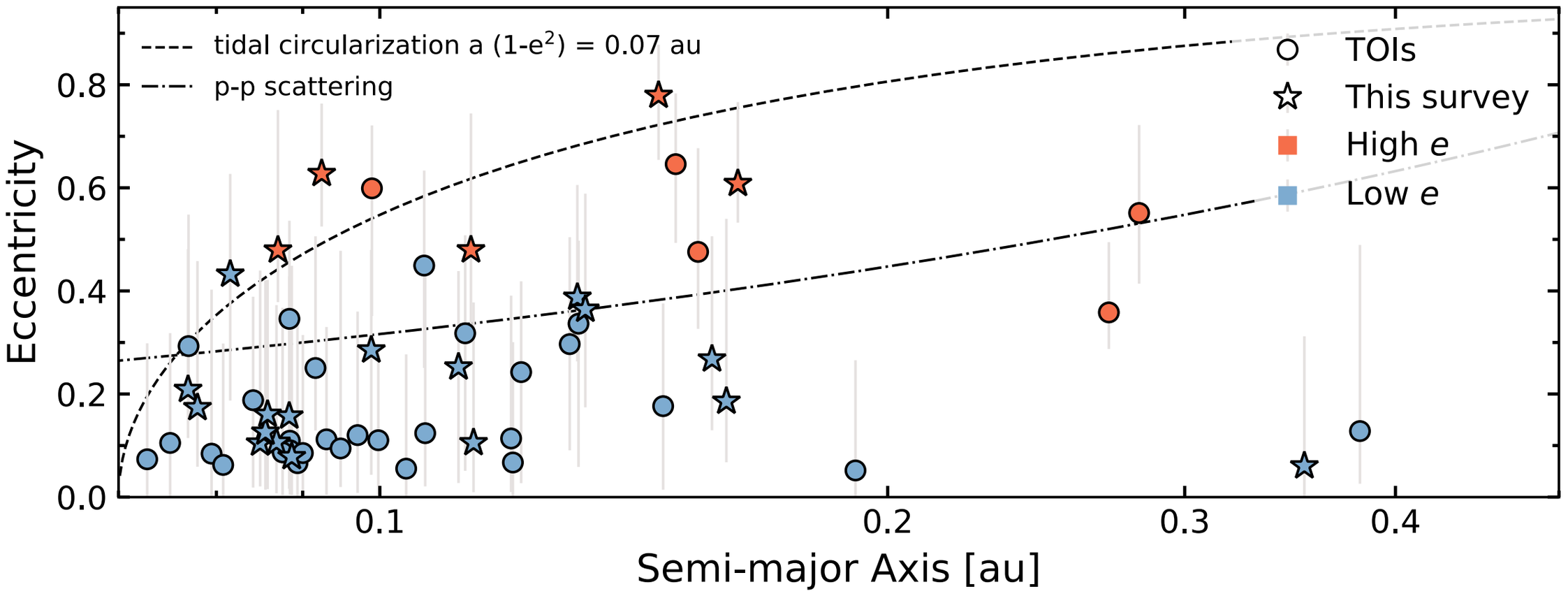
Warm Jupiters — planets larger than 6 Earth radii with orbital periods 8–200 days — in *TESS* Sector 1-13 with *TESS*-band mag < 12

1. MIT QLP for light-curve production and transit searches — resulting in ~**2000** targets
2. Human-vet "threshold-crossing events" and "false positives" — resulting in ~**200** targets
3. Isochrone fitting with Gaia parallax to characterize stellar densities
4. Model light curves with `exoplanet` package and remove grazing targets (b>1) — resulting in ~**70** targets
    - Fit mid-transit times one by one for TTVs
    - Assume a circular orbit and characterize planets' eccentricities later using the "photoeccentric" effect
    - A scalable GP model
5. Remove targets dispositioned as FPs and FAs by TFOP Subgroups — a catalog of **57** WJ candidates

What *TESS* teaches us about Warm Jupiters?

Where do WJs form? In situ or via disk/high-eccentricity tidal migration?

WJ's eccentricity and semi-major axis evolve during these processes.



Above the dashed line: Planets are experiencing high-e tidal migration; follow a tidal circularization track of constant angular momentum.

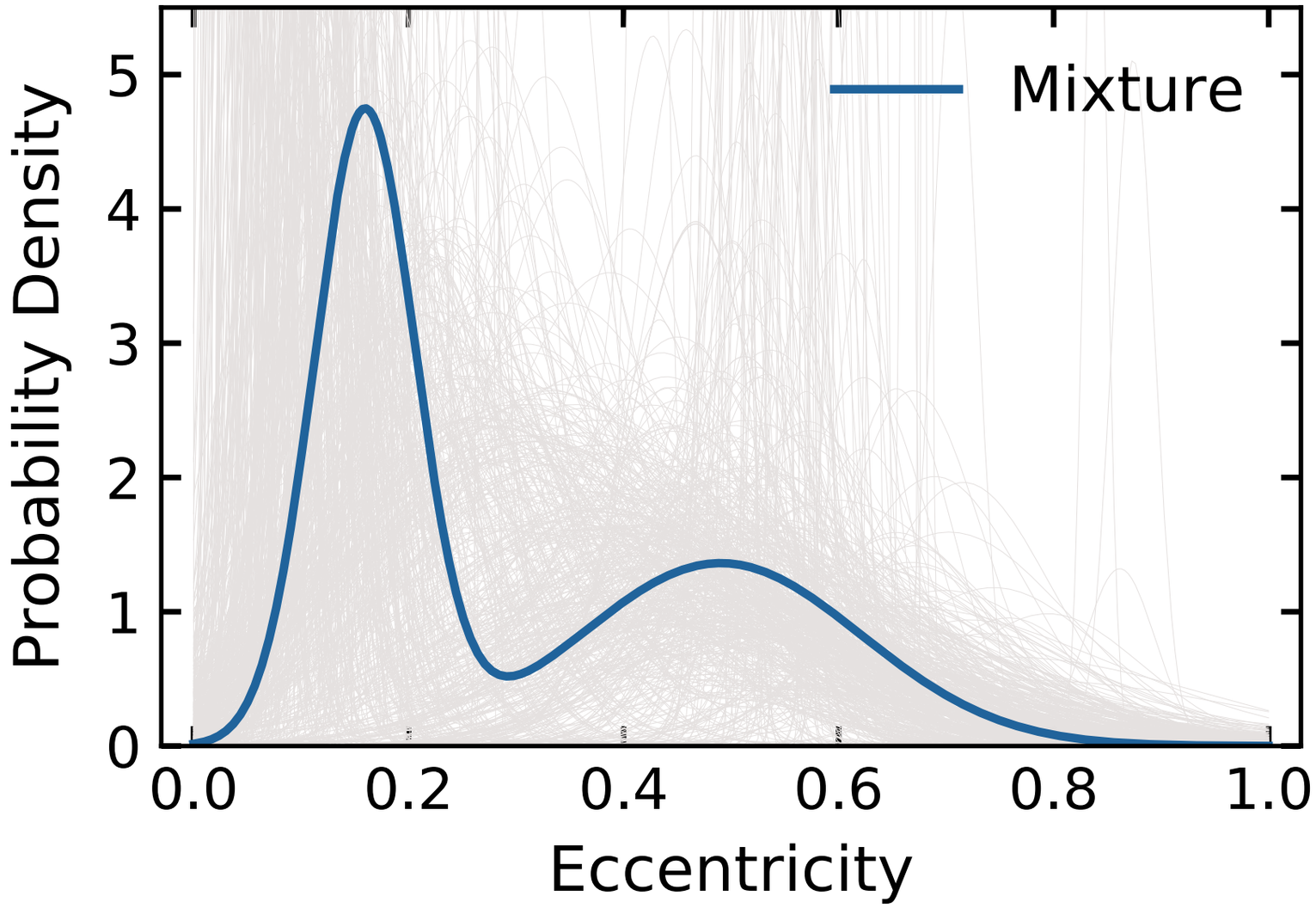
Below the dot-dashed line: Planets are likely formed in situ or via disk migration.

Between two lines: Planets might be coupled to outer companions and undergo eccentricity oscillations.

What *TESS* teaches us about Warm Jupiters?

Where do WJs form? In situ or via disk/high-eccentricity tidal migration?

Using hierarchical Bayesian modeling to infer the eccentricity distribution.



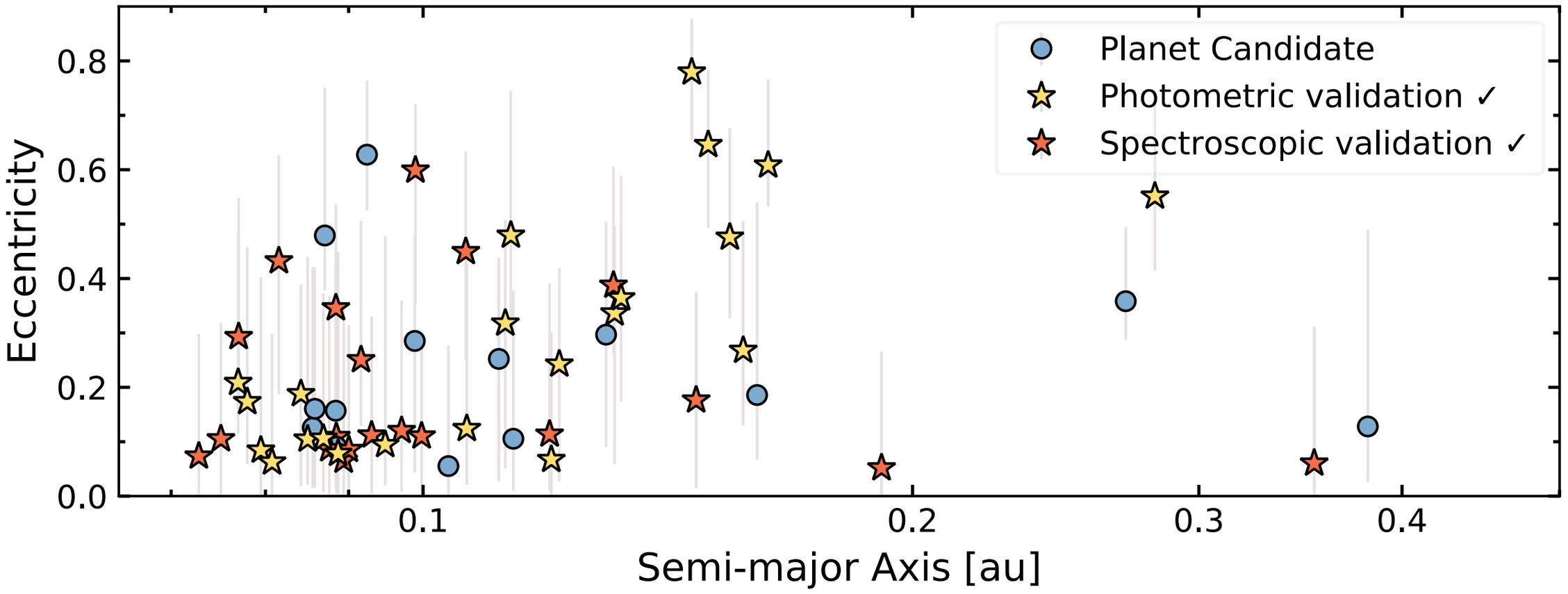
Low-e population: ~55% of the systems with $\bar{e}$ = 0.16; consistent with in situ or disk migration

High-e population: ~45% of the systems with $\bar{e}$ = 0.49; consistent with high-e migration and others

Eccentricity oscillations complicate the picture!

Planet Candidates >> Planets

Towards the occurrence rates, intrinsic eccentricity distribution, period-eccentricity distribution of WJs



Photometric validation

SG1 Follow-up Observations + LCOGT (20B, PI Collins; 20B & 21A, Dong, Huang, Dawson et al.)

Spectroscopic validation

SG2 Follow-up Observations (mostly on TOIs) + HARPS (Triaud) + MINERVA-Australis (Wang; 21A, Dong, Huang, Dawson et al.) + CHIRON (20B & 21A, Dong, Huang, Dawson et al.)