Deep Hα Imaging Survey of IC 348 with the Hubble Space Telescope:

Demographics of *Accreting Protoplanets* on *Wide* Orbits

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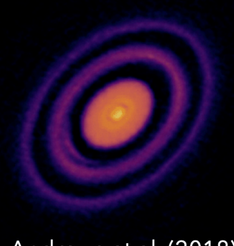
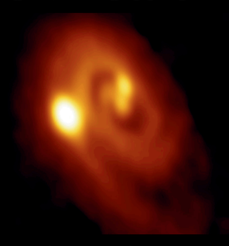
What is the origin of planets on wide orbits?

Core accretion



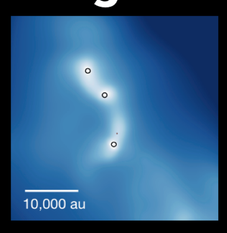
Andrews et al. (2018)

Disk instability



Tobin et al. (2016)

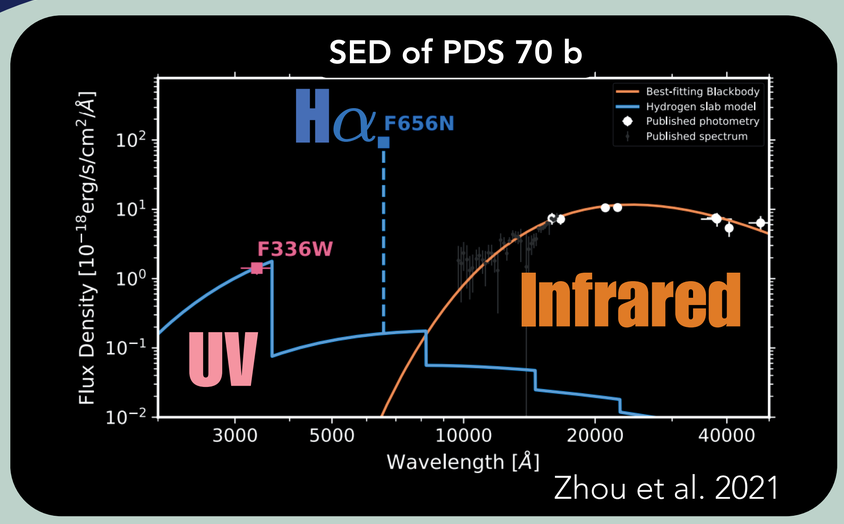
Cloud Fragmentation



Guszejnov et al. (2021), Offner et al. (2023)

Dynamical Capture

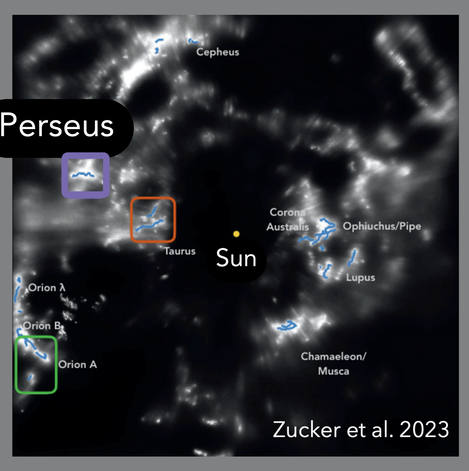
Munoz et al. (2015), Offner et al. (2023)



Hα emission can be used as a beacon to directly image young accreting planets, irrespective of their formation history.

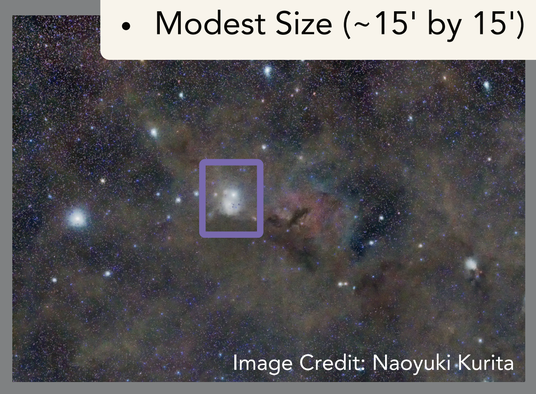
(e.g., Baraffe et al. 2003, Marley et al. 2007, Fortney et al. 2008, Bowler 2016)

1 Perseus Cloud

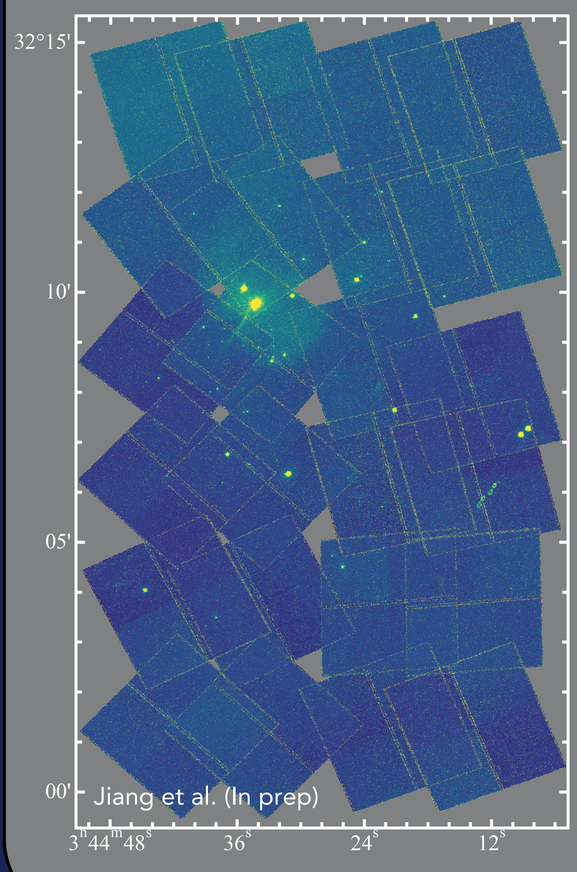


2 IC 348

- Young (~2 Myr)
- Nearby (~320 pc)
- Compact (~400 members)
- Modest Size (~15' by 15')



3 Efficient Hα Imaging of Accreting Planets in IC 348



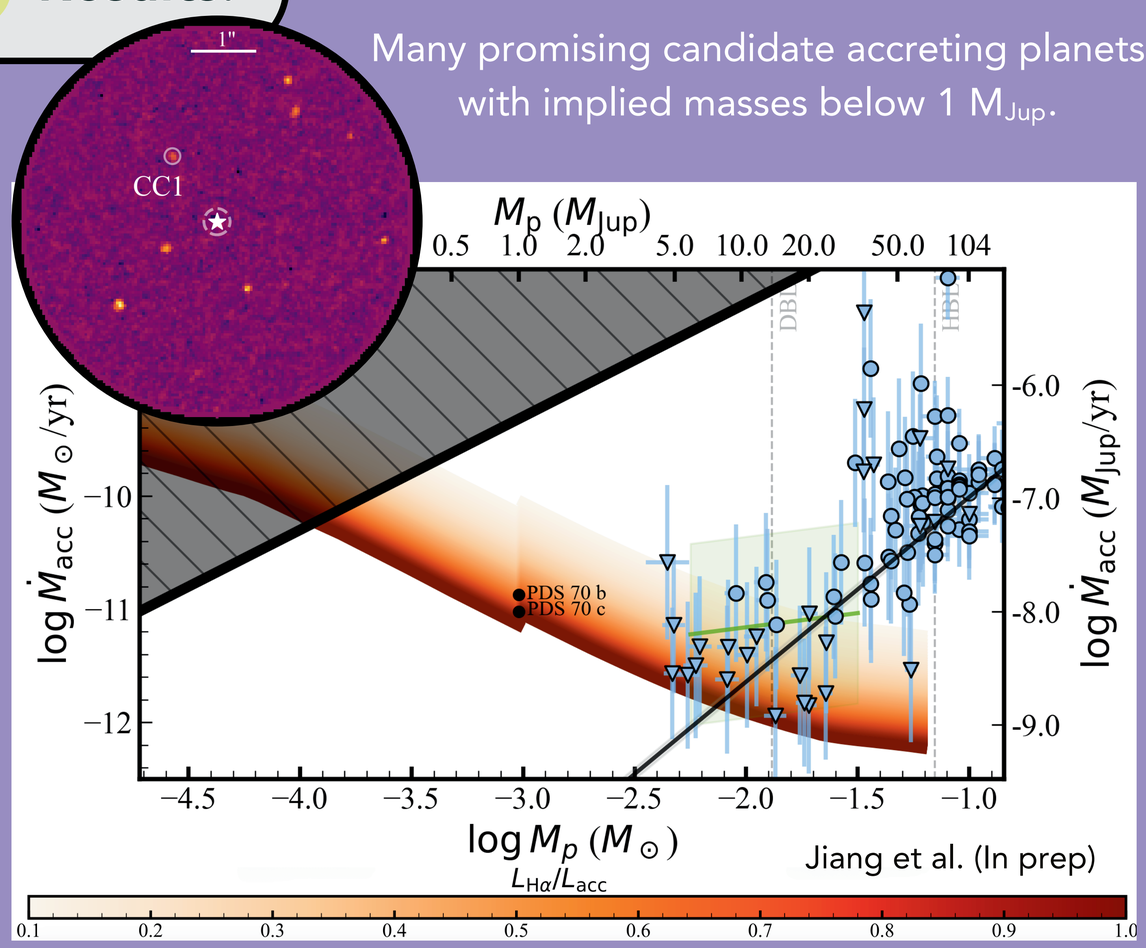
Goals:

- Search for hot- and cold-start giant planets in an unbiased manner
- Explore sub-Saturn-mass planets at wide wide separations
- Measure the occurrence rate of accreting planets at ~100-1000 AU

- HST WFC3-UVIS *F656N* Filter
- 12 orbits, one dither pattern, ~20 mins per field (GO 14172)
- 227 known members fall into the field-of-view of our HST mosaic footprint.

5 Results:

Many promising candidate accreting planets with implied masses below 1 M_{Jup}.



4 Image Classification Model

We develop a Convolutional Neural Network (LeCun et al. 2015) model to distinguish point sources from cosmic ray events.

References:

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