

Tracing Planet Formation in the Hidden Far Infrared



Fingerprinting Planetary Reservoirs:
Determine how planets form in disks around young stars, and explain the observed diversity of planets.

Are we alone?



Tracing Water to Rocky Planets:
Determine the source of water in planet-forming disks, and explain how water accumulates into oceans.

How did we get here?



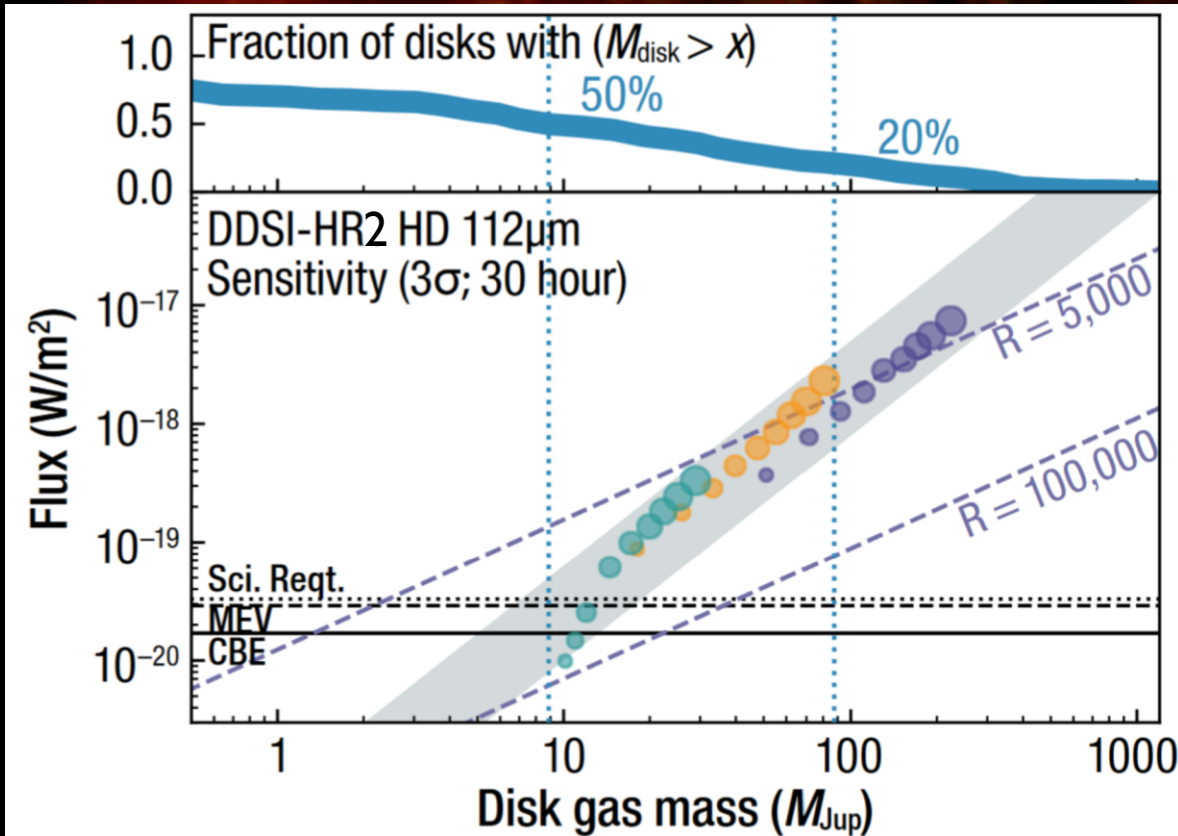
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AAS 243 IRSTIG



HD will establish accurate disk masses



- 56 μm and 112 μm lines
- 50% of disks can be detected at sensitivities of $<10^{-19}$ at $R=10^5$
- At lower sensitivities and R , only detect HD around most massive disks

Disk to stellar mass ratios of 1% (purple), 0.4% (orange), and 0.1% (green) for 0.3 – 2.0 solar masses

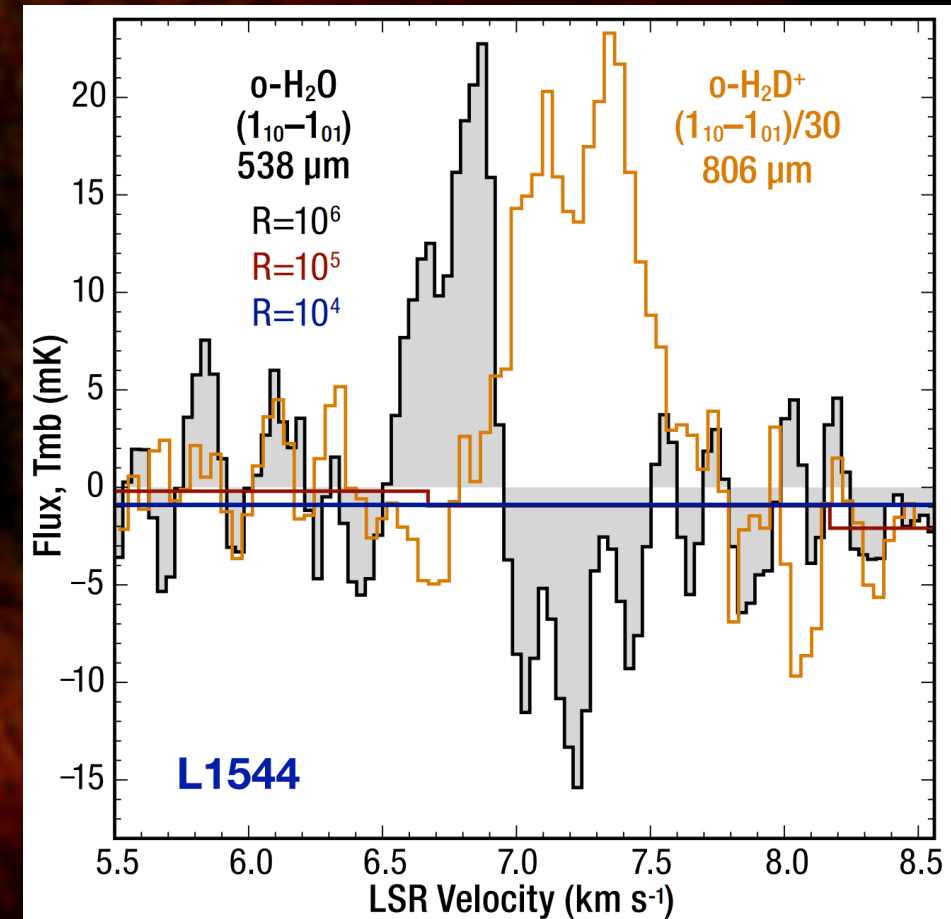
FIRSST: ●

PRIMA: ●

SALTUS: ●

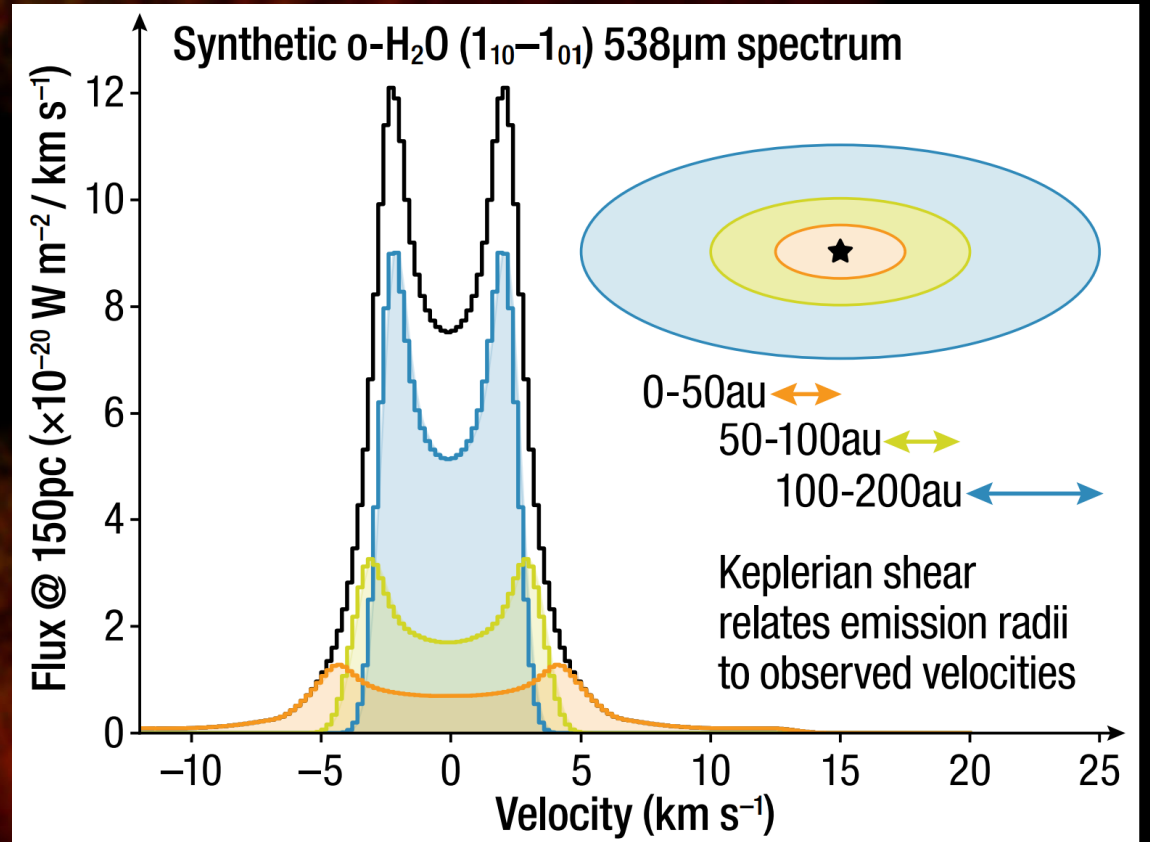
Water lines in prestellar cores and disks

- Complex emission and absorption features demand $R=10^6$ to accurately measure line fluxes
- Can study kinematic behavior like infall to connect to later stages of planet formation
- Keplerian line profiles of disk water lines can inform us about the radial distribution of water
- Measurements of HDO/H₂O and o/p H₂O ratios of prestellar cores and disks will clarify inheritance



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FIRSST: ●

PRIMA: ●

SALTUS: ●

Debris disk science

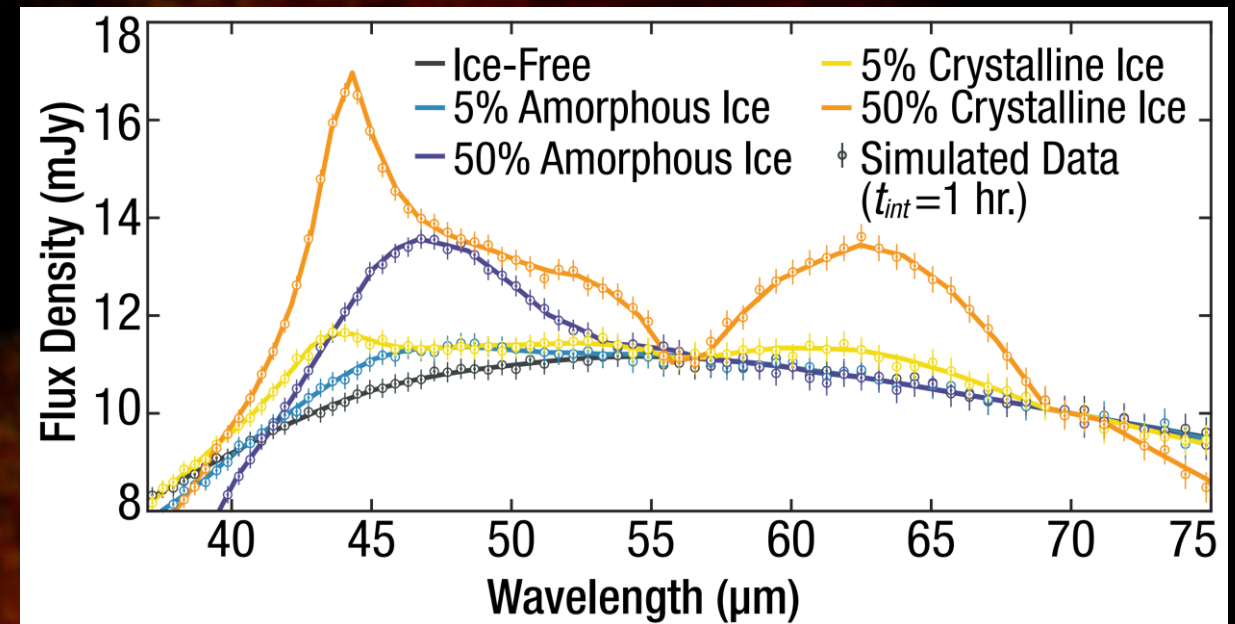
- Yet undetected amorphous and crystalline ice features at 40-55 μm

FIRSST: ● PRIMA: ● SALTUS: ●

- C:O ratios in gaseous debris disks can constrain composition and connect to exoplanet atmospheres

- Need $R > 10^4$ for [CII] at 158 μm for total flux in most disks

FIRSST: ● PRIMA: ● SALTUS: ●



Other Science Objectives and GO Ideas

- Comets!
 - D/H ratios from water lines
 - Disk Evaporation Mechanisms
 - [OI] and [NII]
 - Revisit the Fab Four Debris Disks
 - ***Debris Disk Halos?***
 - Search for Exo-Zodis around nearby stars
 - Extreme Debris Disk Variability
 - Protostar Variability
 - **PRIMA GO Handbook**
 - Star-forming region mapping
 - Size distribution of KBOs
 - Mineralogy in PPDs
 - Ammonia chemistry in PPDs
- Discussion: What is missing on this list?***

Thanks for listening!