

Herschel Observations of gas in protoplanetary disks

D. Fedele¹

S. Bruderer¹, E.F. van Dishoeck^{1,2}, G. Meeus³, N. Evans⁴, & DIGIT team

We present the results of a Herschel/PACS (50-200 μ m) spectral survey of protoplanetary disks as part of the key-project DIGIT. The goal is to constrain the radial distribution of different species in disks. The sample includes 22 Herbig AeBe and 8 T Tauri disks. We also present high-resolution spectra of mid-J CO and [CII] lines towards HD 100546 taken with Herschel/HIFI.

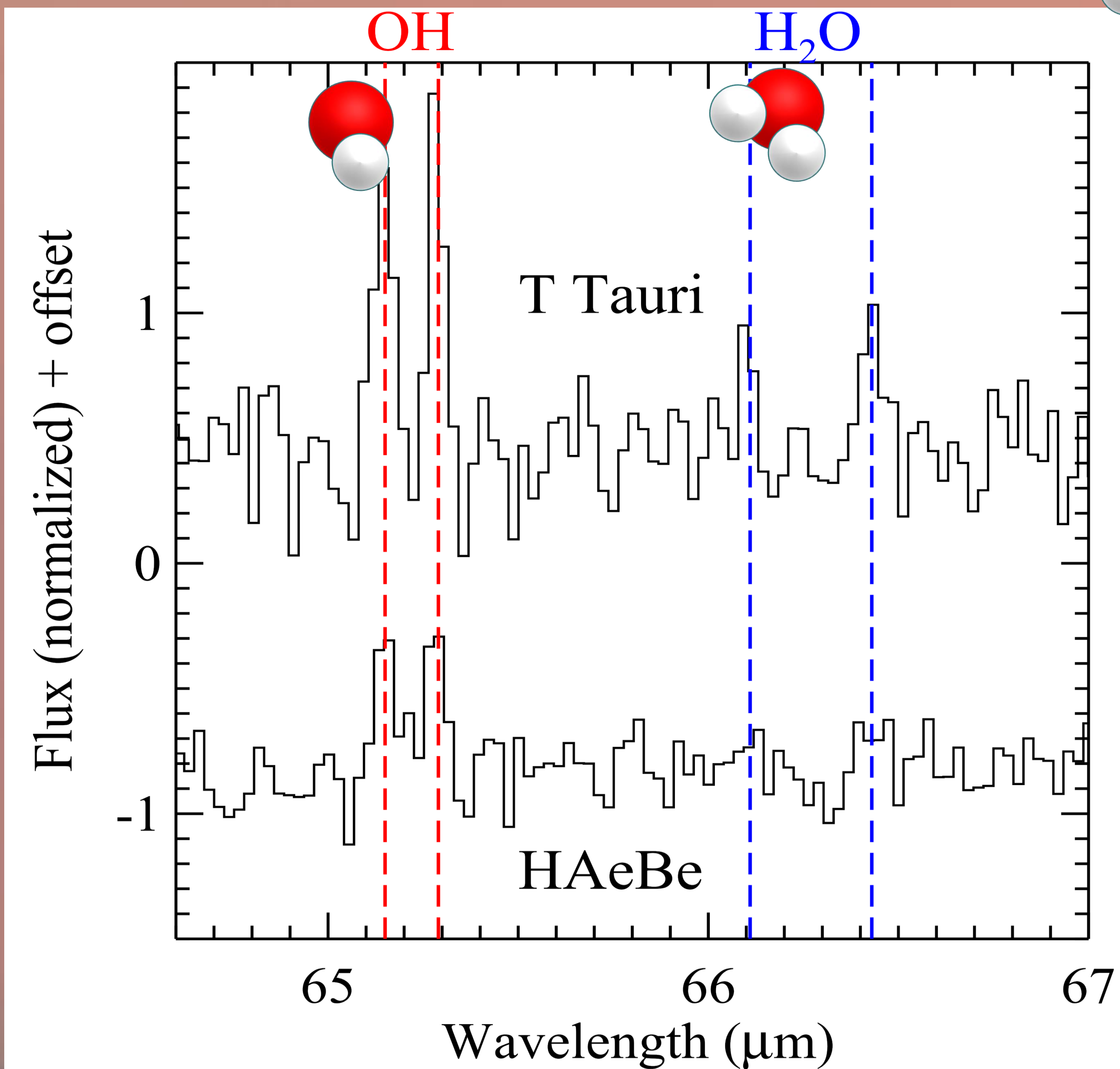


Figure 1: Average Herschel/PACS spectra of T Tauri and Herbig AeBe disks at 65 μ m. Lack of H₂O in Herbig AeBe disks consistent with rapid photodissociation.

PACS detections: [OI], CO, OH, H₂O, CH⁺

[OI] 63 μ m (100% detection) traces the disk atmosphere: $n > 10^5 \text{ cm}^{-3}$, $G_0 \sim 10^3 - 10^7$

CO in TTs and HAeBe flared disks, $T_{\text{CO}} > T_{\text{dust}}$

OH, H₂O, CO trace a warm molecular layer: $r = 10 - 200 \text{ AU}$, $T = 100 - 600 \text{ K}$

HAeBe have high OH/H₂O at all wavelengths, TTs disks show a drop at long wavelengths

Most of [CII] in HAeBe associated to a spatially extended component

$T(r)$ in HD 100546 probed with CO line profiles with HIFI and APEX

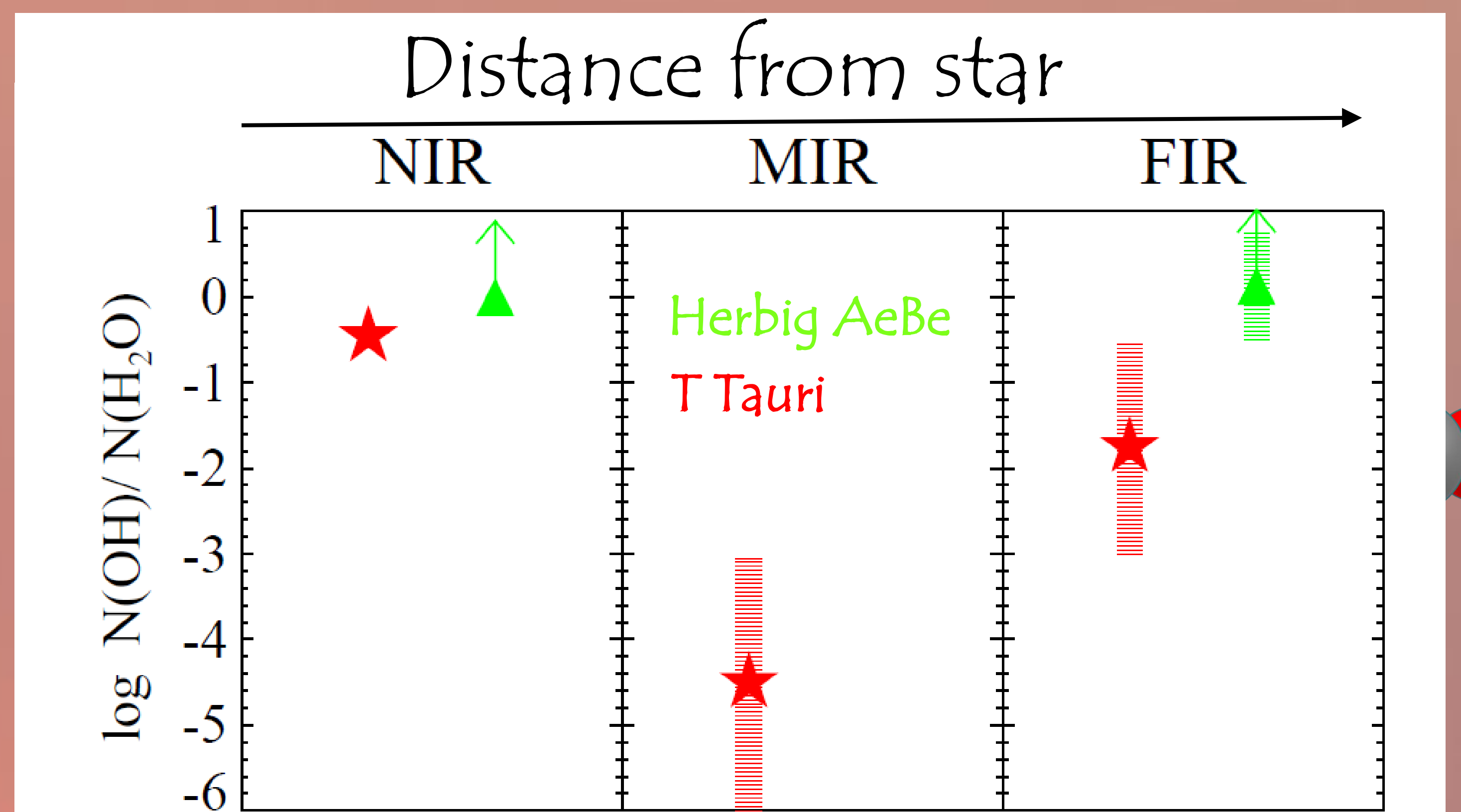


Figure 2: OH/H₂O column density ratio at different wavelengths in T Tauri and Herbig AeBe disks

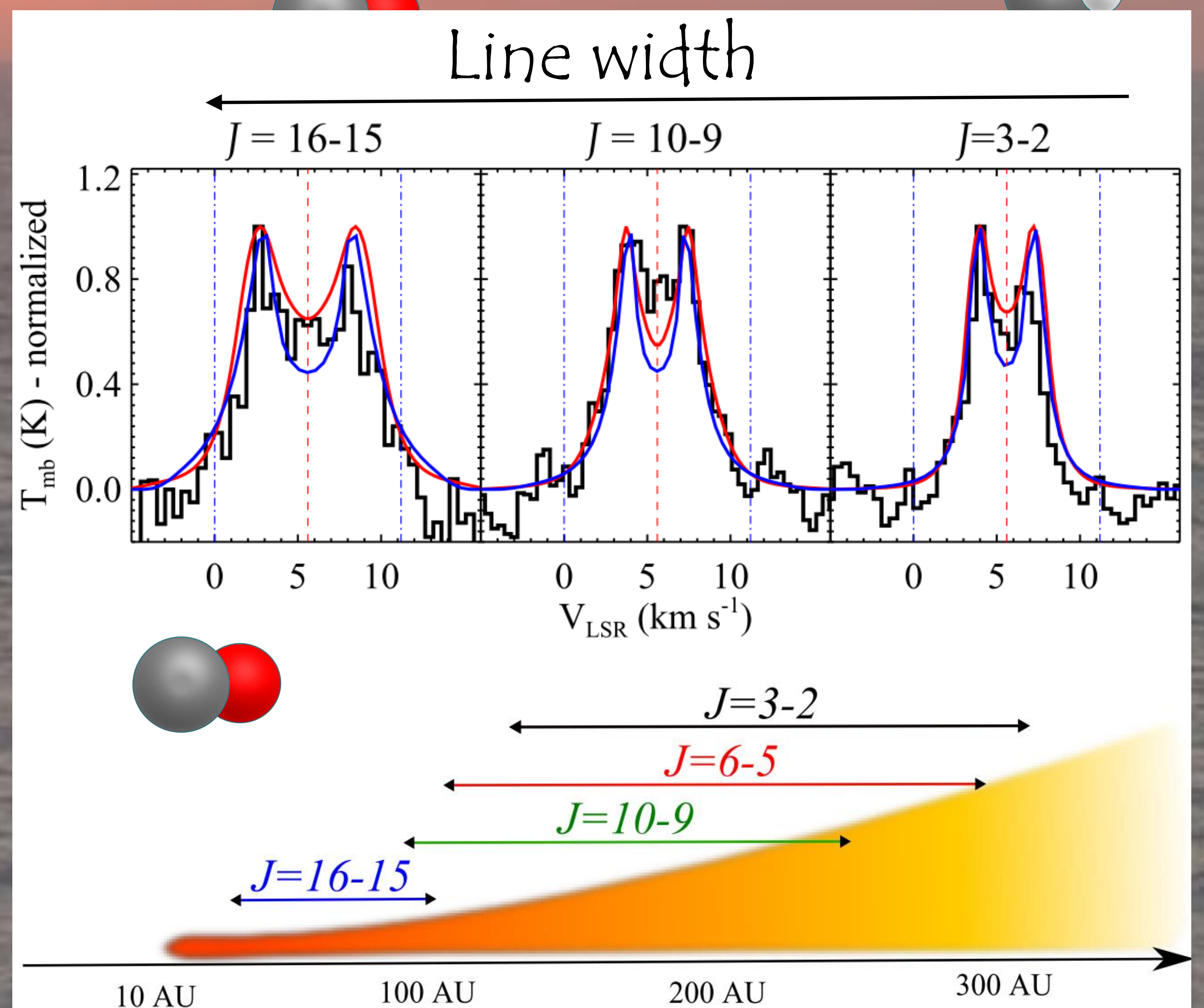


Figure 3: CO line profiles in HD 100546 compared to thermochemical models (red, Bruderer et al. 2012) and best-fit power-law model (blue): $T(r) \propto r^{-0.8}$

Fedele et al. 2011 ApJ, 732, 106; Fedele et al. 2012, A&A, 544, 9; Fedele et al. 2013a submitted; Fedele et al. 2013b submitted; Bruderer et al. 2012, A&A, 541, A91, Meeus et al. 2013 submitted

1: MPE - Germany, fedele@mpe.mpg.de; 2: Leiden Observatory - The Netherlands; 3: UNAM - Spain; 4: University of Texas at Austin - USA

