

Synthetic and Observed Hydrogen Emission from T Tauri Stars

UNIVERSITY OF
EXETER

AWESoMeStars

Background

- Accretion and outflows in CTTS control the stellar formation, but the underlying physics of these systems is poorly constrained. The use of high-resolution spectra offers a powerful diagnostic probe for understanding these processes.
- We present our first parameter study, which investigates synthetic and observed hydrogen emission.

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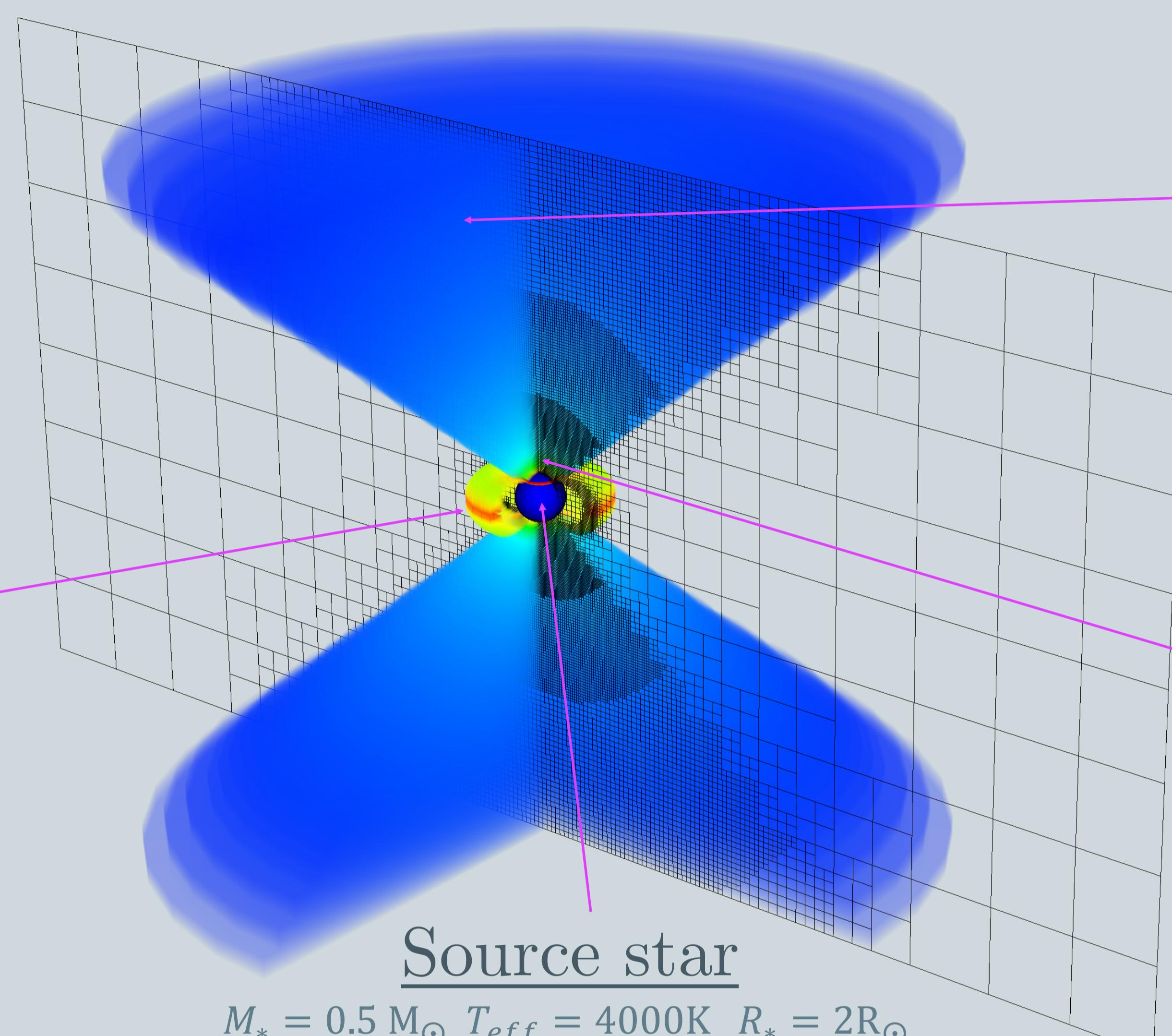
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Radiative Transfer

Non-LTE radiative transfer simulations computed using TORUS¹

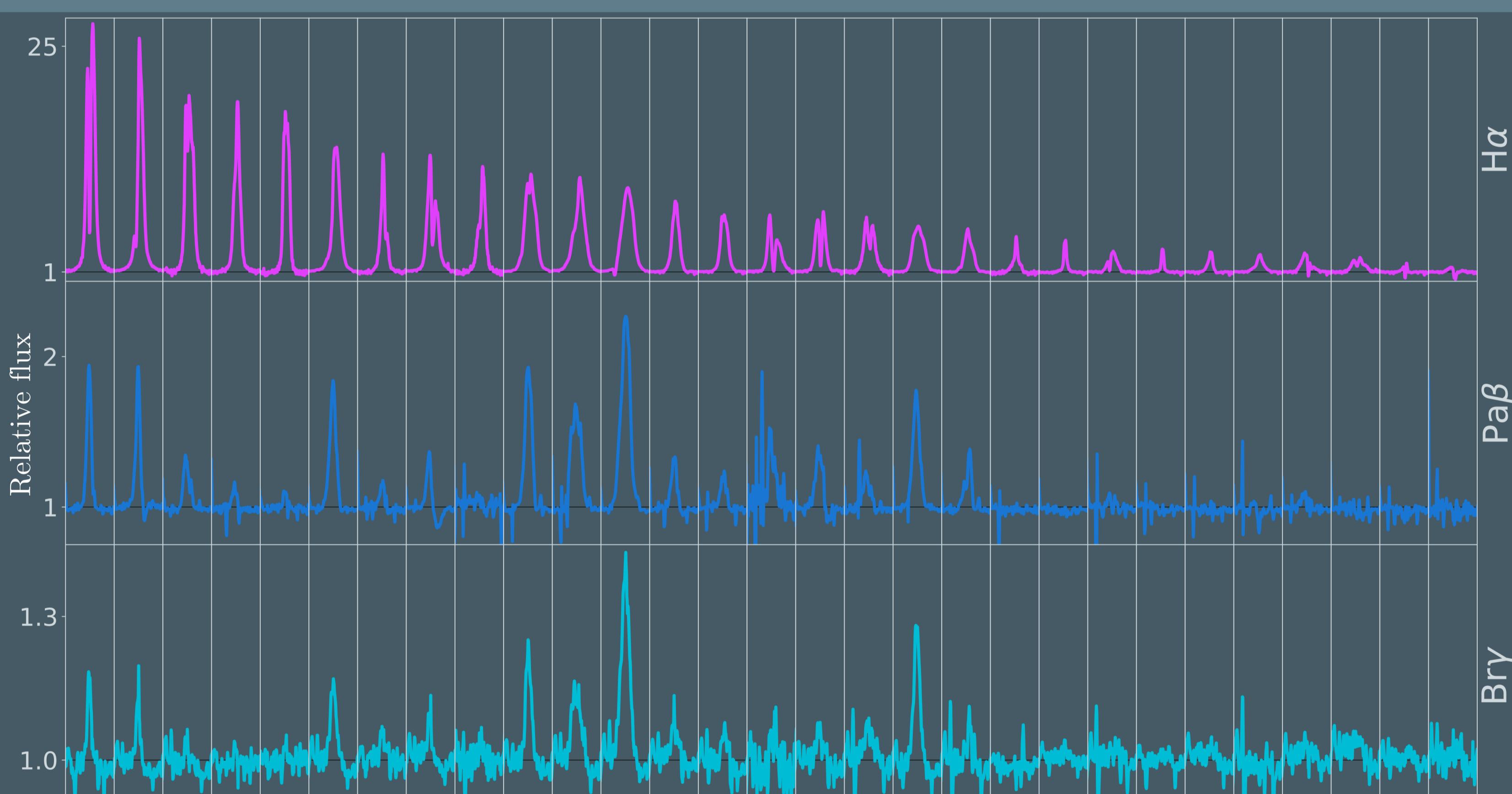


Radial stellar wind

$$v_r(r) = v_\infty \left(1 - \frac{R_*}{r}\right)^\beta \quad v_\infty = 1.3 v_{esc} \quad \beta = 2.89$$

Magnetically connected wind

$$\dot{M}_{sw} = 0.1, 0.01 \dot{M}_{acc} \quad T_{sw} = 6000, 8000, 10000 \text{ K}$$

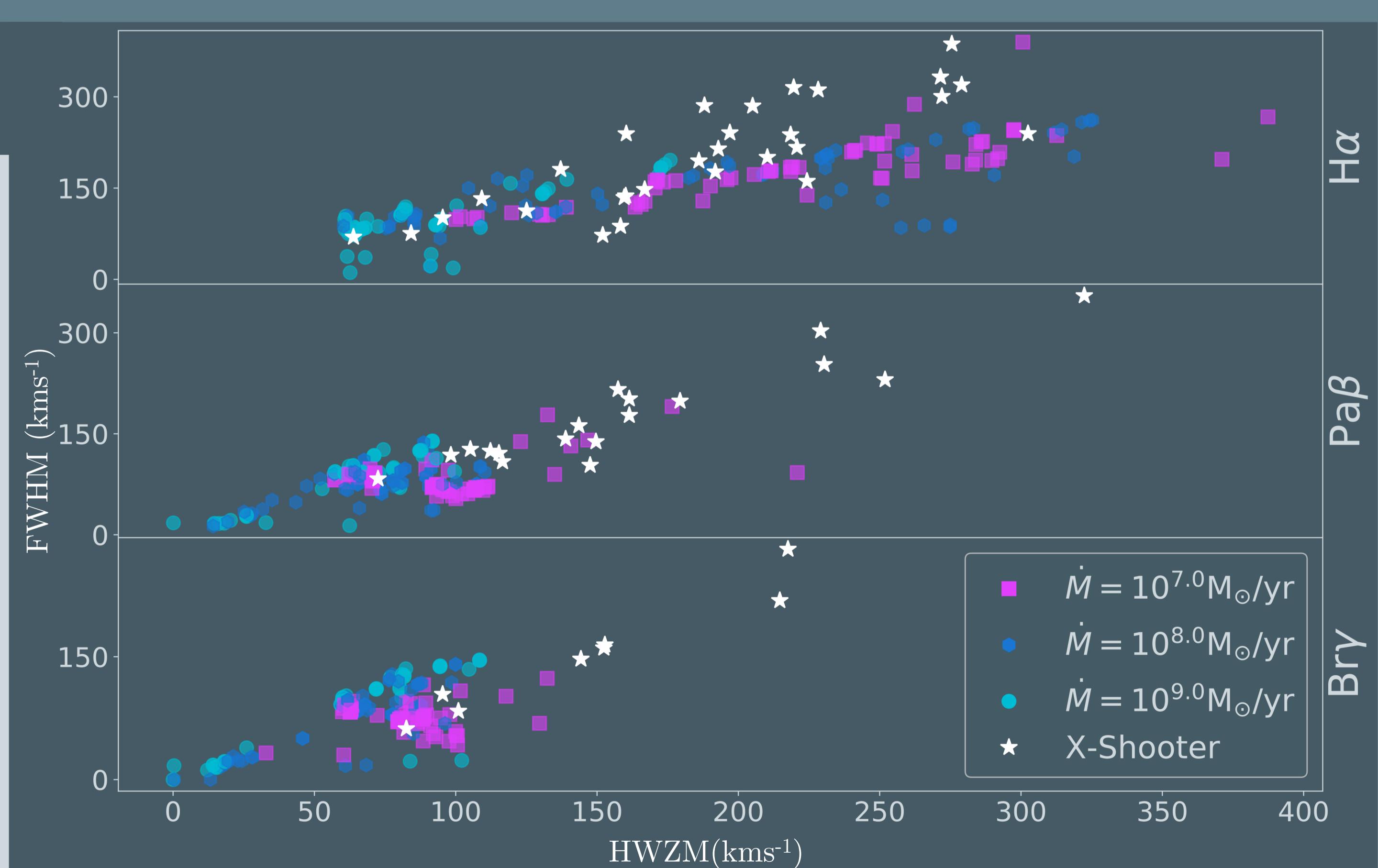


Observations

- The figure shows the line profiles of 29 young, low-mass stellar targets (columns) from the ESO Archive,² selected to have a broad mass accretion range.
- High resolution spectra from VLT's X-Shooter gives near simultaneous observations of H α (top), Pa β (middle), and Br γ (bottom).
- A strong correlation of shape and intensity is seen between the infrared lines, but not between H α and the infrared observations.

Comparison

- The figure shows the FWHM vs. half width at 10% maxima (HWZM). The synthetic observations are clipped so that the H α data points lie near the observed parameter space.
- Synthetic and observed H α lines show a good accord between the measured parameters of: Reipurth classification,³ W_λ , FWHM and HWZM.
- Synthetic lines for Pa β and Br γ are found to be too narrow and Stark broadening is unable to account for the difference.
- Inverse P-Cygni profiles are commonly predicted by the simulations for Pa β and Br γ yet this is not reflected in the observations.⁴



This research has made use of the services of the ESO Science Archive Facility.

1. Harries et al. (2019).
2. Based on observations collected under ESO programme 084.C-1095(A)
3. Reipurth et al. (1996).
4. Folha, D. F. M. & Emerson, J. P. (2001).