

THE IMPRINT OF ACCRETION ON THE UV SPECTRUM OF YOUNG STELLAR OBJECTS: AN X-SHOOTER VIEW

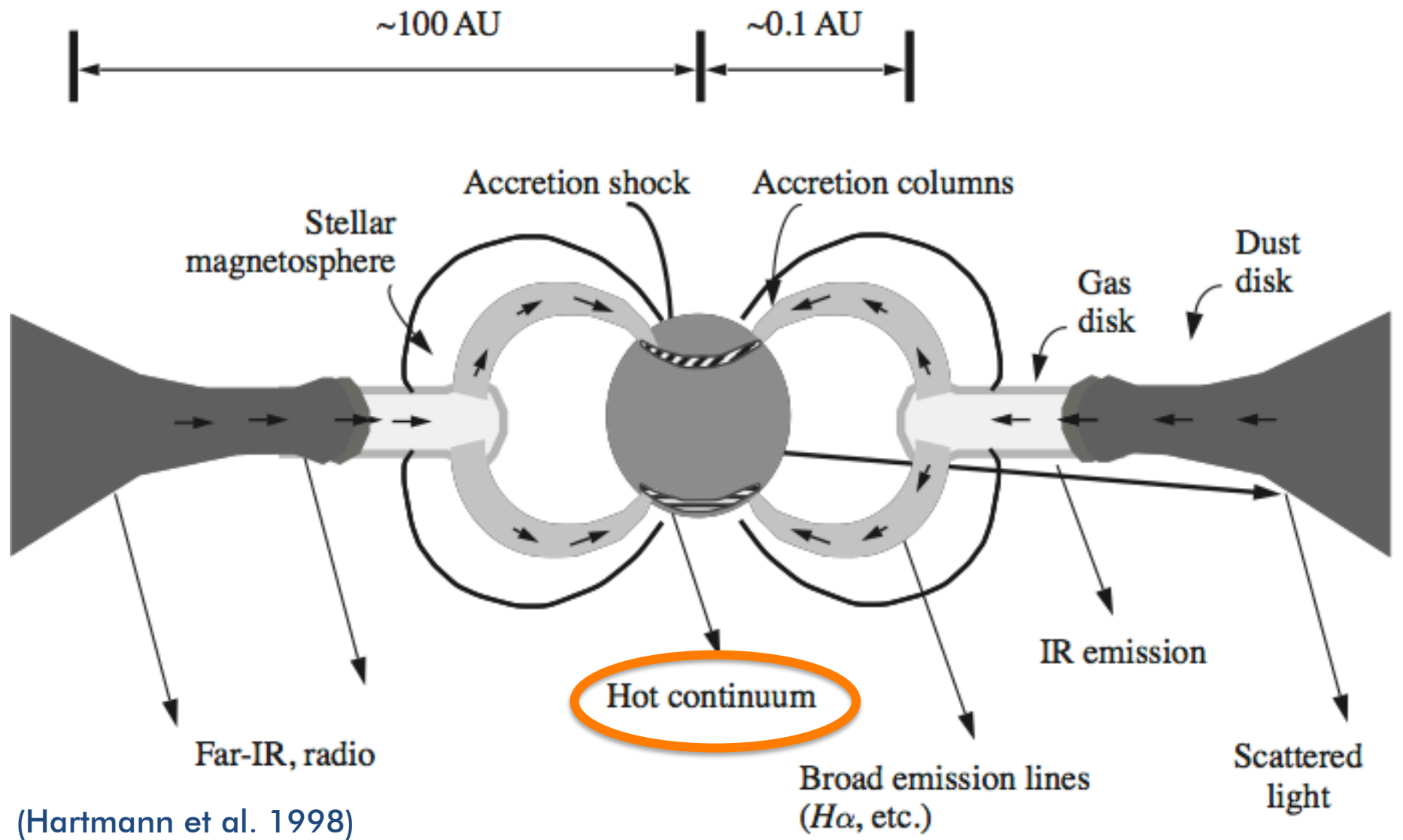
Carlo Felice Manara (ESO-Garching)

UV @ ESO conference - 07.10.2013

WITH: L. Testi (ESO), A. Natta (INAF/DIAS), J. Alcalà (INAF), B. Ercolano (USM),
G. Beccari (ESO), L. Ricci (Caltech), M. Robberto (STScI), N. Da Rio (Florida),
G. De Marchi (ESTEC), G. Lodato (UniMI)



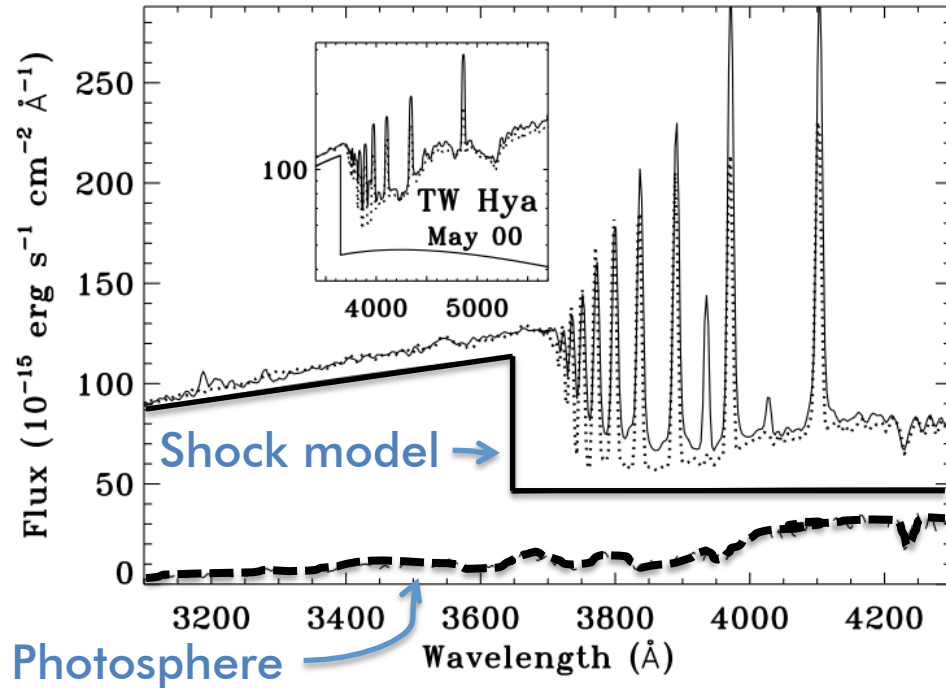
Star-disk interaction: accretion



(Hartmann et al. 1998)

Observations of accretion

UV excess

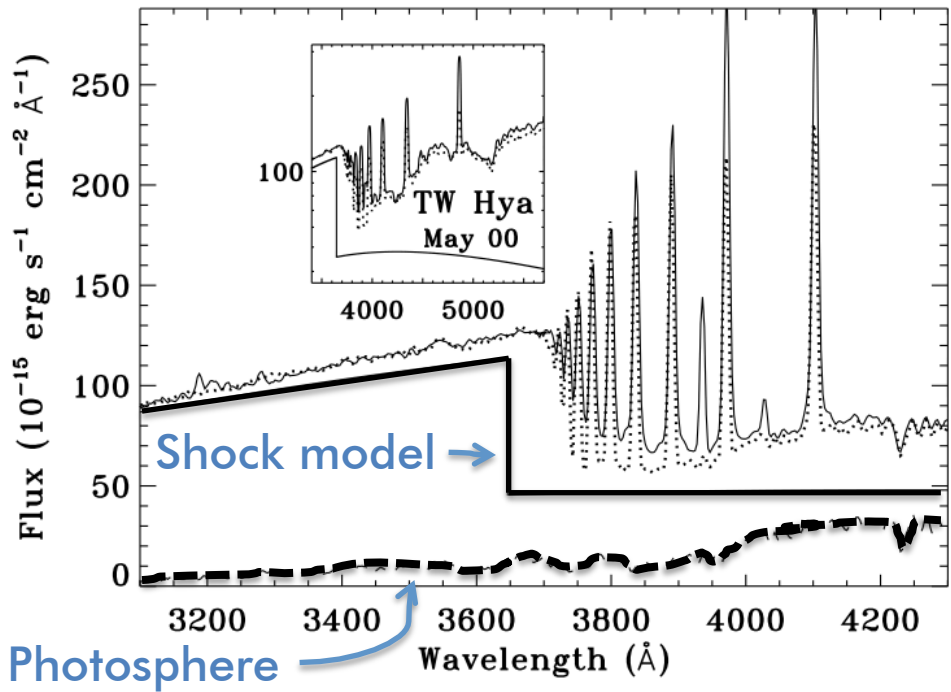


(Herczeg&Hillenbrand 2008)

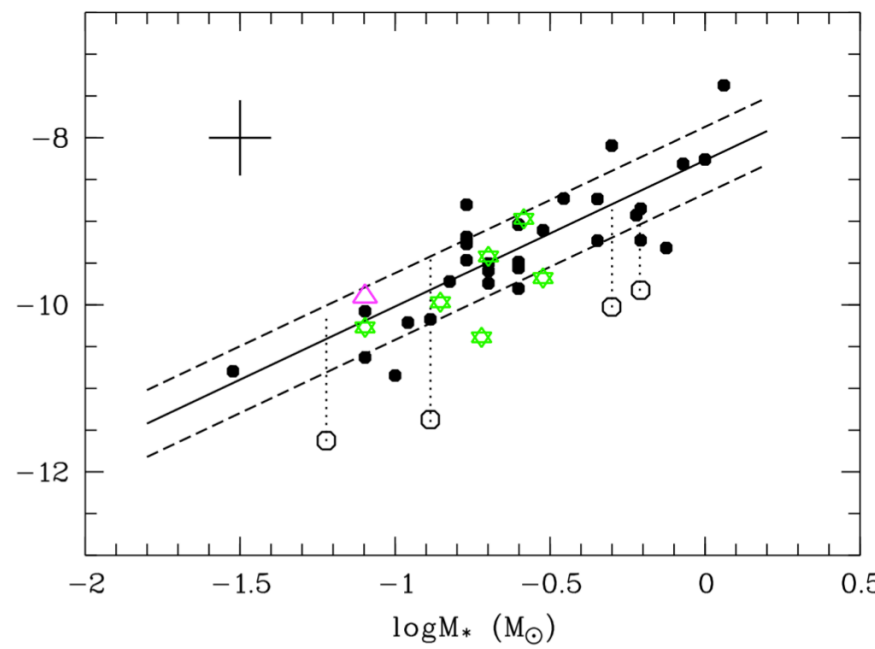
See also: Valenti et al. 1993, Calvet&Gullbring 1998,
Calvet et al. 2004, Rigliaco et al. 2012, Ingleby et al. 2013,
Manara et al. 2013b, Alcalá et al. 2013

Observations of accretion

UV excess



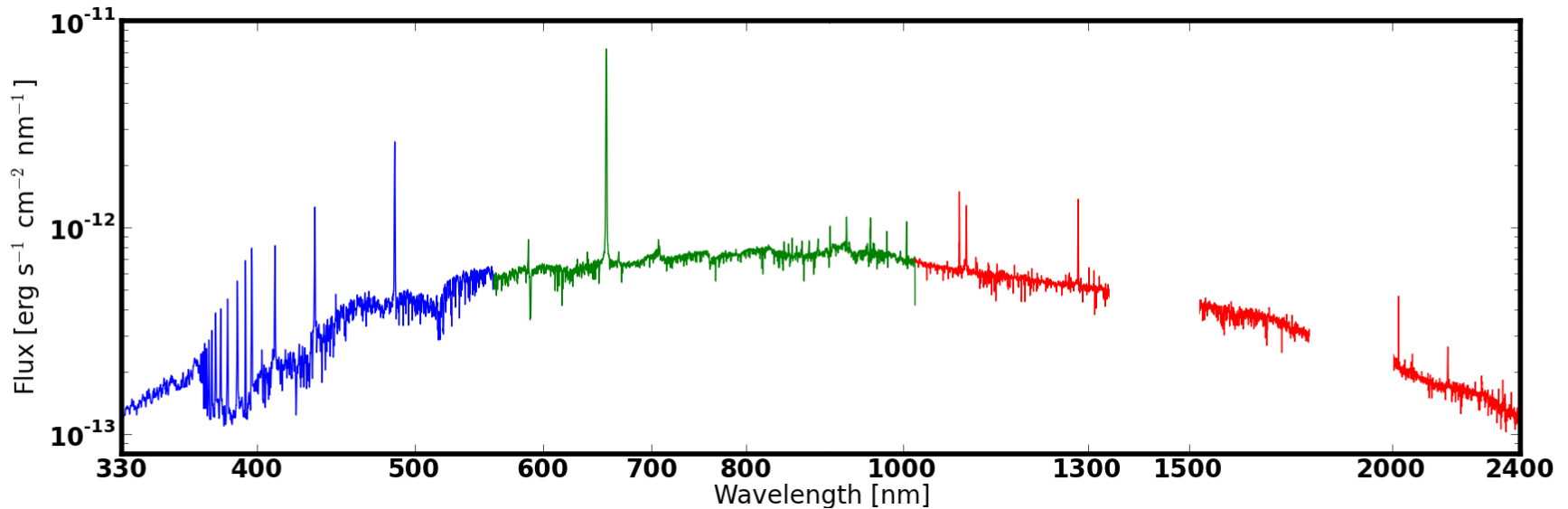
(Herczeg&Hillenbrand 2008)



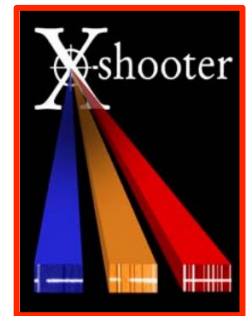
(Alcala et al. 2013)

See also: Valenti et al. 1993, Calvet&Gullbring 1998, Calvet et al. 2004, Rigliaco et al. 2012, Ingleby et al. 2013, Manara et al. 2013b, Alcala et al. 2013

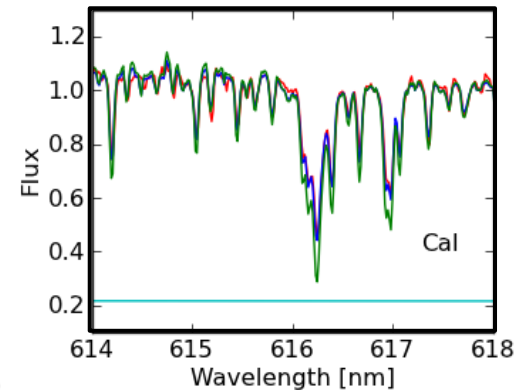
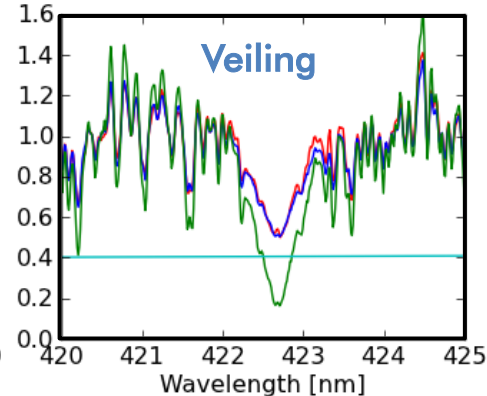
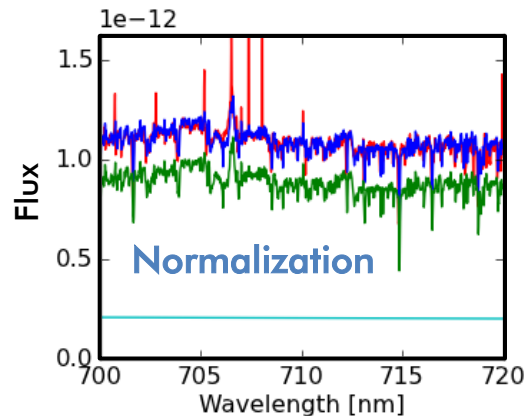
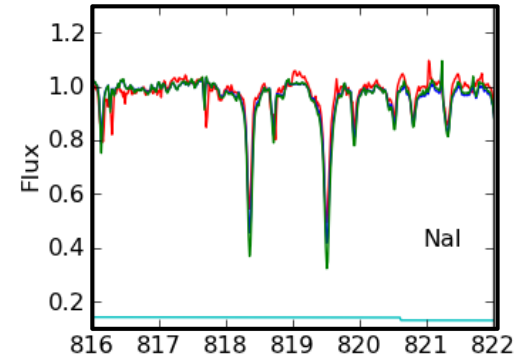
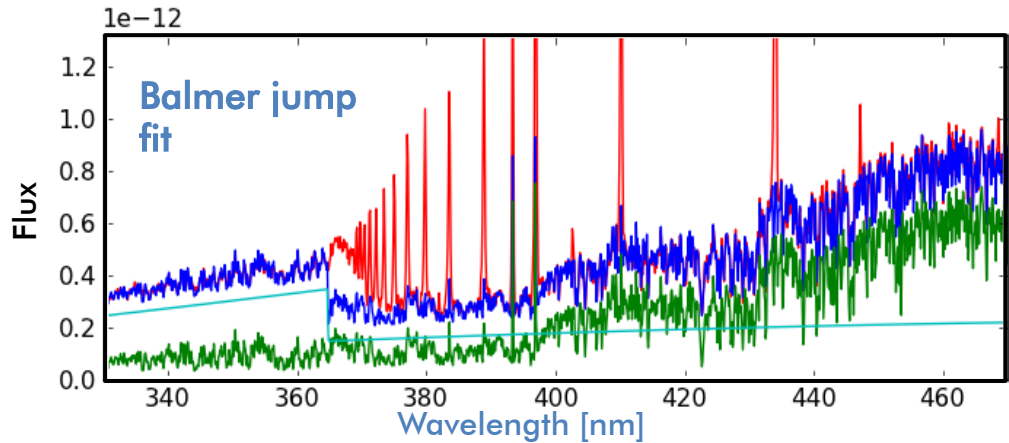
VLT/X-Shooter



- Medium resolution and high-sensitivity
- Simultaneous coverage from ~300 nm to ~2500 nm
 - UV-excess
 - Various accretion tracers
 - Photospheric features



VLT/X-Shooter



(Manara et al. 2013b)

- ❑ Photospheric template: Class III YSOs (Manara et al. 2013a) → **SpT, L***
- ❑ Isothermal hydrogen slab model for the accretion shock spectrum → **L_{acc}**
- ❑ Extinction values + reddening law → **A_V**

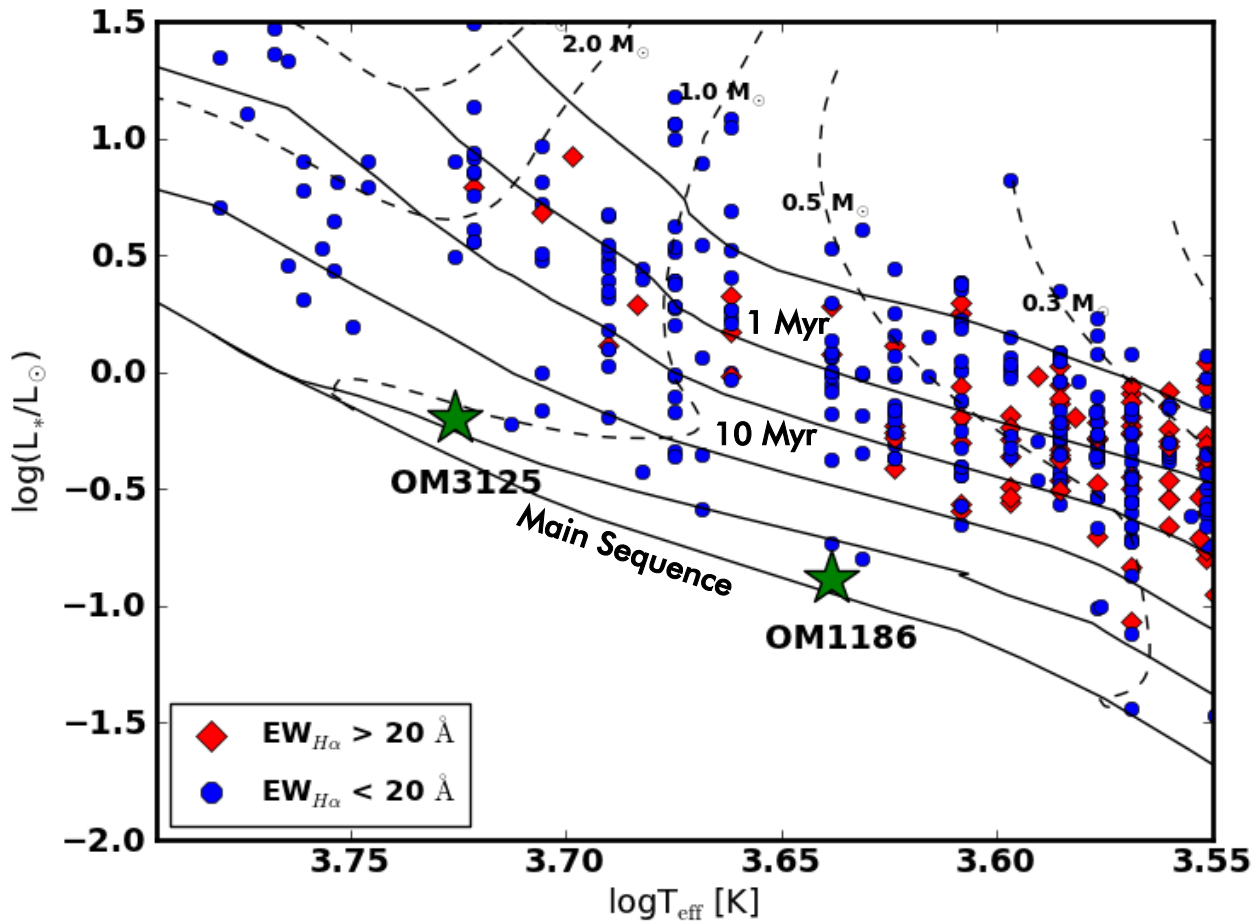
**ACCRETION &
STELLAR PROPERTIES
DETERMINATION**

Older population?

EVIDENCE for longer lived protoplanetary disks at ages > 10 Myr (e.g. Beccari et al. 2010, De Marchi et al. 2010, 2011) in massive stellar clusters.

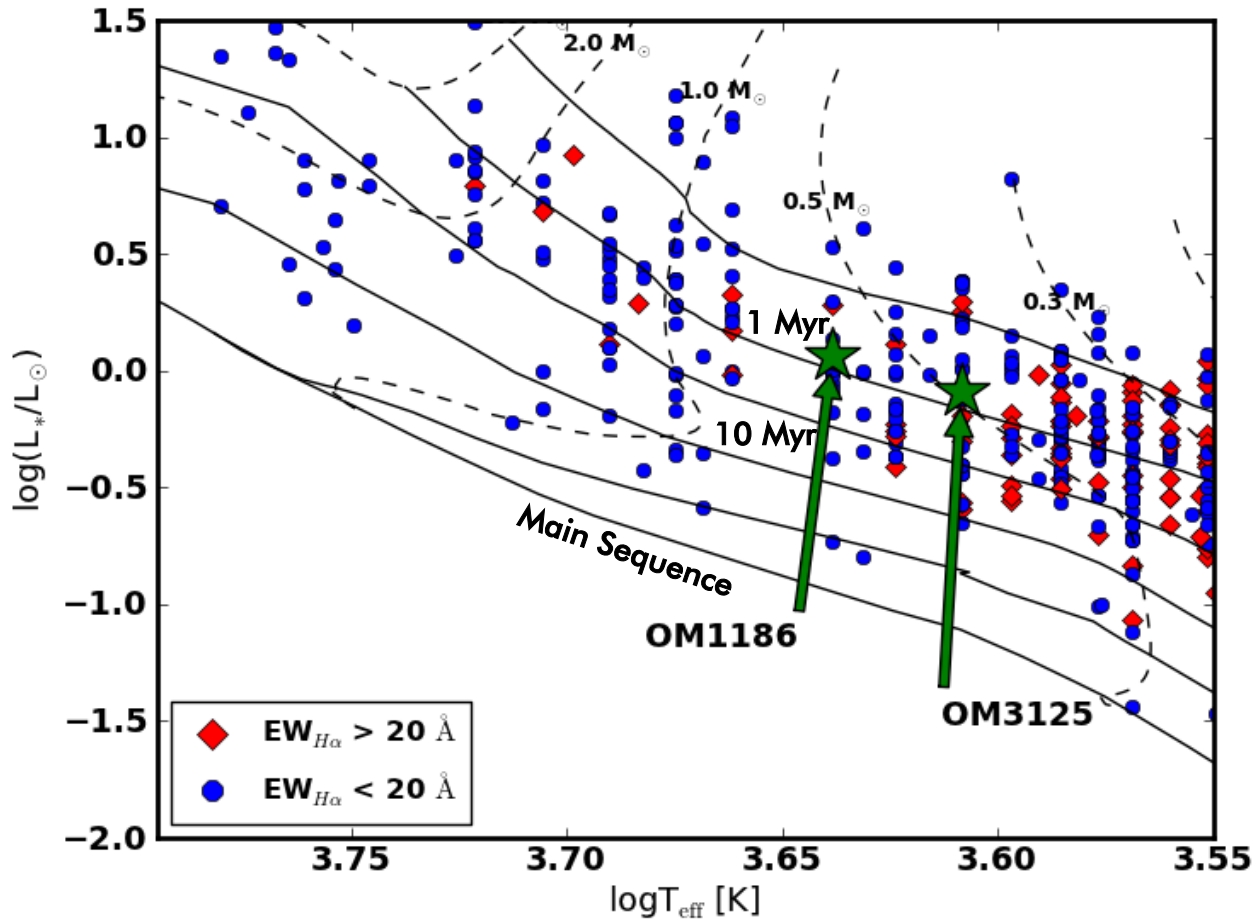
Few of these candidate "older" Pre Main Sequence objects could be found in nearby regions like the Orion Nebula Cluster (e.g. Da Rio et al. 2010, 2012).

→ Ideal TARGETS
for X-Shooter
analysis



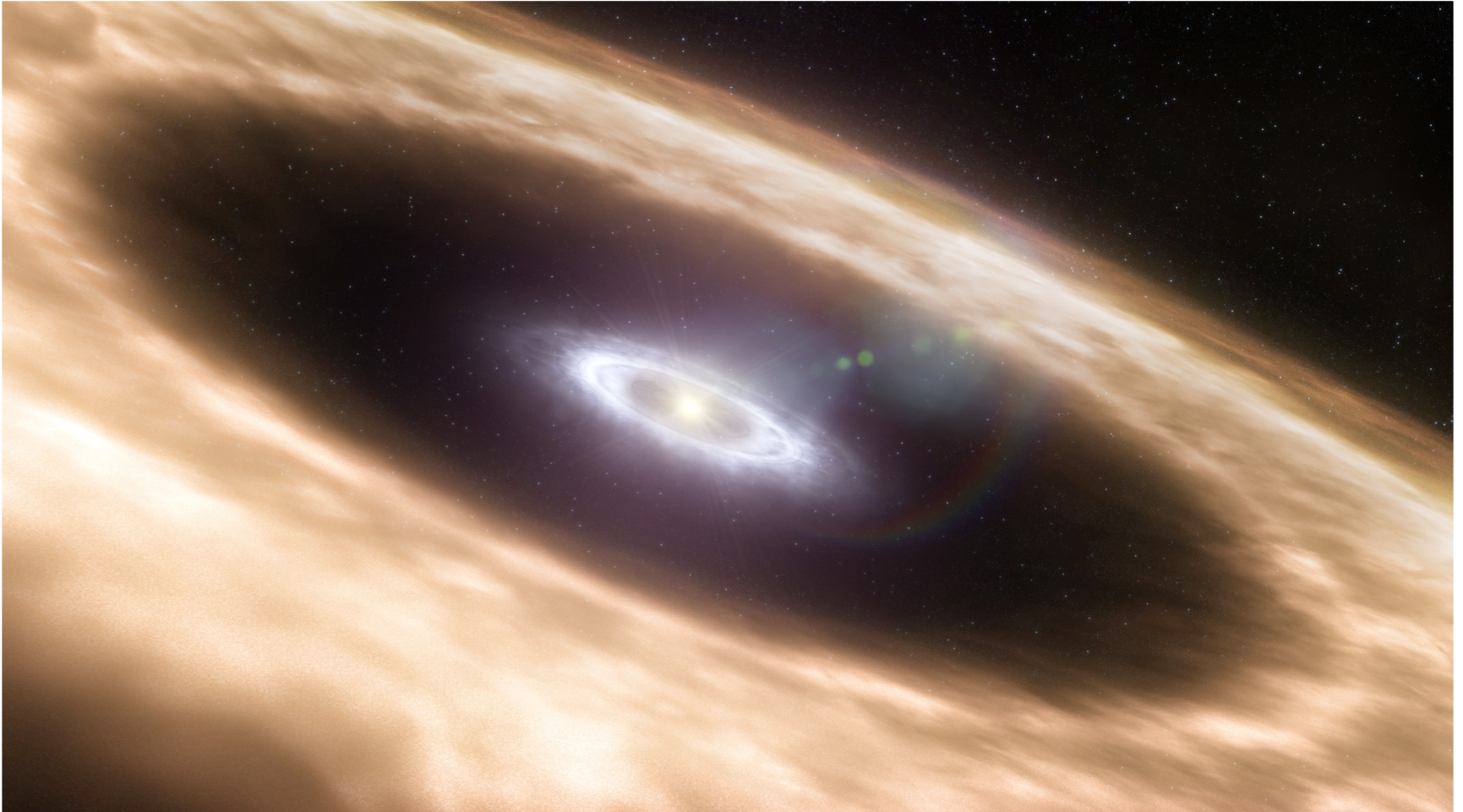
Older population?

RESULT: Both targets were misclassified.
Their ages are compatible with that of the ONC.



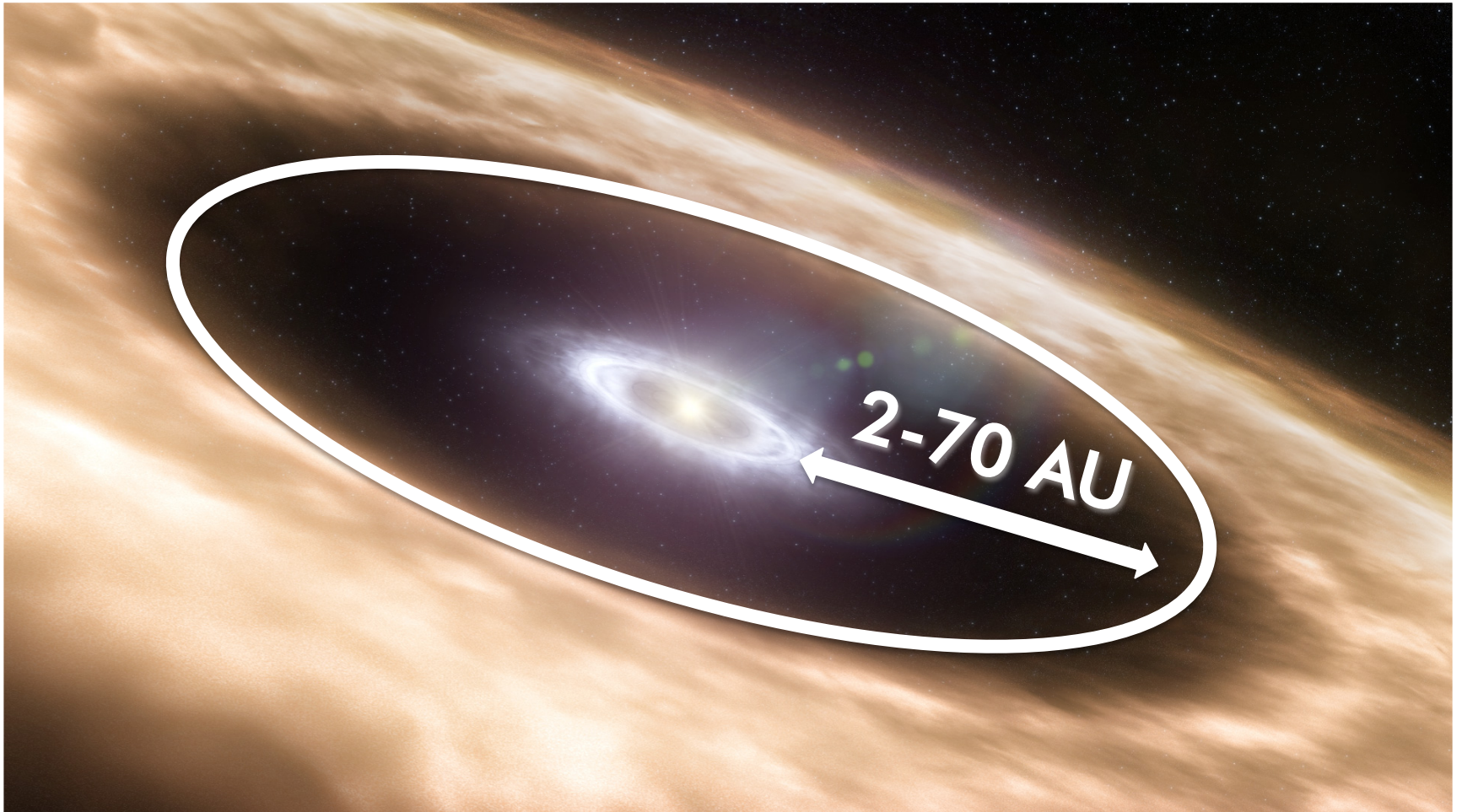
→ The question on the real nature of this older population remains open.
BUT
now we have a method!

Transitional disks



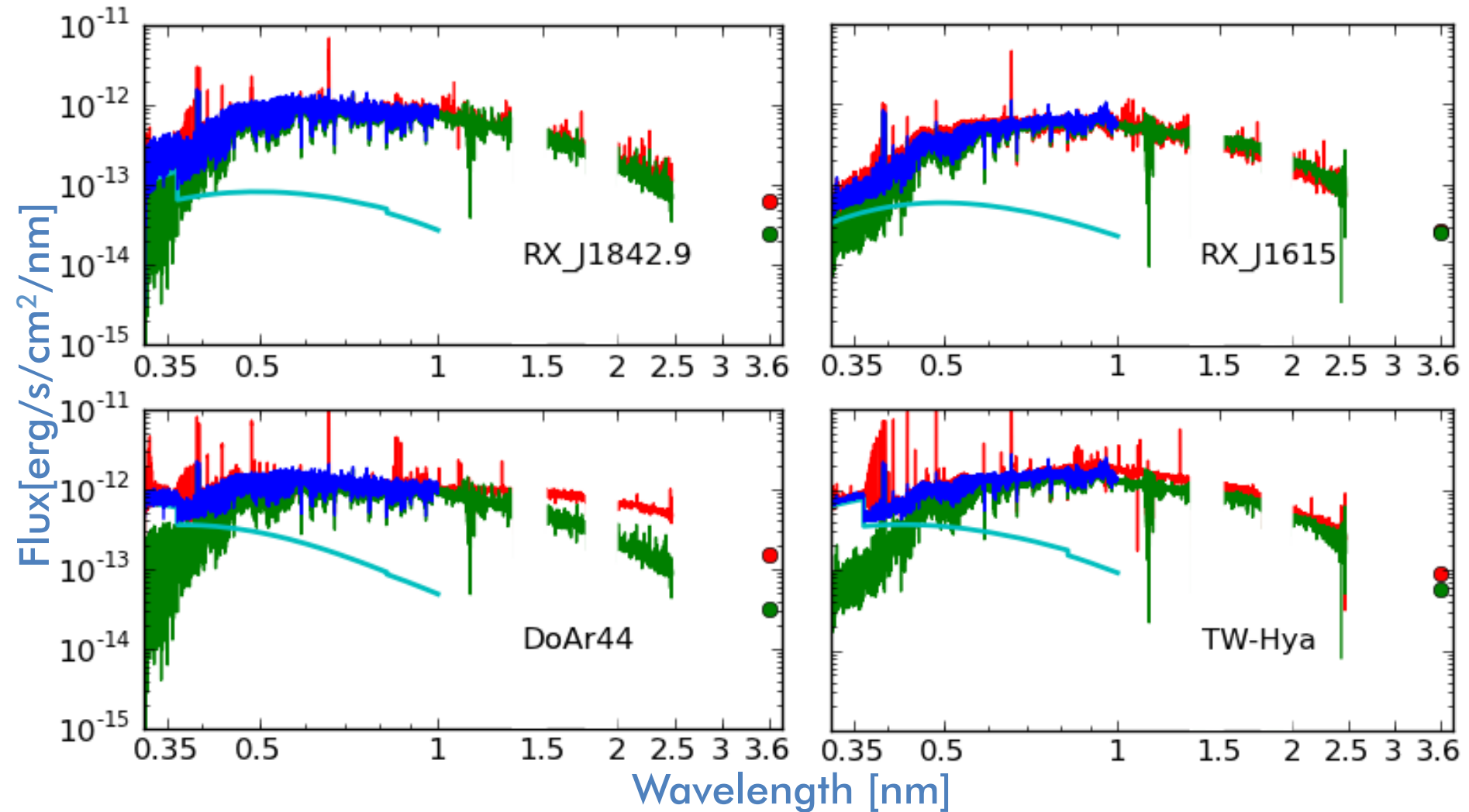
CREDITS: ESO

Transitional disks



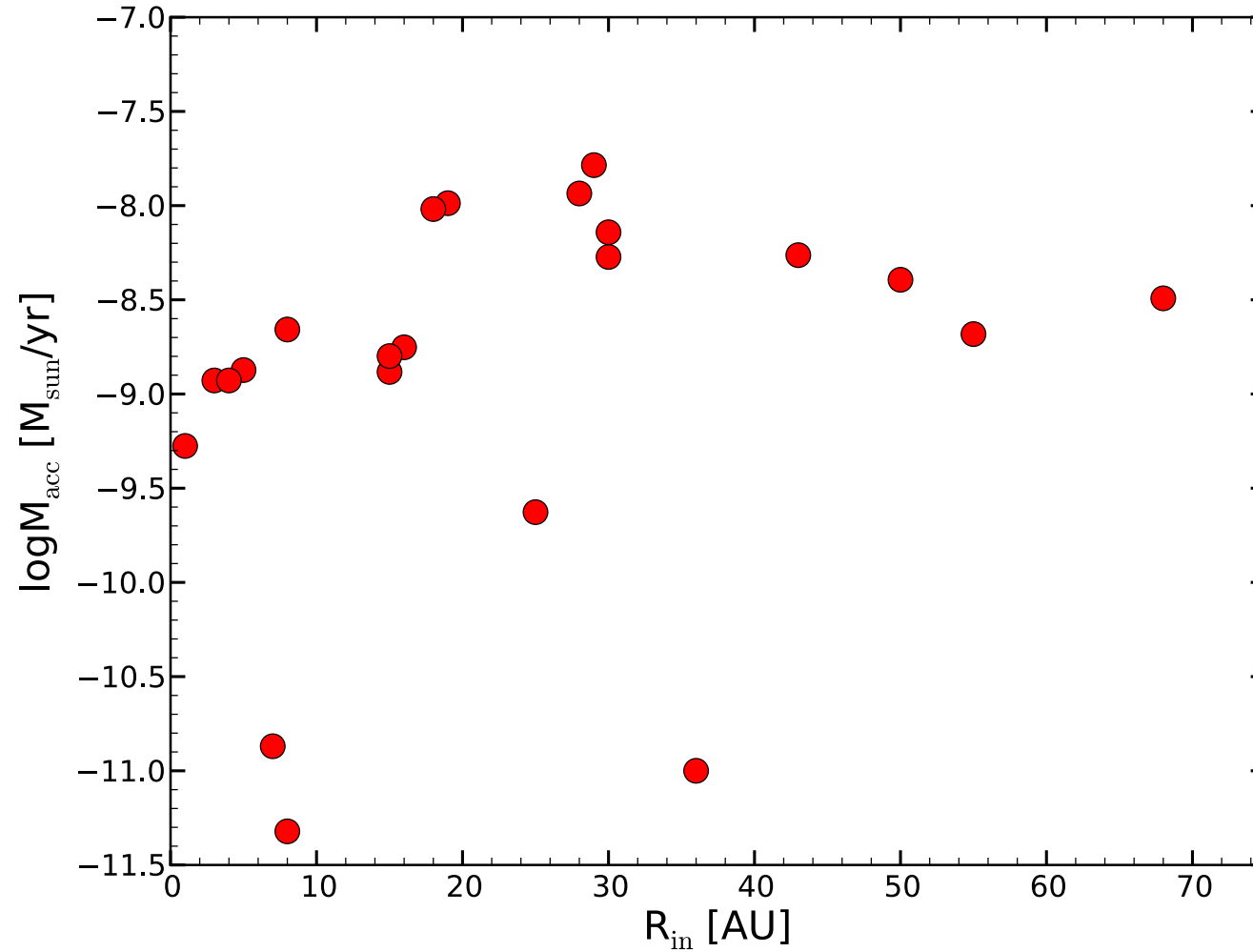
CREDITS: ESO

Transitional disks – Accretion



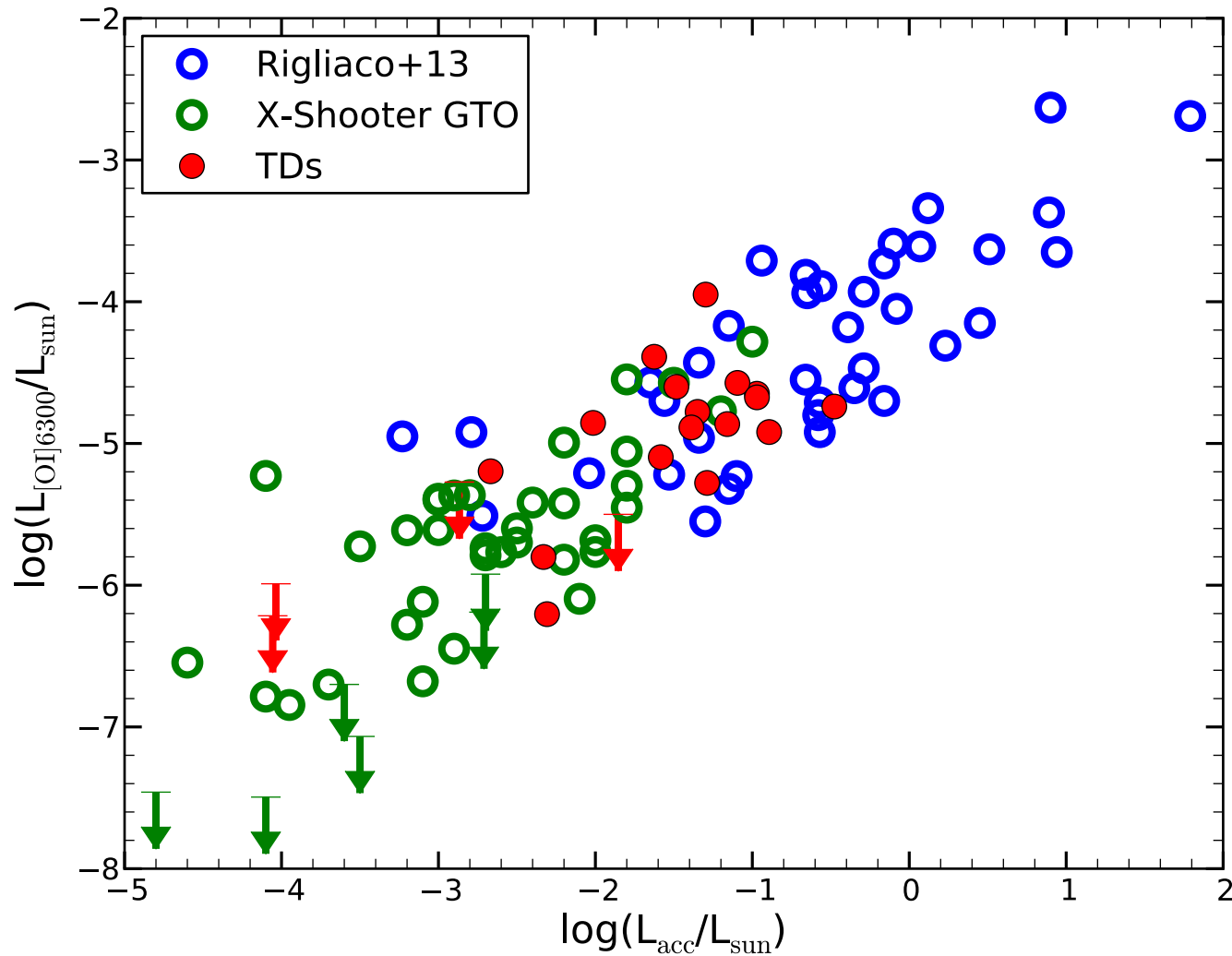
(Manara et al., in prep.)

Transitional disks – Accretion



(Manara et al., in prep.)

Transitional disks – Winds



(Manara et al., in prep., Rigliaco et al. 2013, Natta et al., in prep.)

TAKE HOME

- UV observations are crucial to study accretion in YSOs
- Large wavelength coverage is needed to derive stellar parameters
- Observations of UV are a probe also of the disk morphology

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THANK YOU

Carlo Felice Manara (ESO-Garching)

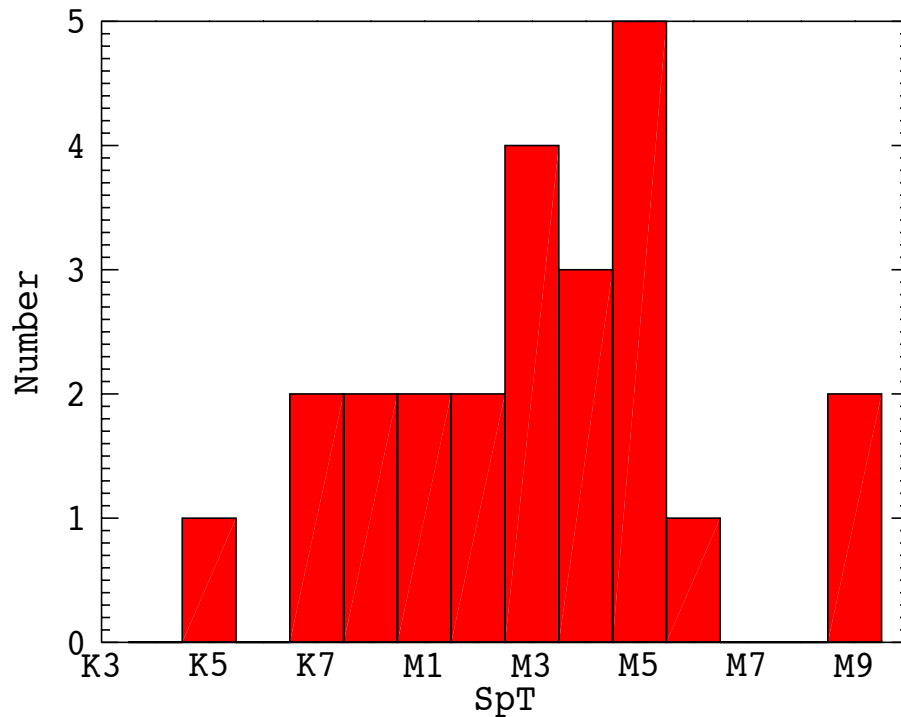


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Photospheric templates

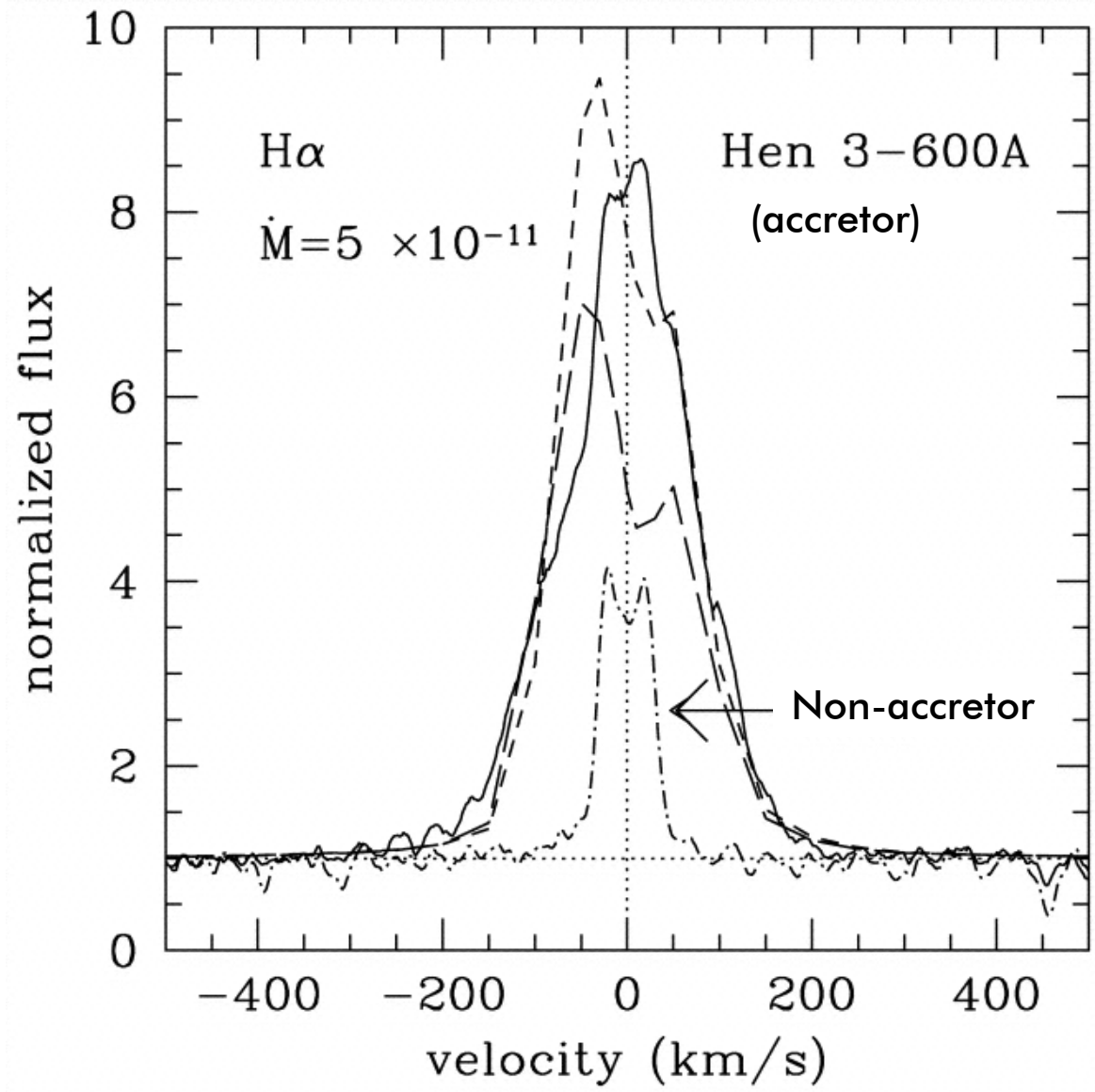
Spectra of non-accreting young stellar objects are the best possible photospheric templates for accretion determination because they have similarly intense chromospheric activity



Public library of 24 spectra with SpT from K5 to M9.5

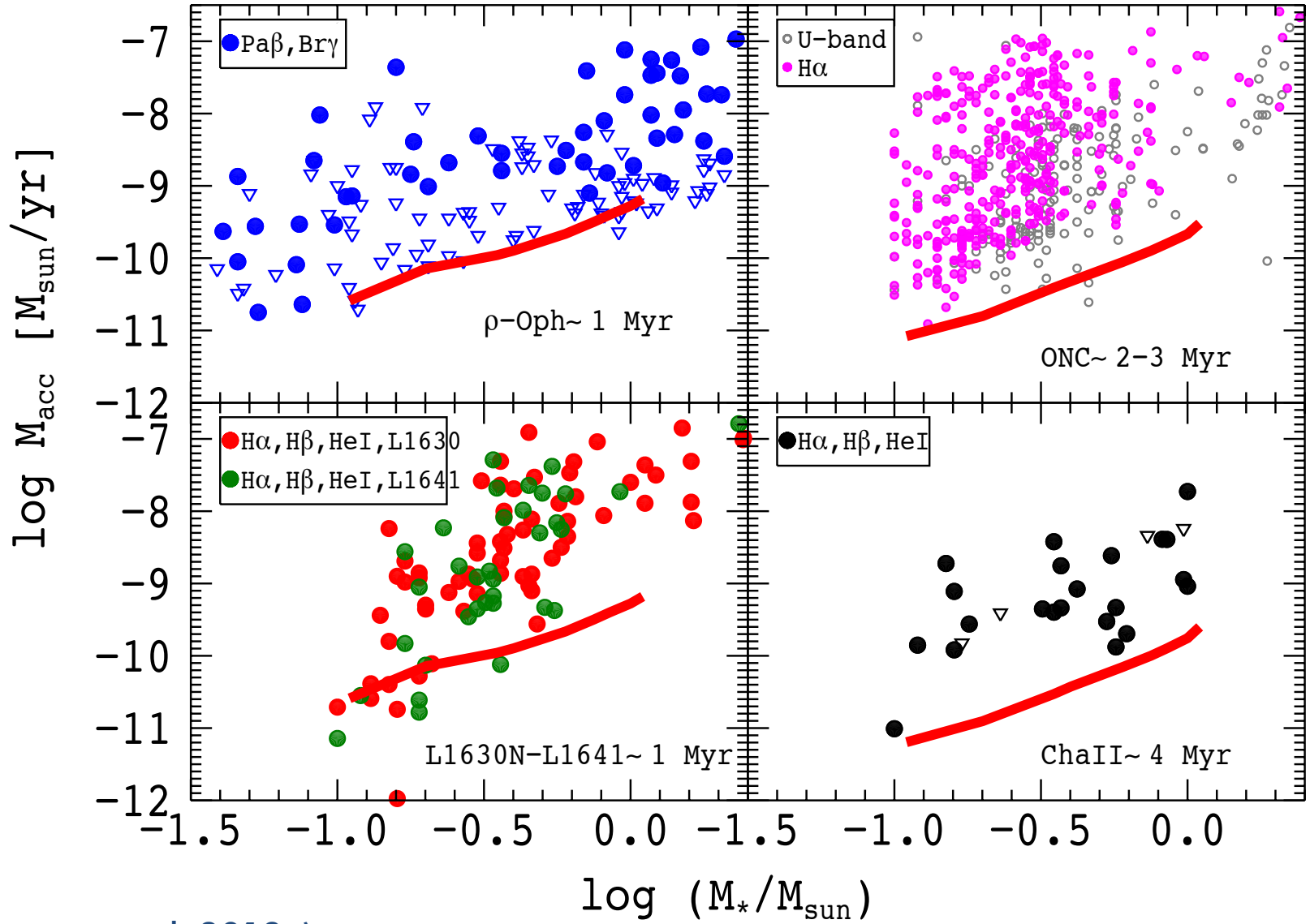
(Manara et al. 2013a)

Observational threshold on \dot{M}_{acc}



(Adapted from Muzerolle et al. 2000)

Observational threshold on M_{acc}



(Manara et al. 2013a)

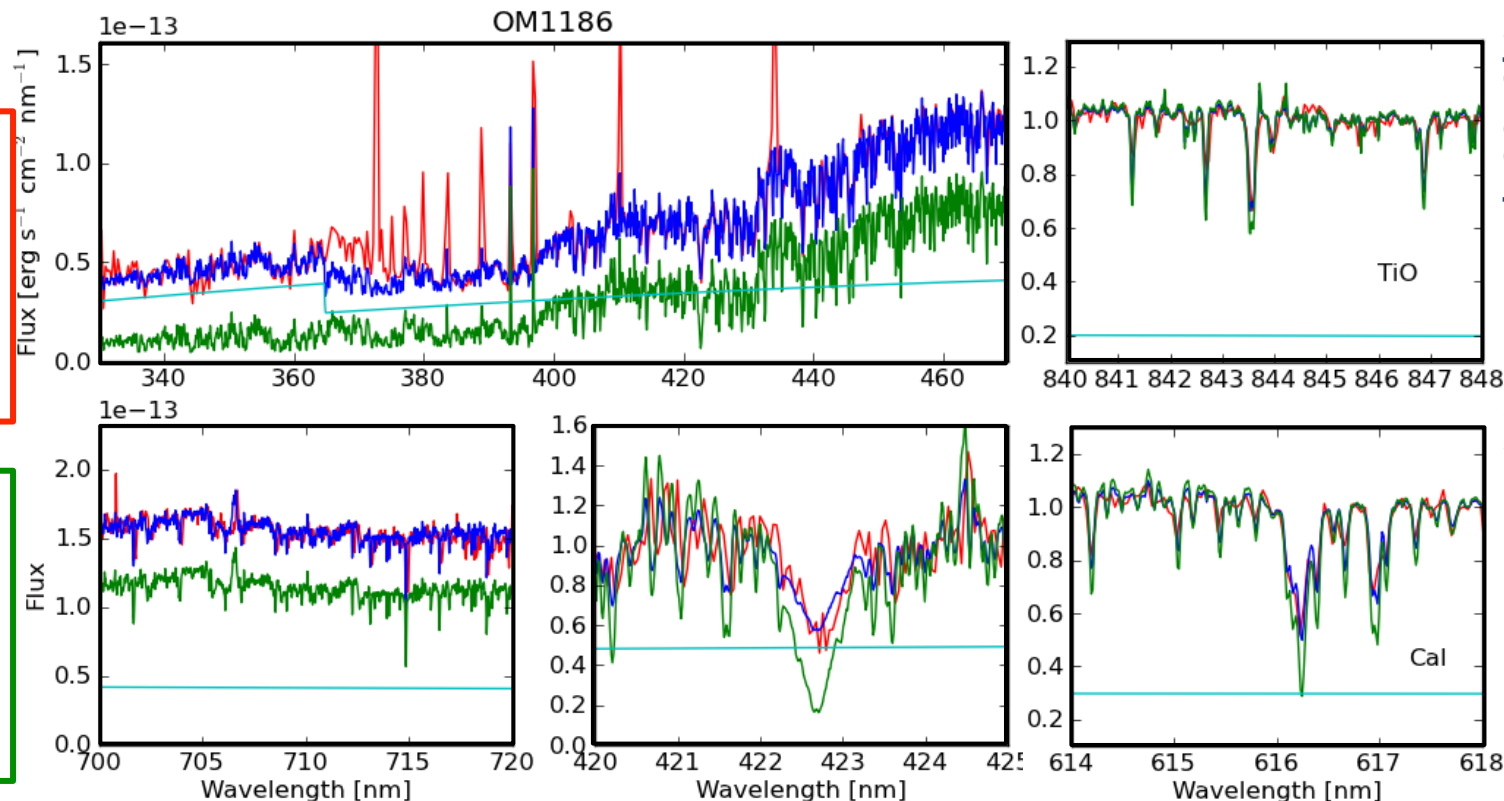
Older population?

Literature:

SpT = K5
 $A_V = 2.4$ mag
 $L_* = 0.13 L_\odot$
 Age ~ 60 Myr

Our result:

SpT = K5
 $A_V = 0.9$ mag
 $L_* = 1.15 L_\odot$
 Age ~ 3 Myr



(Manara et al. 2013b)

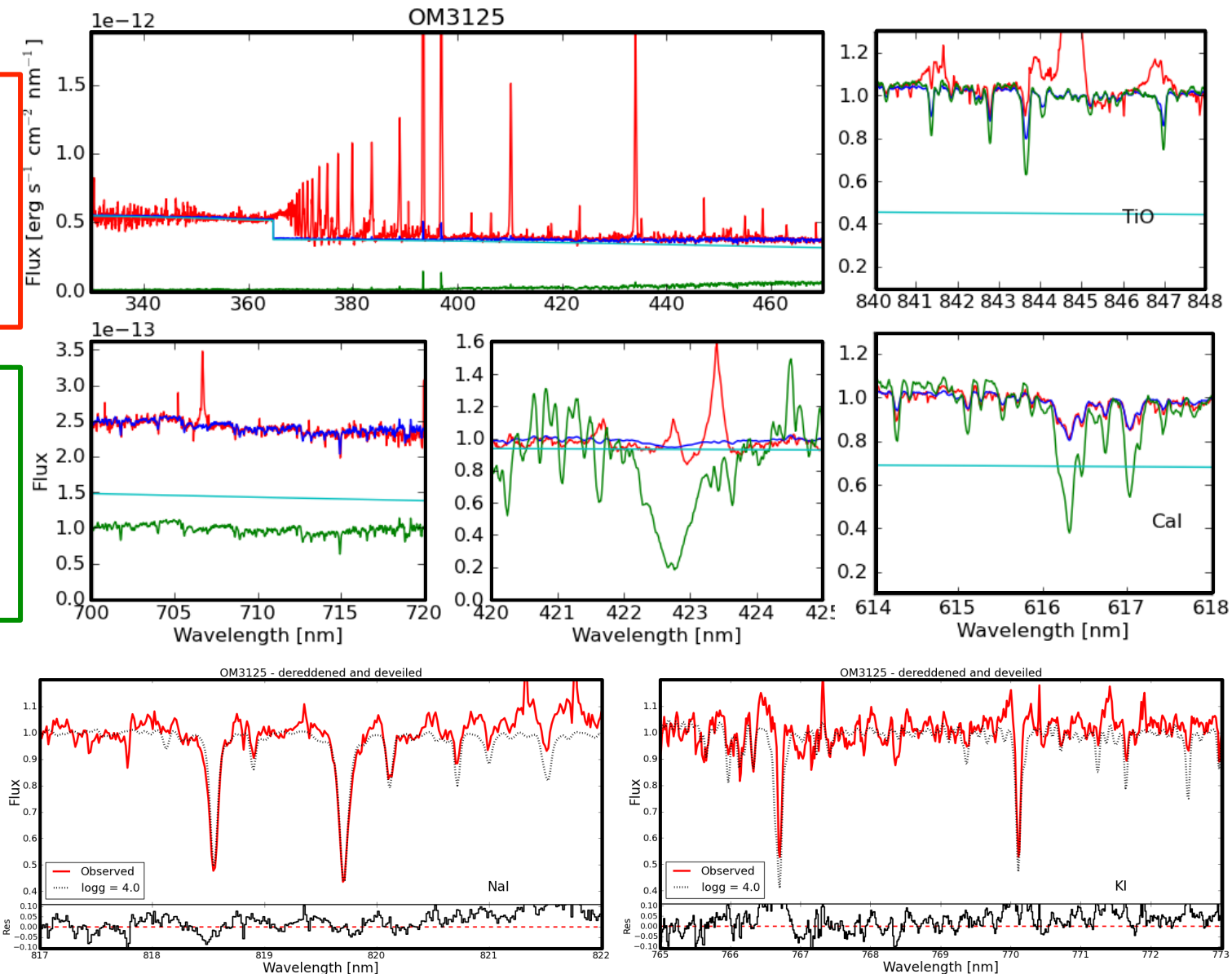
Older population?

Literature:

SpT = G8
 $A_V = 1.5$ mag
 $L_* = 0.63 L_\odot$
 Age ~ 25 Myr

Our result:

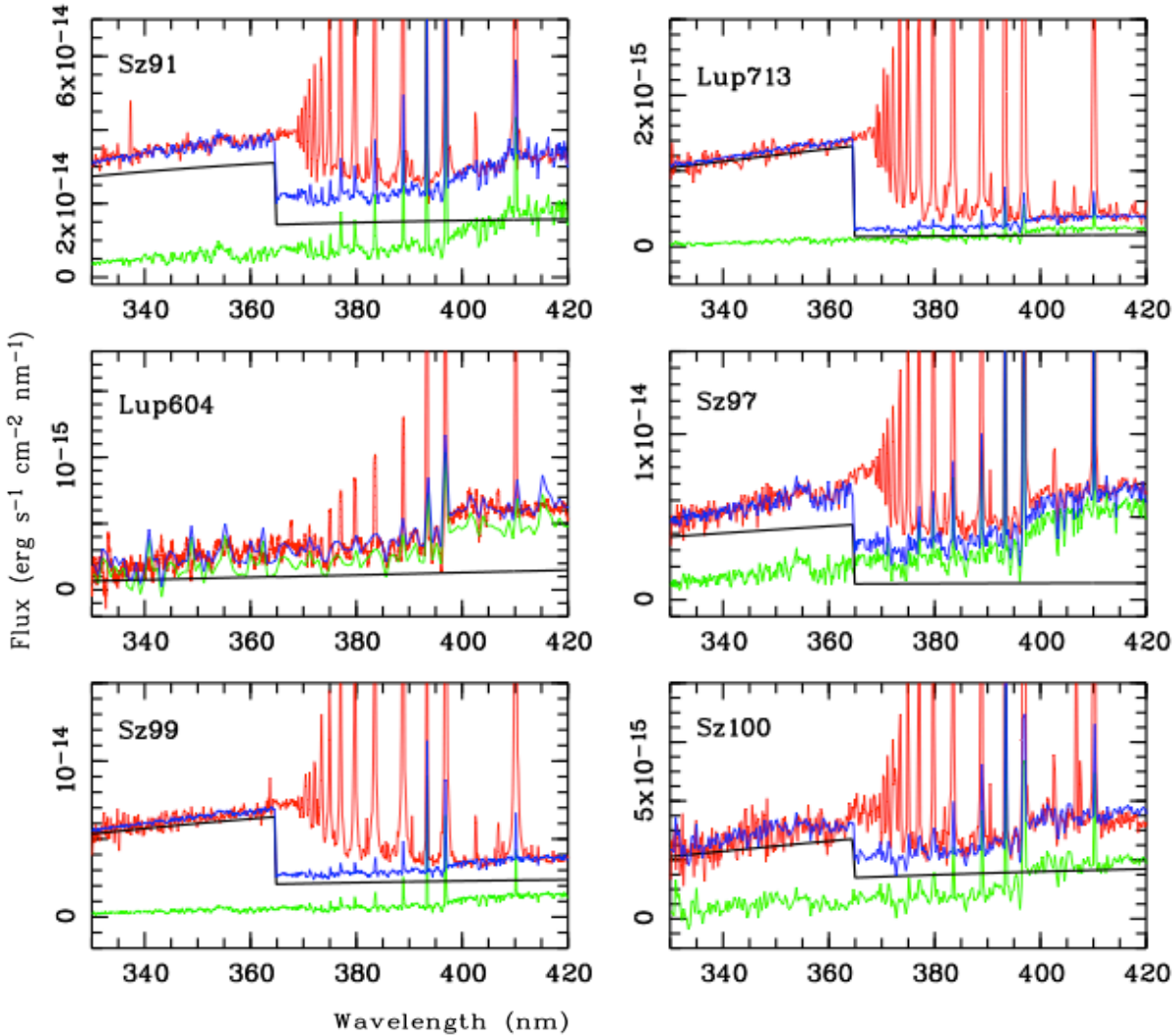
SpT = K7
 $A_V = 1.0$ mag
 $L_* = 0.81 L_\odot$
 Age ~ 1 Myr



(Manara et al. 2013b)

Survey of Lupus I & III

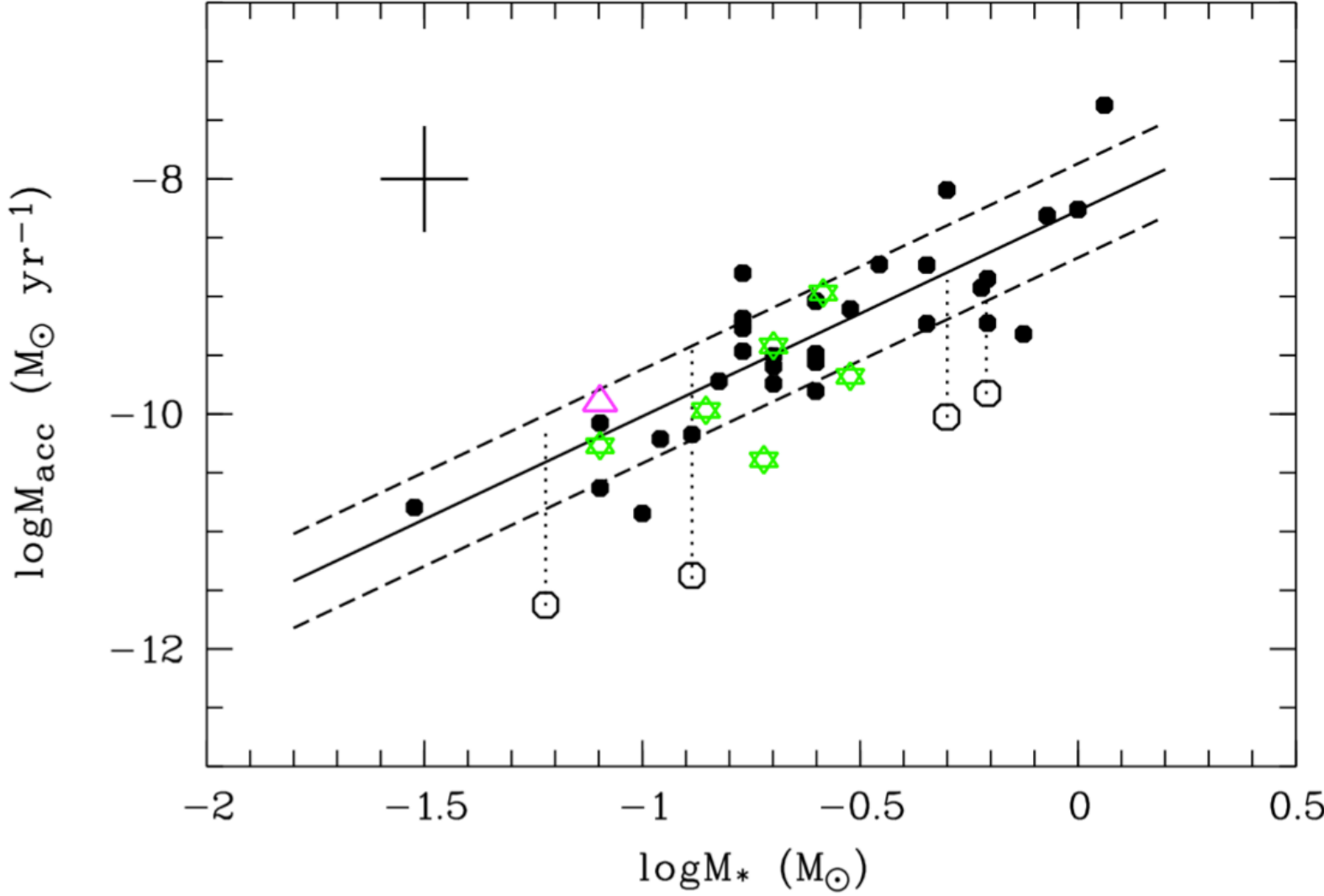
36 low mass stars targets in the Lupus I & III star forming regions:
accurate accretion rates derivation & line luminosity calibration



(Alcalà, Natta, Manara et al. 2013, subm)

Survey of Lupus I & III

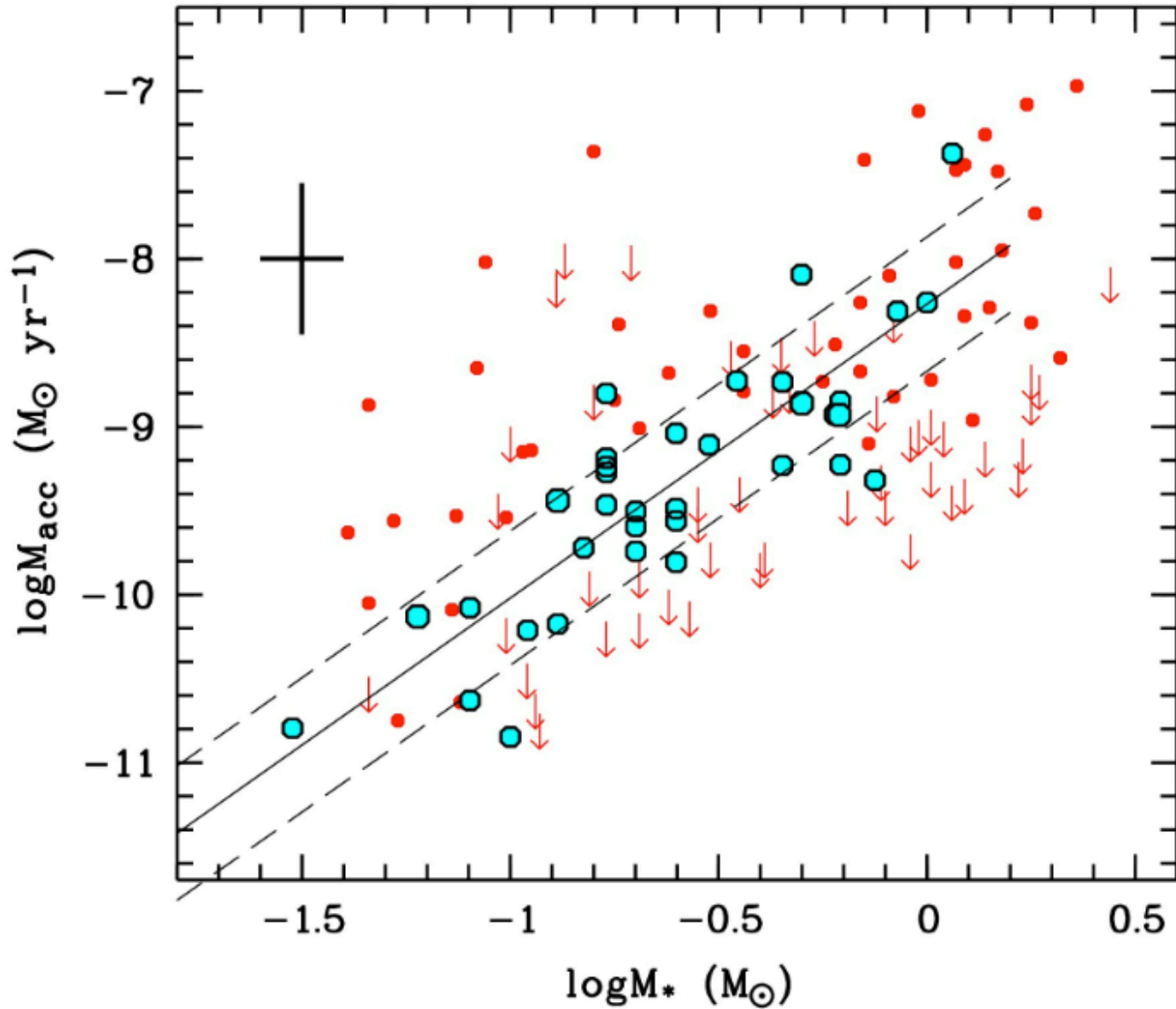
An homogenous sample with an accurate method leads to smaller spread!



(Alcalà, Natta, Manara et al. 2013, subm)

Survey of Lupus I & III

An homogenous sample with an accurate method leads to smaller spread!



(Alcalà, Natta, Manara et al. 2013, subm)