

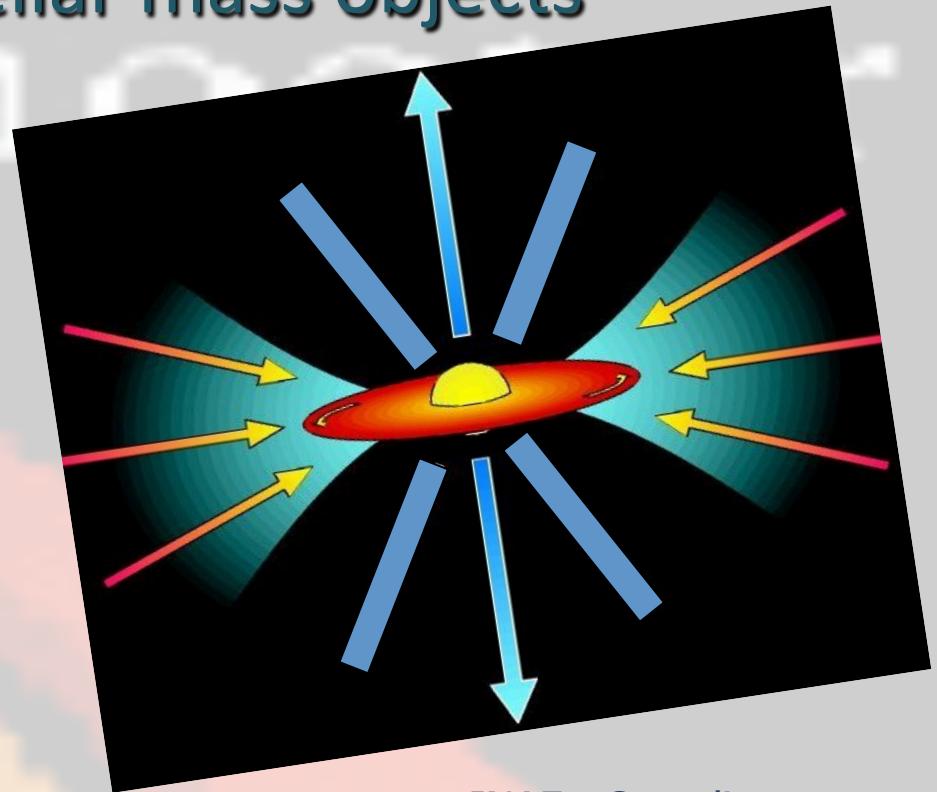
An X-shooter survey of galactic star forming regions: low and sub-stellar mass objects

Italian Star formation GTO time
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B.Stelzer @ ESAC 21.01.2013

CoIs:

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INAF - Capodimonte
INAF - Arcetri
INAF - Palermo
INAF - Trieste
INAF - Rome
INAF - Catania
ESO/Garching
Grenoble
Dublin

Aims: study accretion, outflows, activity

Sample selection:

- Objects with low A_V : exploit full X-shooter range
- Targets with as much photometry as possible (UV-IR)
- Mostly very low-mass ($M < 0.5 M_\odot$) YSOs with disk
- YSOs in well characterized clusters: Lupus, sigma Ori, TW Hya
- Individual interesting targets: DENIS 1048-3956, FUTau A, ESO-Ha574, ISO-217

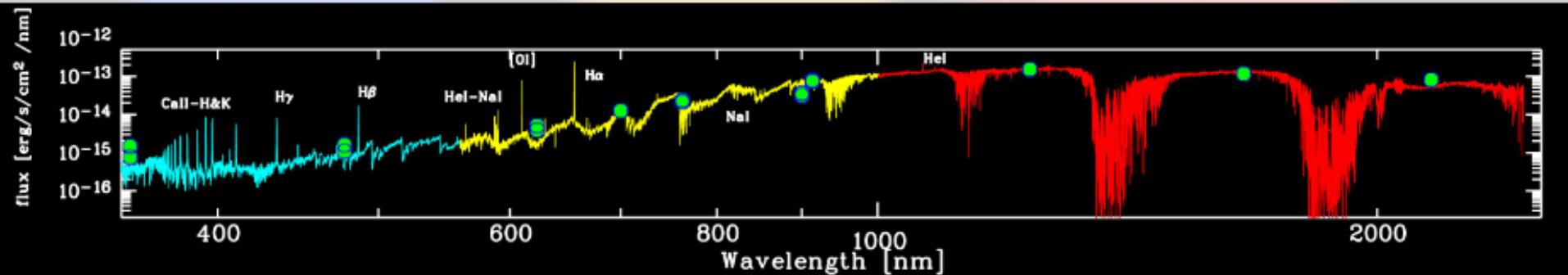
Instrument Setup:

1.0"/0.9"/0.9" (R ~ 5100/8800/5600)

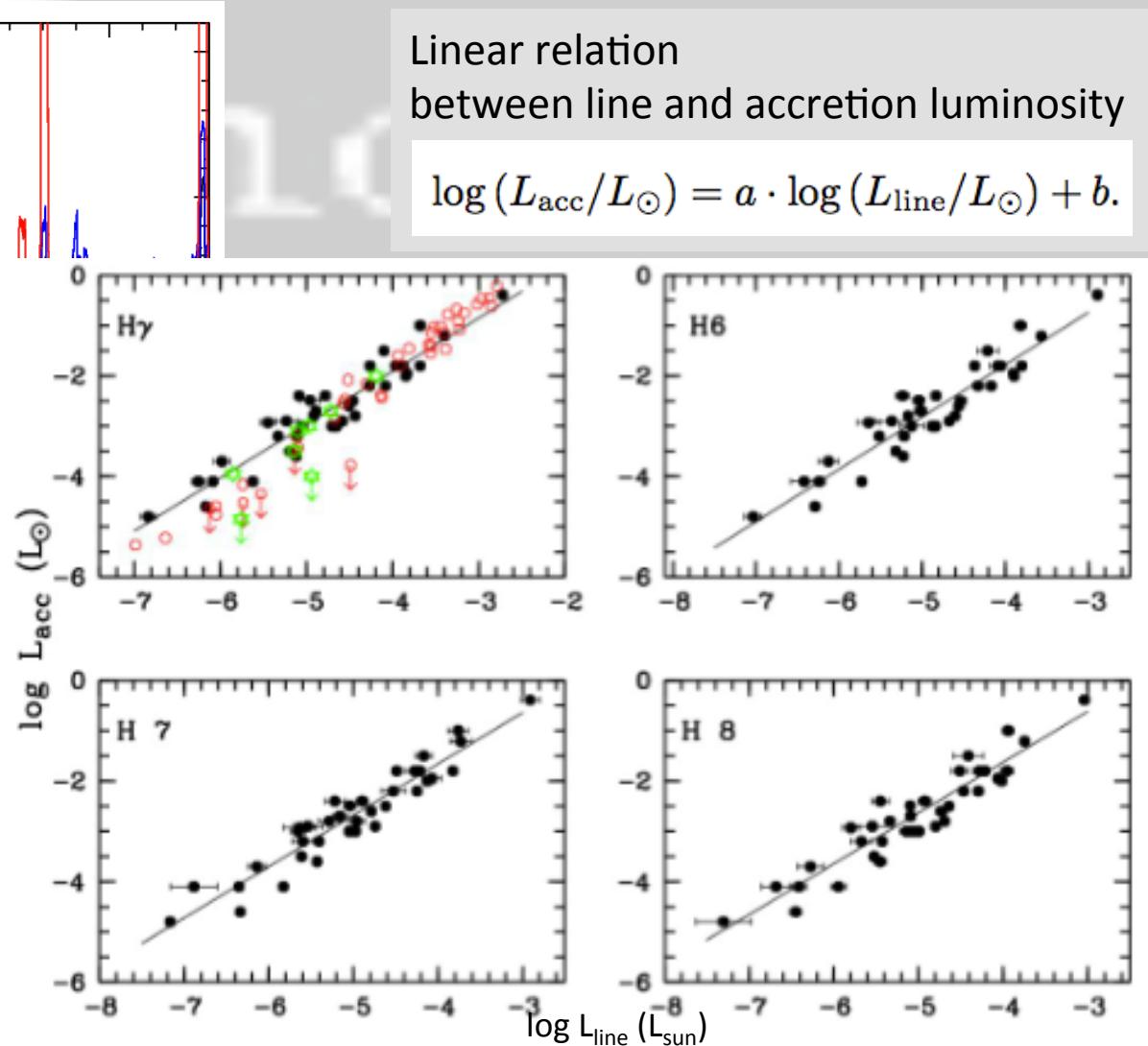
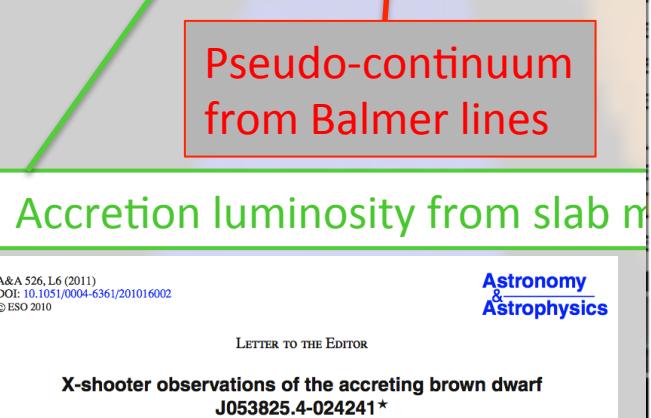
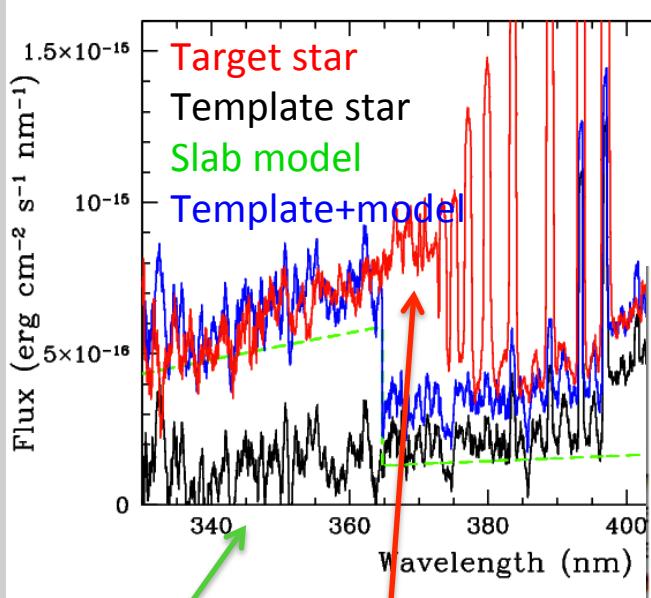
0.5"/0.4"/0.4" (R ~ 9100/17400/11300)

Project Status:

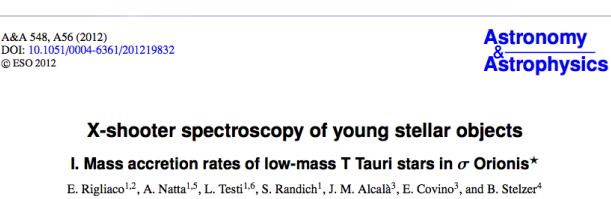
Observations completed: 8 nights total in P84 - P89;
58 Class II, 25 Class III observed
so far 7 A&A papers, several others in prep.



Accretion luminosity



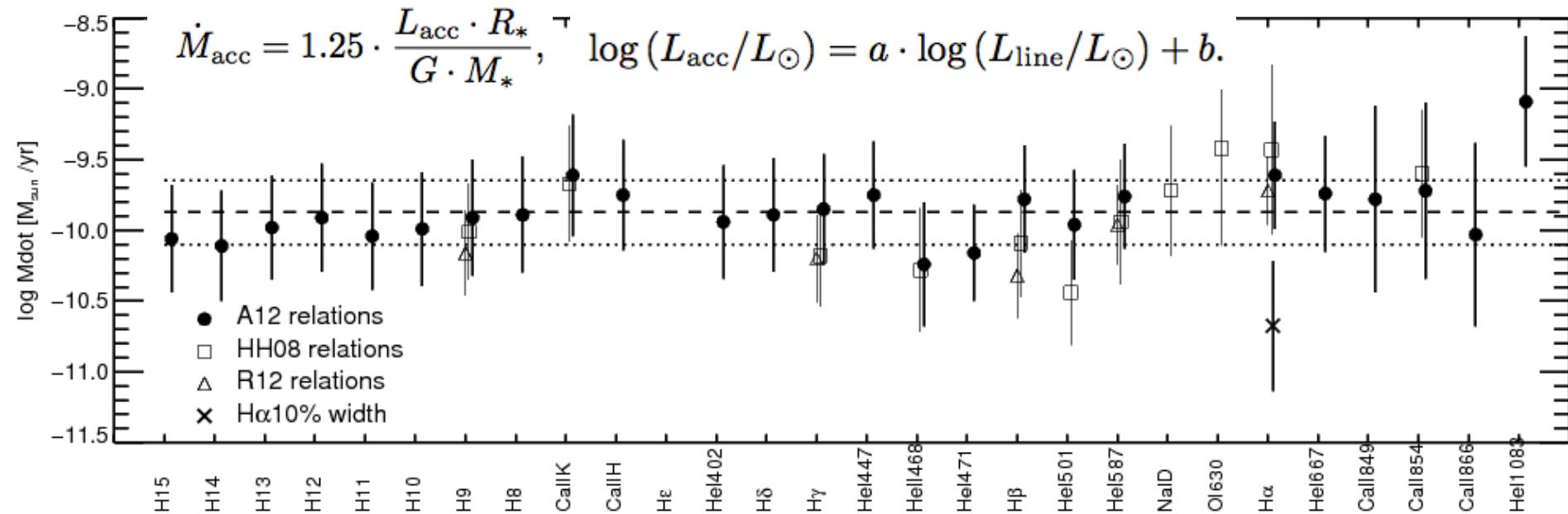
Alcalá et al. in prep.:
Large number of lines, simultaneous with continuum
for large number of stars (36 Class II in Lupus)



Mass accretion rate

X-Shooter spectroscopy of FU Tau A*

B. Stelzer¹, J.M. Alcalá², A. Scholz³, A. Natta^{3,4}, S. Randich⁴, and E. Covino²



References:

HH08 Herczeg & Hillenbrand (2008)

R12 Rigliaco et al. (2012)

A12 Alcalá et al. (2013)

Accretion luminosity from slab model:

$$L_{\text{acc}} = 1.3 * 10^{-4} L_{\odot}$$

$$\rightarrow \text{Accretion rate: } \log M_{\text{acc}} = -10.1 M_{\odot}/\text{yr}$$

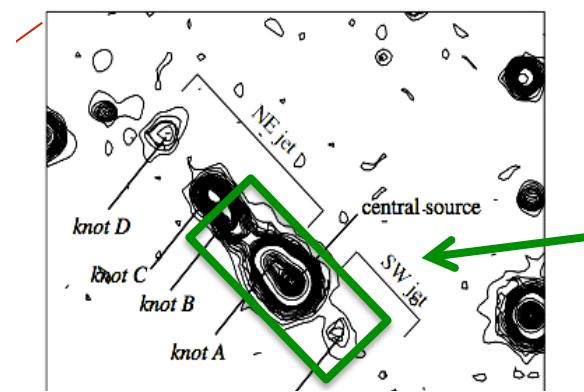
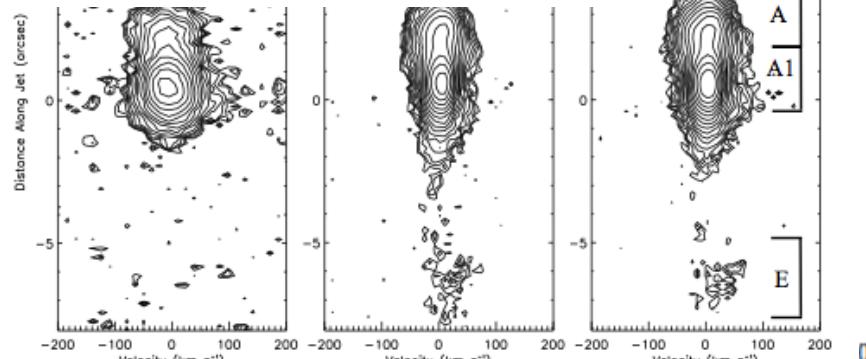


$$\langle \log M_{\text{acc}} \rangle = -9.9 \pm 0.2 M_{\odot}/\text{yr}$$

Outflows

PV diagram: small RV

comparison w. [SII] image from 2005: v_{\tan}
→ Inclination $\sim 1\text{-}5$ deg, i.e. edge-on disk
→ outflow rate

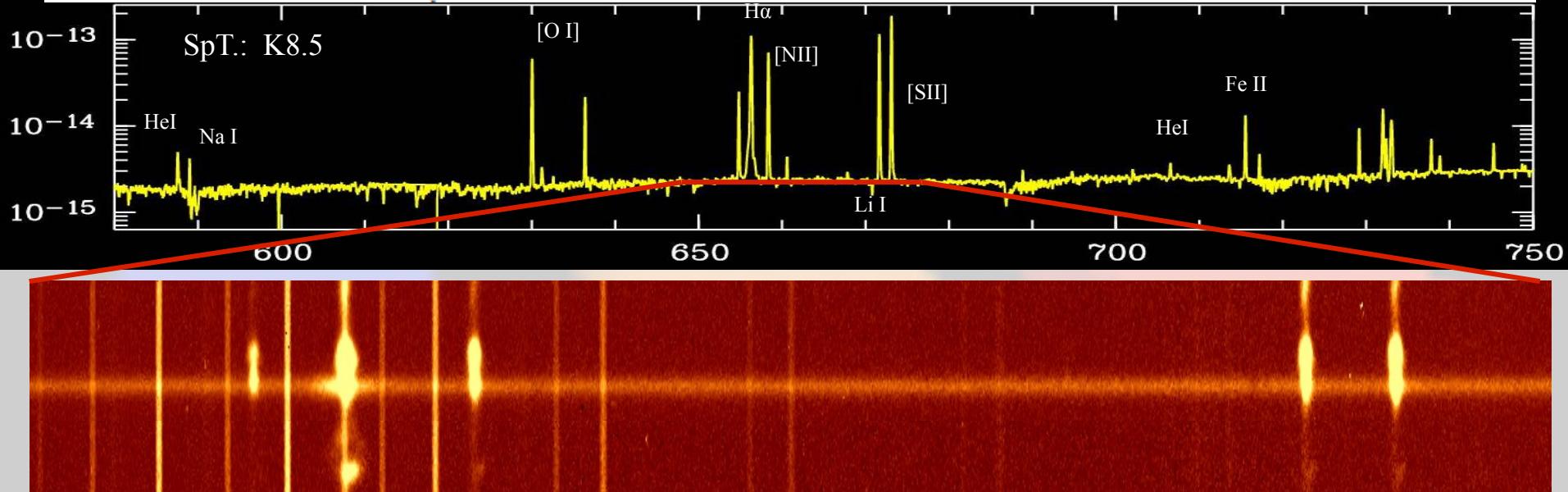


doi:[10.1088/2041-8205/737/2/L26](https://doi.org/10.1088/2041-8205/737/2/L26)

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THE FIRST X-SHOOTER OBSERVATIONS OF JETS FROM YOUNG STARS*

F. BACCIOTTI¹, E. T. WHELAN², J. M. ALCALÁ³, B. NISINI⁴, L. PODIO⁵, S. RANDICH¹, B. STELZER⁶, AND G. CUPANI⁷



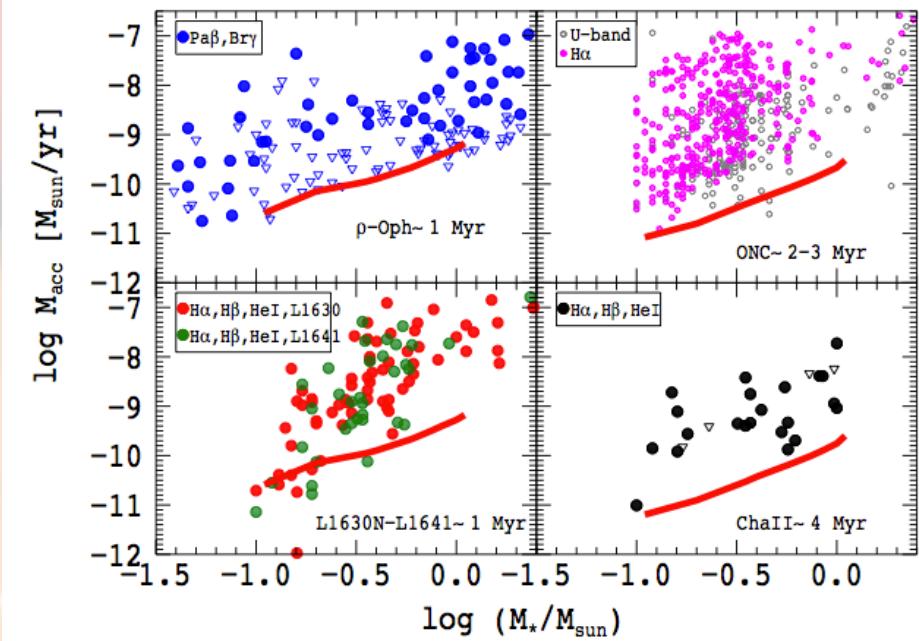
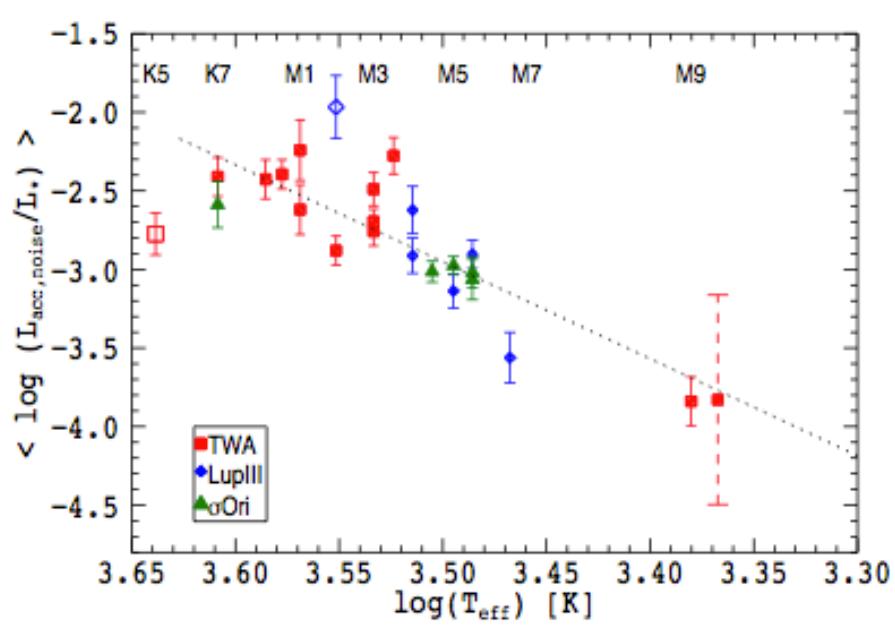
Magnetic activity

X-Shooter spectroscopy of young stellar objects:^{*}

II. Impact of chromospheric emission on accretion rate estimates

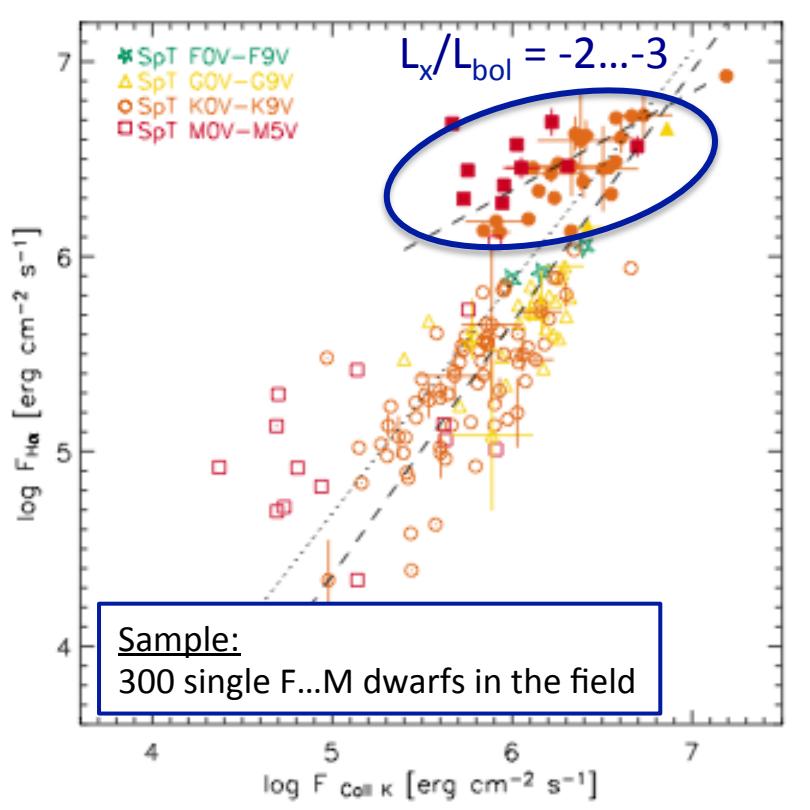
C.F. Manara¹, L. Testi^{1,2}, E. Rigliaco³, J.M. Alcalá⁴, A. Natta^{2,5}, B. Stelzer⁶,
K. Biazzo⁴, E. Covino⁴, S. Covino⁷, G. Cupani⁸, V. D'Elia⁹, S. Randich²

Computing L_{acc} for Class III from $\log(L_{\text{acc}}/L_{\odot}) = a \cdot \log(L_{\text{line}}/L_{\odot}) + b$. yields chromospheric “noise”



Magnetic activity: Flux-flux relations of chromosphere + corona diagnostics

Martinez-Arnai et al. (2011)



Aims with X-Shooter data:

- 1) flux-flux relations for **young stars**
(in prep.)
- 2) flux-flux relations for **ultracool dwarfs**

Magnetic activity:

Flux-flux relations of chromosphere + corona diagnostics

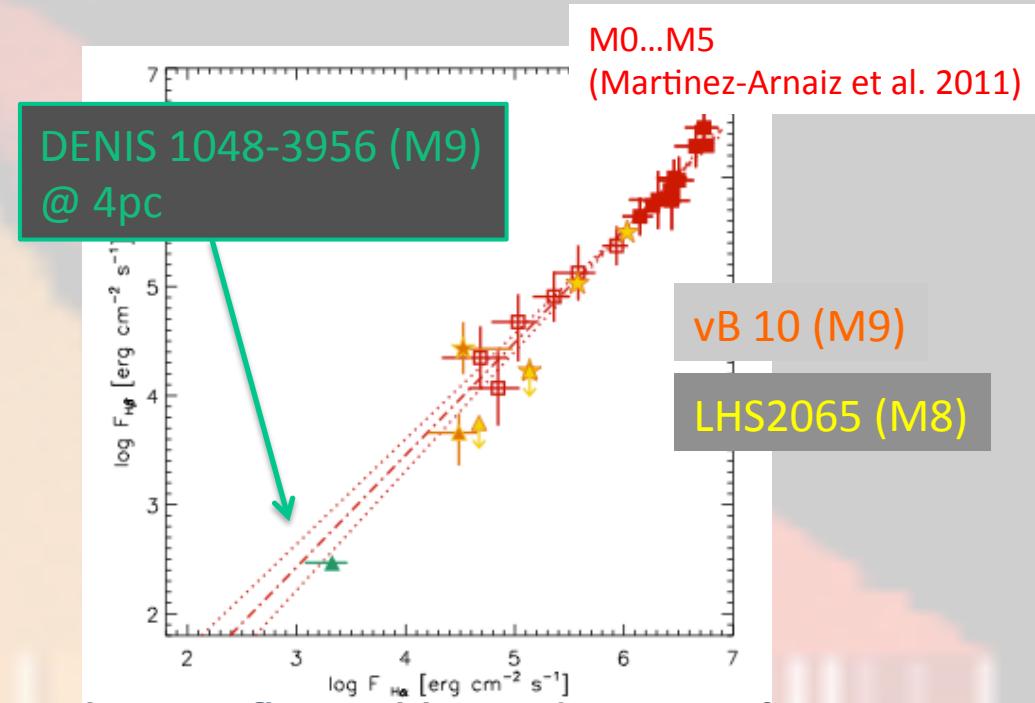
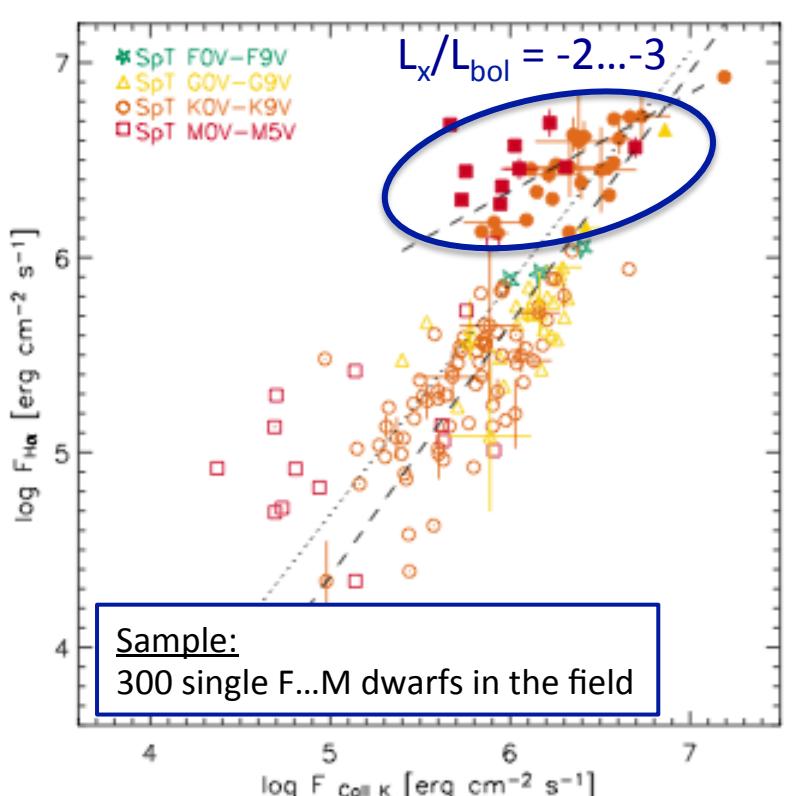
A&A 537, A94 (2012)

The ultracool dwarf DENIS-P J104814.7-395606

Chromospheres and coronae at the low-mass end of the main-sequence

B. Stelzer¹, J. Alcalá², K. Biazzo², B. Ercolano³, I. Crespo-Chacón⁴, J. López-Santiago⁴, R. Martínez-Arnáiz⁴, J. H. M. M. Schmitt⁵, E. Rigliaco⁶, F. Leone⁷, and G. Cupani⁸

Martinez-Arnáiz et al. (2011)



X-Shooter flux-calibrated spectra for DENIS1048:
First extension of chromospheric
flux-flux relations to late-M SpT

OUTLOOK (FUTURE WORK)

Variability studies:

- Rotational modulation of accretion ?
- Episodes of spasmodic high M_{acc} ?

Improving slab models: include emission lines

Time evolution of mass accretion rate

Physical conditions of gas using line decrements