WEAVE:
THE YOUNG STARS PIPELINE

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Within the ***WEAVE Galactic Archaelogy survey*** framework we are focused on young open clusters (covering an approximate age range from 5 to 500 Ma). With the aim of analyzing their members we are implementing a pipeline (by adopting a tailored version of the ***ROTFIT*** code) which, in an (semi)automatic way, is able to derive the atmospheric stellar parameters as well as other accretion and chromospheric diagnostics in the case of the pre-MS objects. We have been working with simulated spectra so far and results are being very encouraging. While waiting for the real spectra we are doing the last tests in order to improve the code and develop its final version.

Context

- **WEAVE** (WHT Enhanced Area Velocity Explorer) is **a new multi-object survey spectrograph for the 4.2-m William Herschel Telescope** (WHT) at the Observatorio del Roque de los Muchachos, on La Palma in the Canary Islands. It will allow astronomers to take optical spectra of up to **≈1000 targets over a two-degree field of view (FoV) in a single exposure** (MOS), or to carry out integral-field spectroscopy using 20 deployable mini integral-field units or one large fixed integral-field unit. WEAVE's fibre-fed spectrograph comprises two arms, one optimised for the blue and one for the red, and offers two possible spectroscopic resolutions, 5000 and 20,000.

- **WEAVE will help to fully exploiting Gaia data** by obtaining accurate radial velocities and elemental abundances for stars too faint for Gaia's Radial Velocity Spectrometer. The Milky Way is the only galaxy for which we can determine a precise chemo-dynamical formation and evolutionary history. WEAVE's **Galactic Archaeology (GA) survey** will provide exactly such data, **enabling the determination of fundamental Galactic parameters** (mass, mass assembly over time, etc.), the origin of the thick stellar disc, identifying/characterising streams of stars in the Galaxy's halo to understand the fraction of the halo originating in accreted systems, and performing fundamental galaxy-dynamics experiments to understand the role of non-axisymmetriesin disc substructures.

- Within the GA group, we are dedicated to the study of open clusters, a key element for improving our knowledge about the structure and evolution of the MW. The multi-object capabilities and the large FoV makes WEAVE an ideal instrument to study them, from their cores to their outskirts. WEAVE will provide us with homogeneous data for a large number of stars in **20 young open clusters and star forming regions**, in the age range between 5 and 500 Ma. The instrumental setup will be the **MOS mode at R=20000**, which covers two spectral regions: 4700-5500 Å (blue arm) and 6000-6800 Å (red arm).

- The **ROTFIT code** (Frasca et al. 2006,2017) is an optimal tool for the analysis of these objects thanks to the experience previously acquired (e.g. participation in the Gaia-ESO Survey and some campaings with X-Shooter and LAMOST spectra).

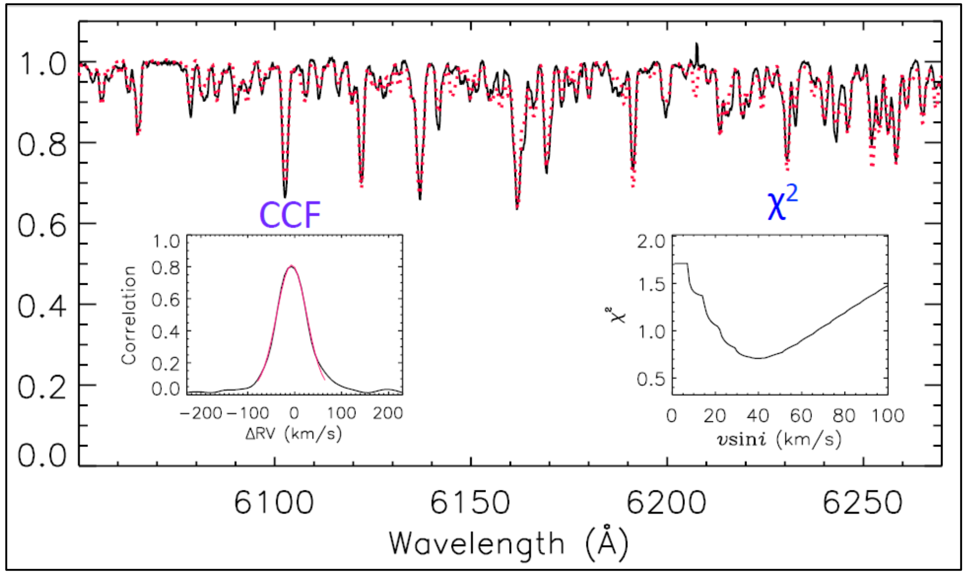
Methodology

WEAVE spectra

Normalization
χ^2-minimization

ROTFIT

ELODIE templates
(rotationally broadened)



Spectral Type

$7 \leq v \sin i$ (km/s) ≤ 200

Atmospheric Parameters

$3500 \leq T_{\rm eff}$ (K) ≤ 7000

$1 \leq \log g \leq 5$

$-1.0 \leq$ [Fe/H] $\leq +0.5$

Accretion diagnostics

Veiling (Age ≤ 20 Ma)

$EW_{\rm H\alpha}$; 10% $EW_{\rm H\alpha}$

Chromospheric activity

$EW_{\rm H\alpha}$; $F_{\rm H\alpha}$

$EW_{\rm Li}$; A(Li)

Input: Simulated stars of Collinder 69

(convolved from BT-Settl models)

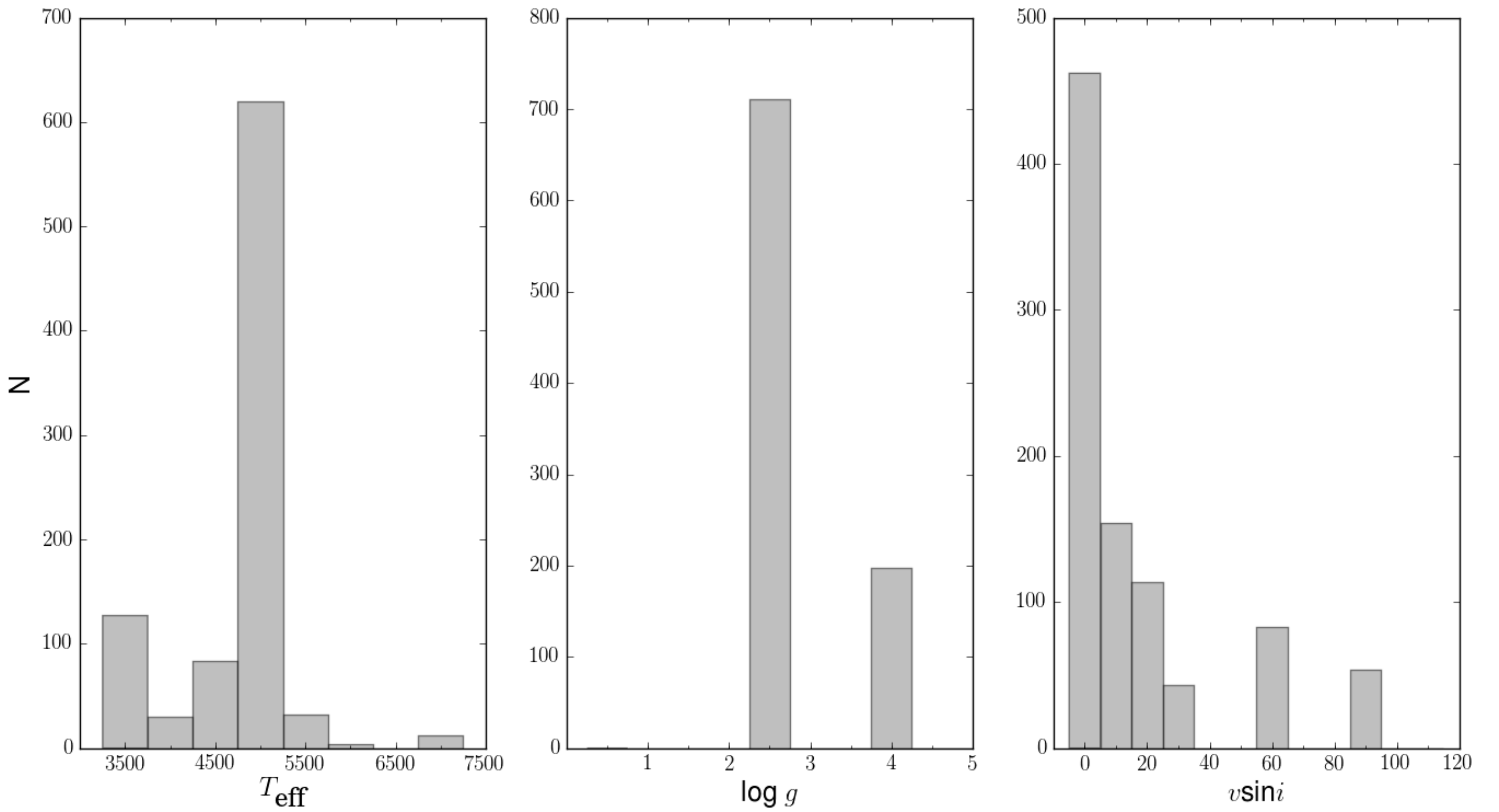
$3500 \leq T_{eff}$ (K) ≤ 7000

log g = 2.5, 4.0

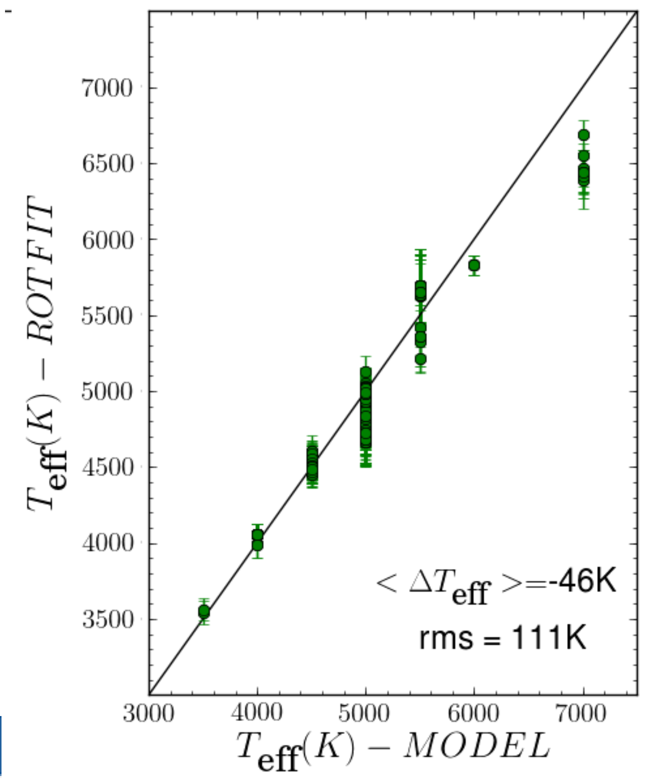
$0 \leq v \sin i$ (km/s) ≤ 90

[Fe/H] = solar

No veiling



Comparison with other pipelines (OpR3b)



S/N>20

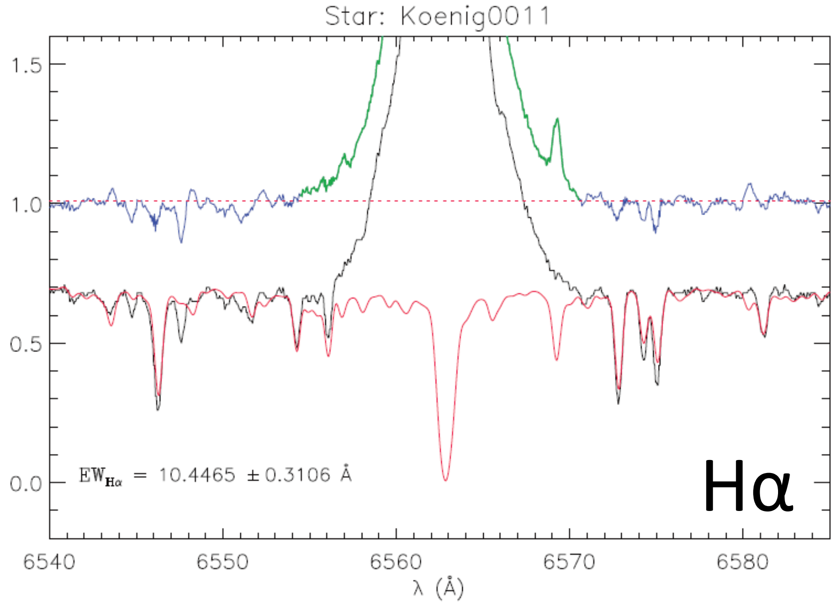
Output-Input	FERRE	RVS	ROTFIT
<ΔT_{eff}>	269 ± 1111	-267± 620	-46 ± 111
<Δlog *g*>	1.53 ± 0.68	1.36 ± 1.43	0.42 ± 0.28
<Δ[Fe/H]>	-0.62 ± 1.28	0.04 ± 0.47	-0.04 ± 0.08
<Δ*v*sin*i*>	---	-12.5 ± 37.2	2.5 ± 2.6

Atmospheric parameters: our results (output) properly recover the simulated (input) values

Future work

- Final implementation of the **spectral subtraction** technique to measure $\boldsymbol{EW_{H\alpha}}$ and $\boldsymbol{EW_{Li}}$ and estimate the accretion rate, chromospheric activity and Li abundance.
- Optimization of the **computational time** by employing a computer **cluster** (on my PC the analysis of each run takes around 30 h)

How different will actual data (from simulations) be?...



Target Template Subtracted EW (Li/Hα)