# 20TH ANNIVERSARY OF SCIENCE EXPLORATION WITH UVES

Lorenzo Monaco
Universidad Andres Bello
lorenzo.monaco@unab.cl

Amelia Bayo
Universidad de Valparaíso
amelia.bayo@uv.cl

# UVES concept (D'Orico today)

## SCIENTIFIC GOALS AND REQUIREMENTS TO THE M-H RESOLUTION SPECTROGRAPH AT THE VLT

*From the High Res. Spect. Working Group (Oct 1986)*

*Chemical composition and atmosphere of stars; Stellar winds, circumstellar mass flows; Stellar rotation; Stellar magnetic fields; composition and kinematics of IM; Radial velocity studies; Kinematics of galaxies and galactic nuclei; IGM from absorption lines to high z QSO.*

*4 spectrographs at Nasmyth with R≤ $2 \times 10^4$ with coverage 300-1100nm + a combined focus spectrograph with R≤ $1 \times 10^5$*

*ESO Workshop on HR Spect. with VLT (Feb.1992)*

*28 scientific talks, 7 extragalactic and on cosmology. Panel discussion on the different trade-off*

Functional requirements/Performance targets in UVES Technical Specifications

20TH ANNIVERSARY OF SCIENCE EXPLORATION WITH UVES

# UVES top 10

- Binary stars
- Extra-solar planet host stars
- Thin and thick disk stars
- Metal-poor stars
- Globular and open clusters
- Dwarf galaxies

- High resolution
- RV stability
- Blue coverage
- Wide coverage
- Faint objects

1 2012Sci...337..444S 2012/07 cited: 934
Binary Interaction Dominates the Evolution of Massive Stars
Sana, H.; de Mink, S. E.; de Koter, A. *and 7 more*

2 2004A&A...416.1117C 2004/03 cited: 876
First stars V - Abundance patterns from C to Zn and supernova yields in the early Galaxy
Cayrel, R.; Depagne, E.; Spite, M. *and 11 more*

3 2004A&A...415.1153S 2004/03 cited: 737
Spectroscopic [Fe/H] for 98 extra-solar planet-host stars. Exploring the probability of planet formation
Santos, N. C.; Israelian, G.; Mayor, M.

4 2009ARA&A..47..371T 2009/09 cited: 735
Star-Formation Histories, Abundances, and Kinematics of Dwarf Galaxies in the Local Group
Tolstoy, Eline; Hill, Vanessa; Tosi, Monica

5 2009A&A...505..117C 2009/10 cited: 624
Na-O anticorrelation and HB. VII. The chemical composition of first and second-generation stars in 15 globular clusters from GIRAFFE spectra
Carretta, E.; Bragaglia, A.; Gratton, R. G. *and 12 more*

6 2014A&A...562A..71B 2014/02 cited: 569
Exploring the Milky Way stellar disk. A detailed elemental abundance study of 714 F and G dwarf stars in the solar neighbourhood
Bensby, T.; Feltzing, S.; Oey, M. S.

7 2001A&A...369...87G 2001/04 cited: 502
The O-Na and Mg-Al anticorrelations in turn-off and early subgiants in globular clusters
Gratton, R. G.; Bonifacio, P.; Bragaglia, A. *and 16 more*

8 2016Natur.536..437A 2016/08 cited: 478
A terrestrial planet candidate in a temperate orbit around Proxima Centauri
Anglada-Escudé, Guillem; Amado, Pedro J.; Barnes, John *and 28 more*

9 2005A&A...433..185B 2005/04 cited: 465
α-, r-, and s-process element trends in the Galactic thin and thick disks
Bensby, T.; Feltzing, S.; Lundström, I. *and 1 more*

10 2009A&A...508..695C 2009/12 cited: 462
Intrinsic iron spread and a new metallicity scale for globular clusters
Carretta, E.; Bragaglia, A.; Gratton, R. *and 2 more*

20TH ANNIVERSARY OF SCIENCE EXPLORATION WITH UVES

# UVES “unexpected” (please forgive our biases)

## UVES spectroscopy of T Chamaeleontis: line variability, mass accretion rate, and spectro-astrometric analysis

Show affiliations

Cahill, Eoin; Whelan, Emma T.; Huélamo, Nuria; Alcalá, Juan

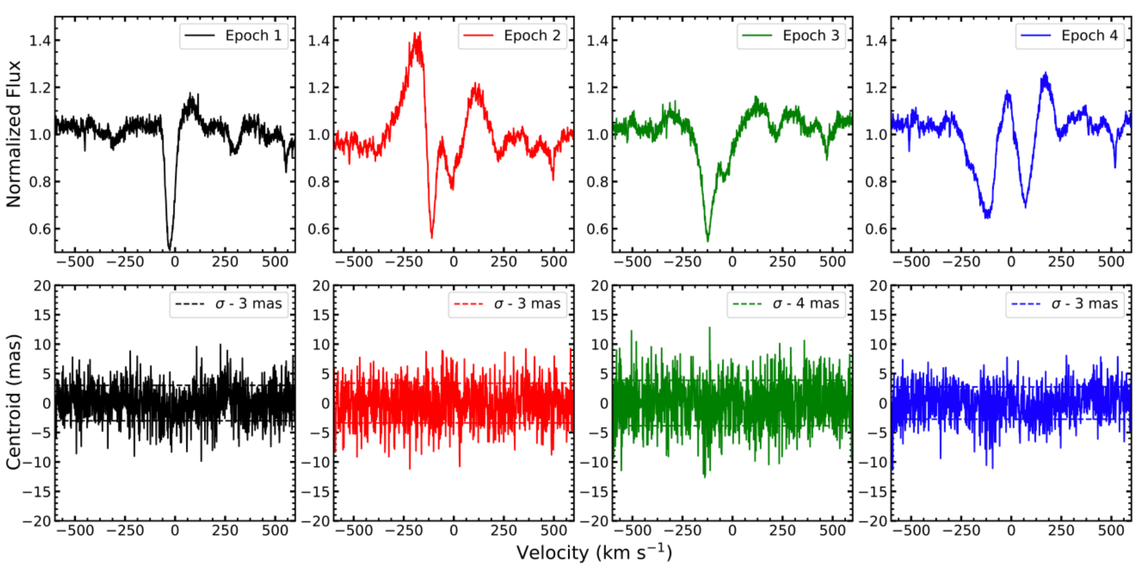



**Figure 6.** Spectro-astrometric analysis of the Hα emission from T Cha. What is shown here is the median of the spectra for each of our four epochs. The spectra were checked individually and no signal was found. The accuracy achieved on average over all 4 epochs was $\sigma$ = 3.65 mas or 0.3 au at a distance of 110 pc to T Cha

Spectro-astrometry, pushing the angular resolution with spectroscopy ~3.65mas, 0.3au!! (non detection of the controversial planet candidate)

## First Large-scale Herbig-Haro Jet Driven by a Proto-brown Dwarf

total (dust+gas) mass of ~36 MJup

Show affiliations

Riaz, B.; Briceño, C.; Whelan, E. T.; Heathcote, S.

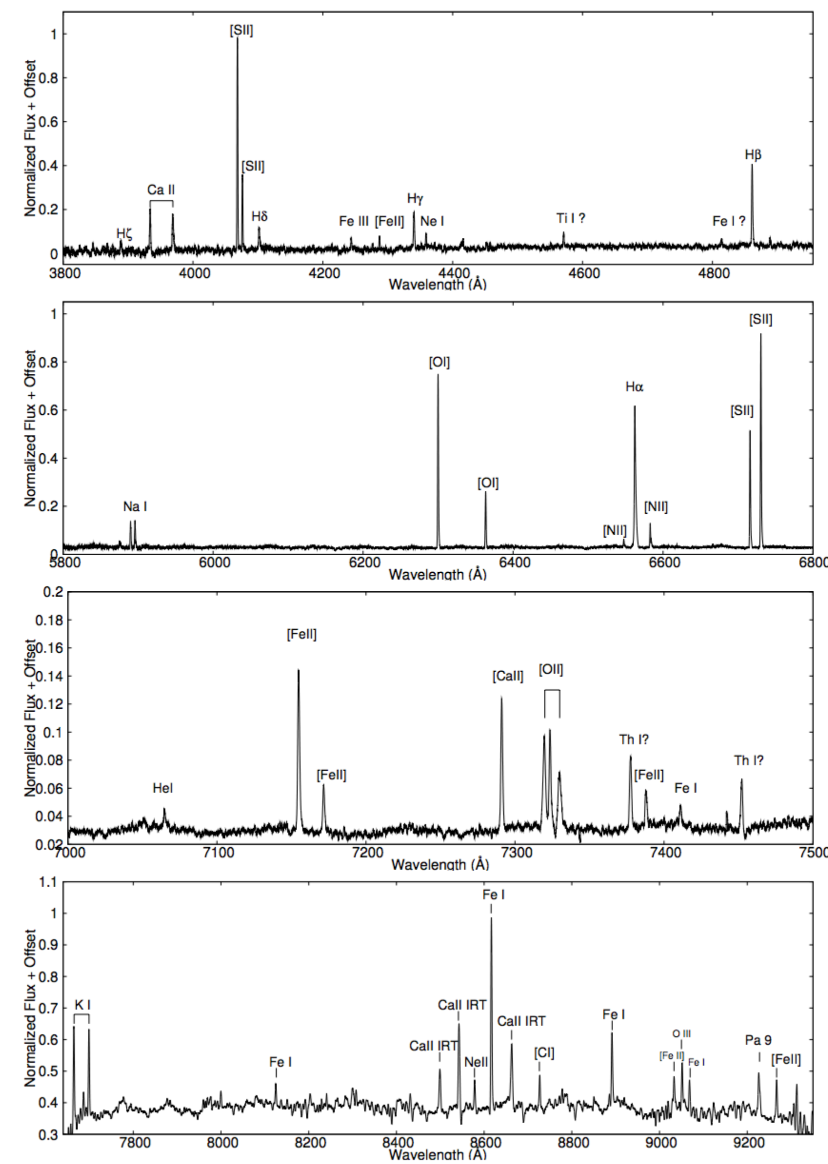


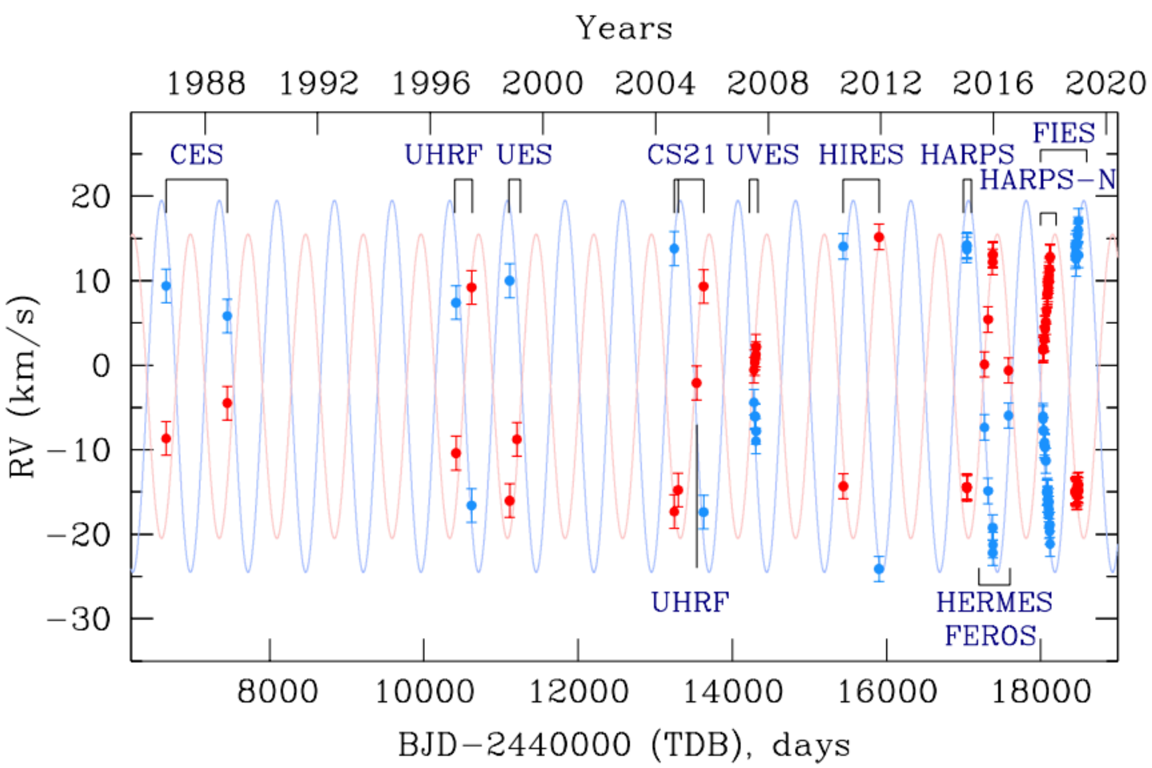

Fig. 5.— UVES spectra for M1701117 with the prominent accretion- and outflow-associated emission lines marked.

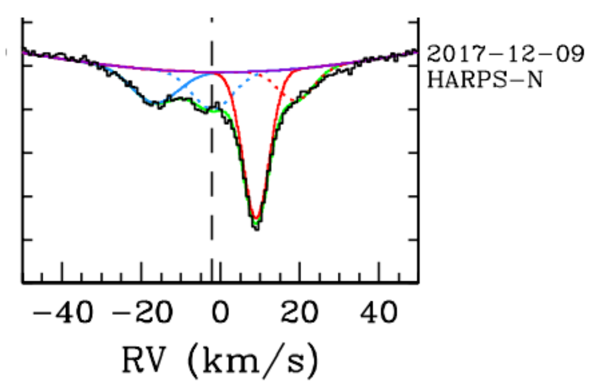
# UVES “unexpected” (please forgive our biases)

## HR 10: a main-sequence binary with circumstellar envelopes around both components. Discovery and analysis

Show affiliations

Montesinos, B.; Eiroa, C.; Lillo-Box, J.; Rebollido, I.; Djupvik, A. A.; Absil, O.; Ertel, S.; Marion, L.; Kajava, J. J. E.; Redfield, S.; Isaacson, H.; Cánovas, H.; Meeus, G.; Mendigutía, ..., Mora, A.; Rivière-Marichalar, P.; Villaver, E.; Maldonado, J.; Henning, T.

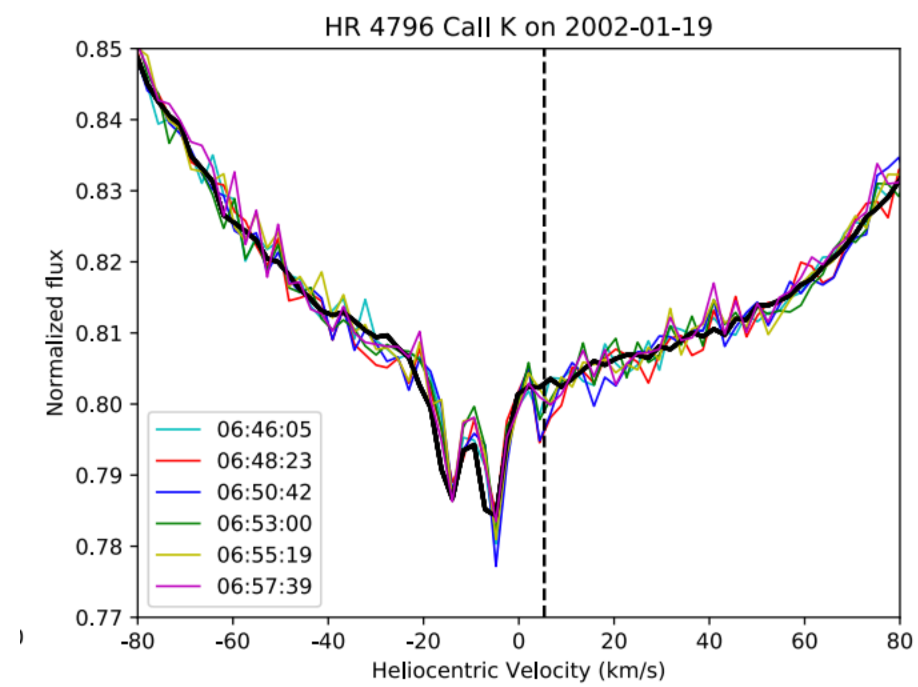


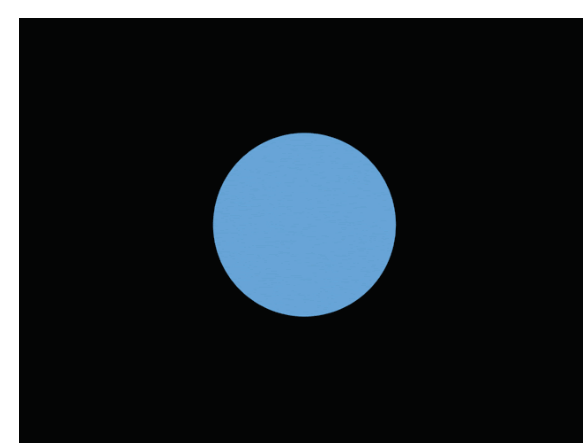




## Debris discs with multiple absorption features in metallic lines: circumstellar or interstellar origin?

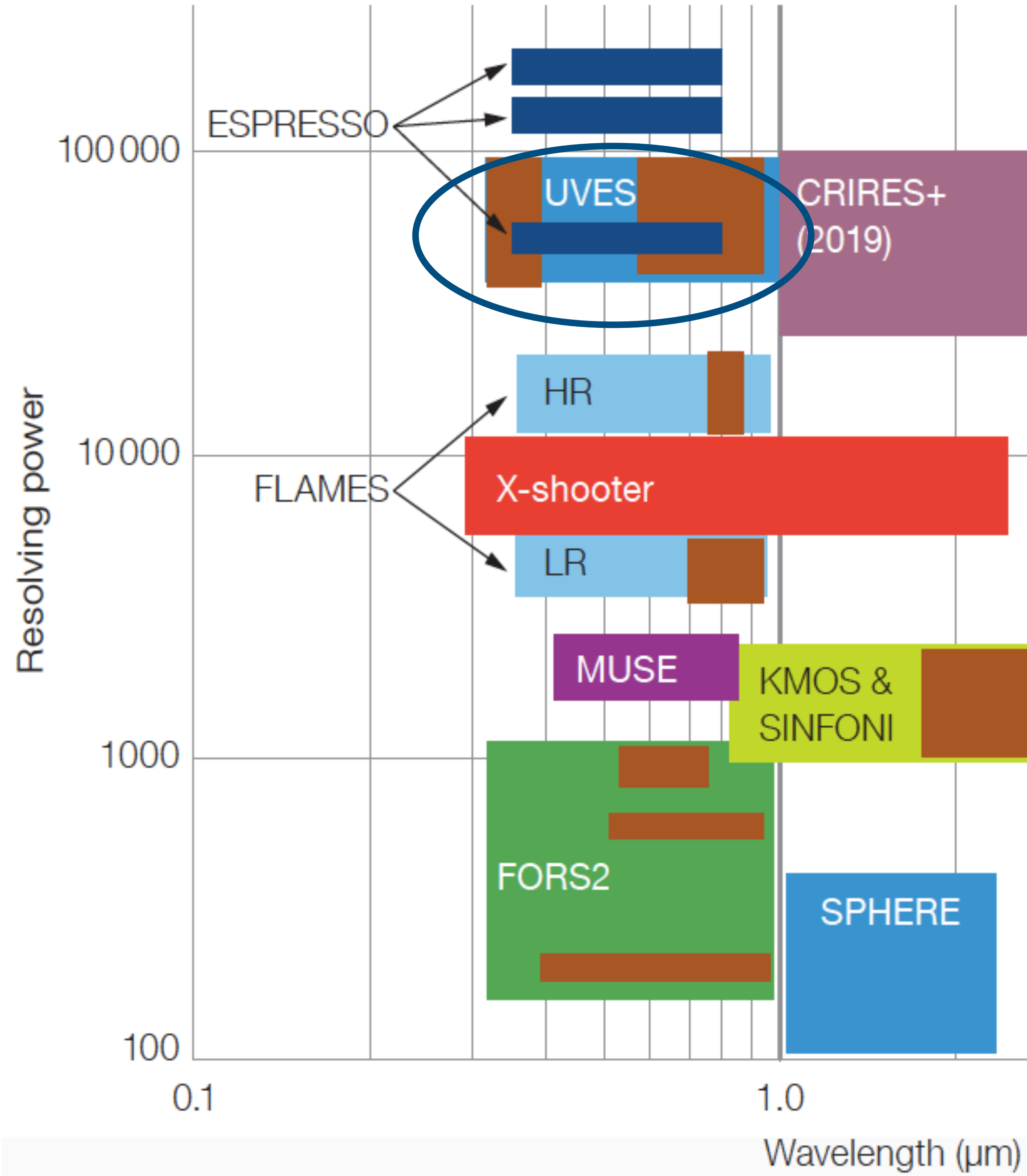
Show affiliations

Iglesias, D.; Bayo, A.; Olofsson, J.; Wahhaj, Z.; Eiroa, C.; Montesinos, B.; Rebollido, I.; Smoker, J.; Sbordone, L.; Schreiber, M. R.; Henning, Th

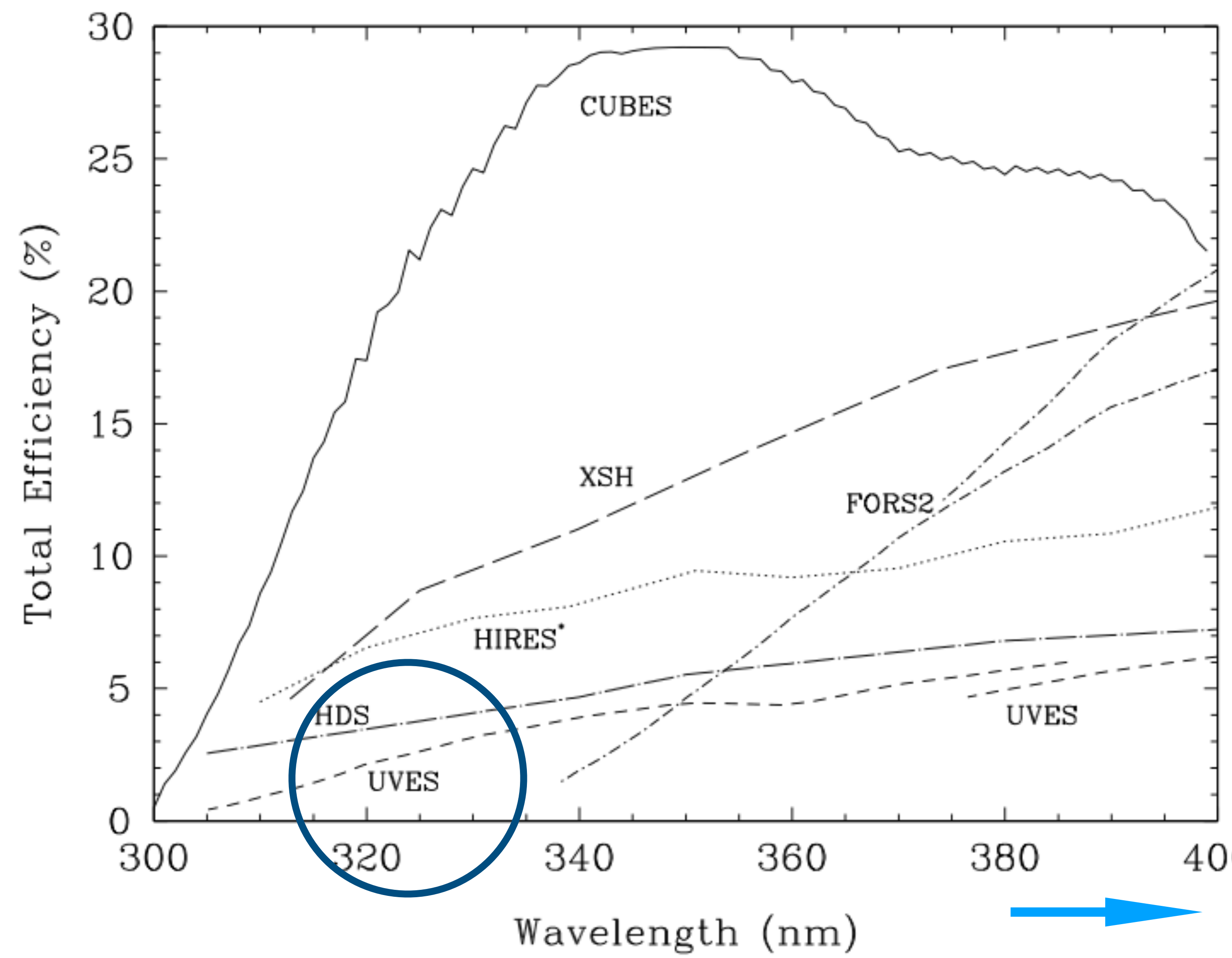


# UVES Resolution coverage & UV efficiency




L. Pasquini, N. Hubin, VLT2030 Workshop




**ESPRESSO**

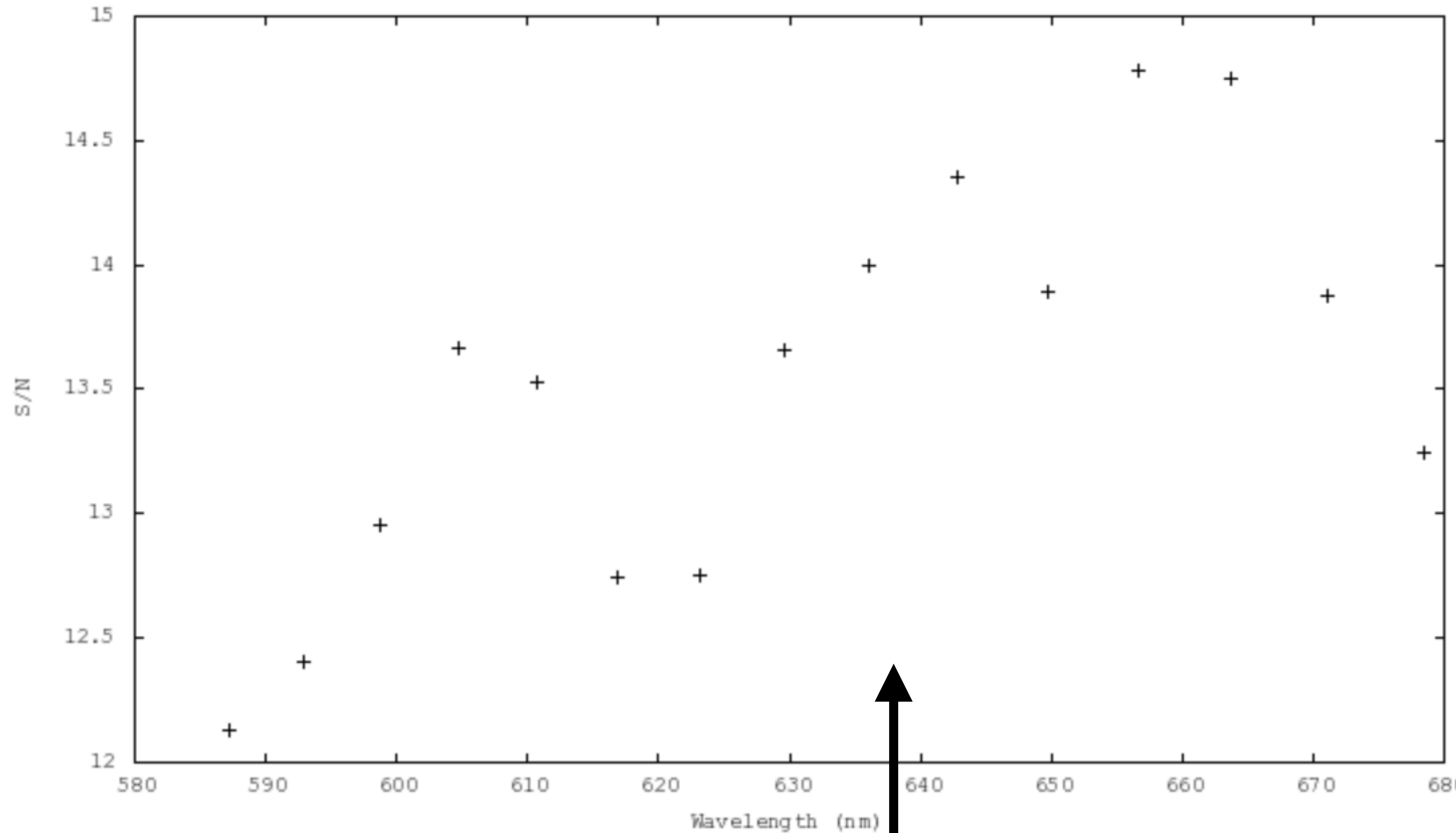
C. Evans, VLT2030 Workshop

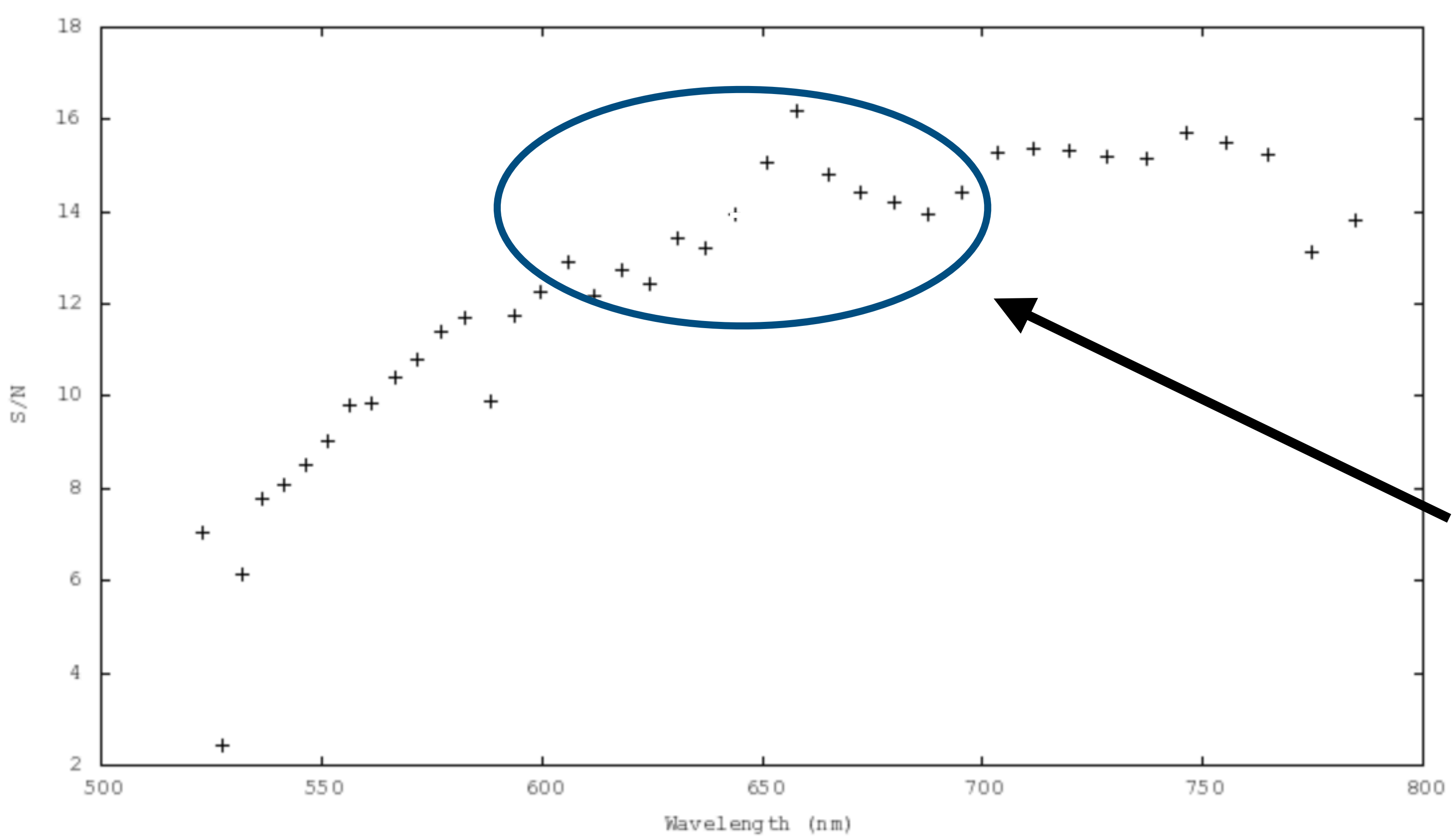
**Among ESO's facilities, UVES:**

- **Largest UV coverage with XSHOOTER (ESPRESSO > 380nm)**
- **Higher resolution & lower efficiency**
- **"Lower" efficiency than HIRES/HDS**

# UVES in the optical:

- Efficiency comparable with ESPRESSO 4UT mode




UVES 580nm Upper CCD, slit=0.7” (R=57000)

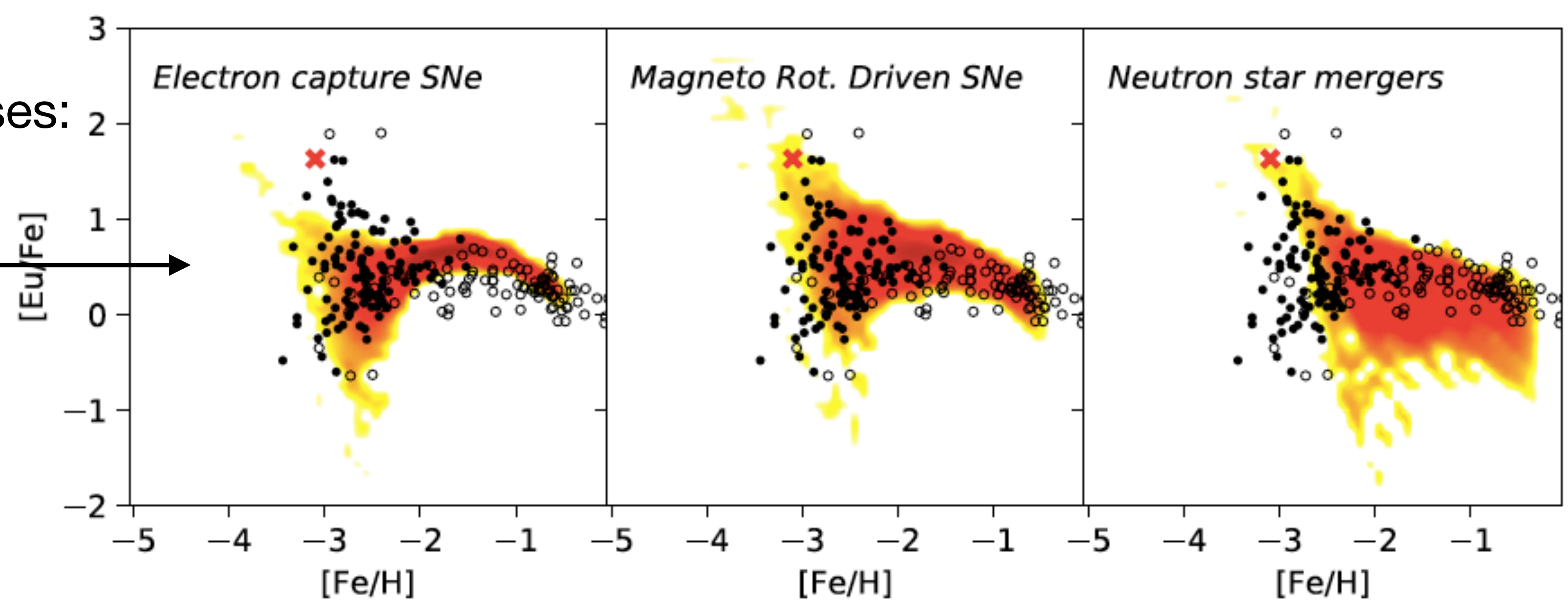
ESPRESSO 4UT (4x1”, R=70000)

AM=1.5, K7V, Seeing=1”, V=17, Texp=600s

# Among the ESO facilities UVES…

- is currently the only instrument covering the 300-400nm wavelength range with high resolution (XSHOOTER, R~10000, 0.5” slit)
- ….however its efficiency at the blue end is “low” even compared with similar facilities like HDS or HIRES.
- CUBES will have a much higher efficiency but will be limited to R=20000 and will cover the 300-400nm wavelength range only.
- Is it possible to improve on UVES UV efficiency? Detector / cross-disperser?

- Relevant (stellar) science cases:
  - Investigating neutron capture elements
  - C, N, O, Be
  - Metal-poor stars




**Cescutti et al. 2014, 2015**

# Among the ESO facilities UVES…

- UVES is still the best choice among the ESO instruments for science cases requiring high resolution spectroscopy of faint objects

- Without UVES the community would resort on XSHOOTER for distant objects (high efficiency but lower resolution) or ESPRESSO for closer objects (much higher resolution and overkilling precision on radial velocity)

- Synergy with CRIRES+ in the NIR -> coverage wider than XSHOOTER and higher resolution (XSHOOTER is more efficient though, and 2 UTs would be employed…)

- The planet hunter community using ESPRESSO requires intensive use of telescope time

- Extensive photometric surveys are and will be discovering substructures and dwarf galaxies up to 200 kpc

- Relevant (stellar) science cases:

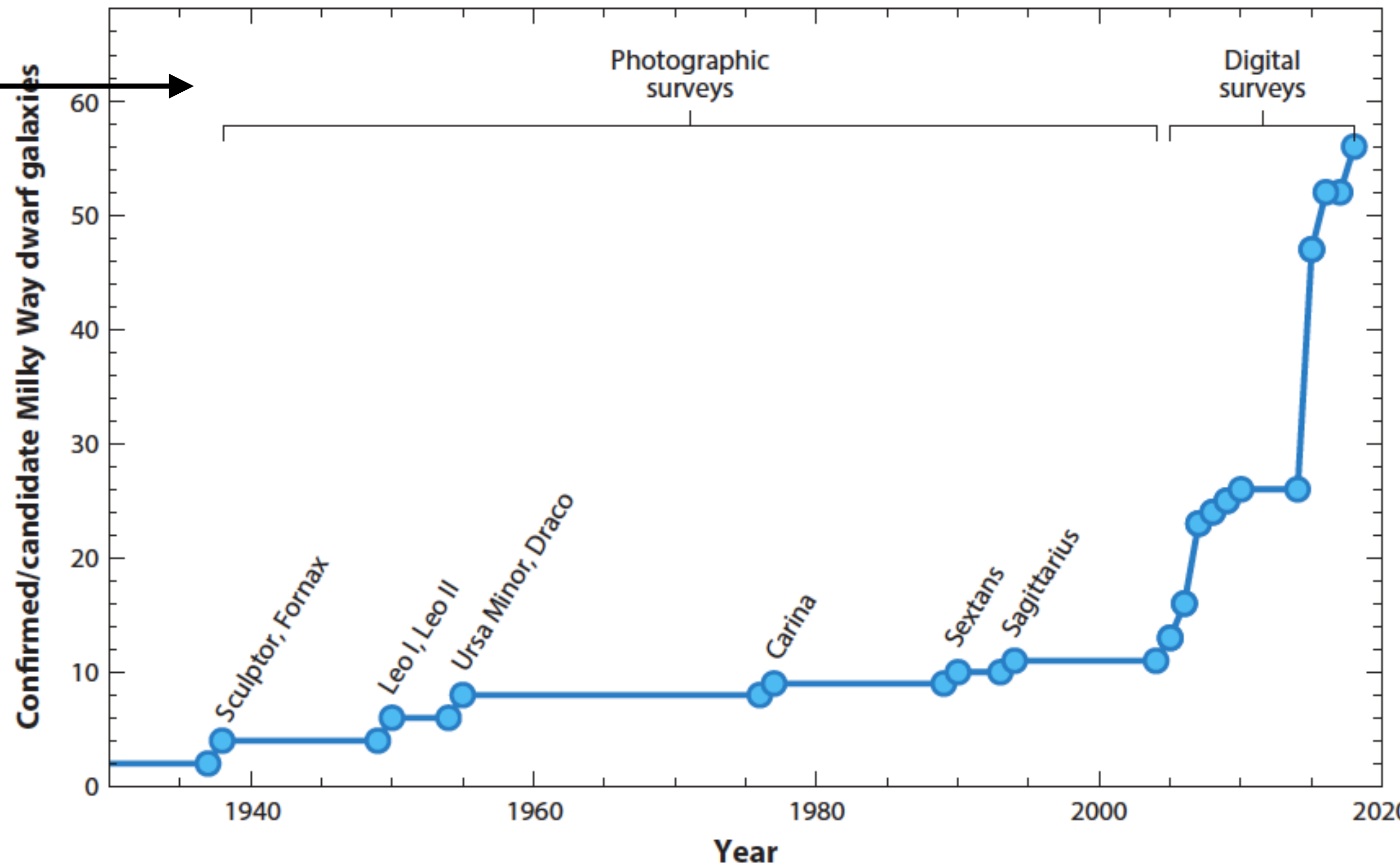
    - Dwarf spheroidal and Ultra-faint dwarf galaxies

    - Remnants of accretion events

    - Globular clusters

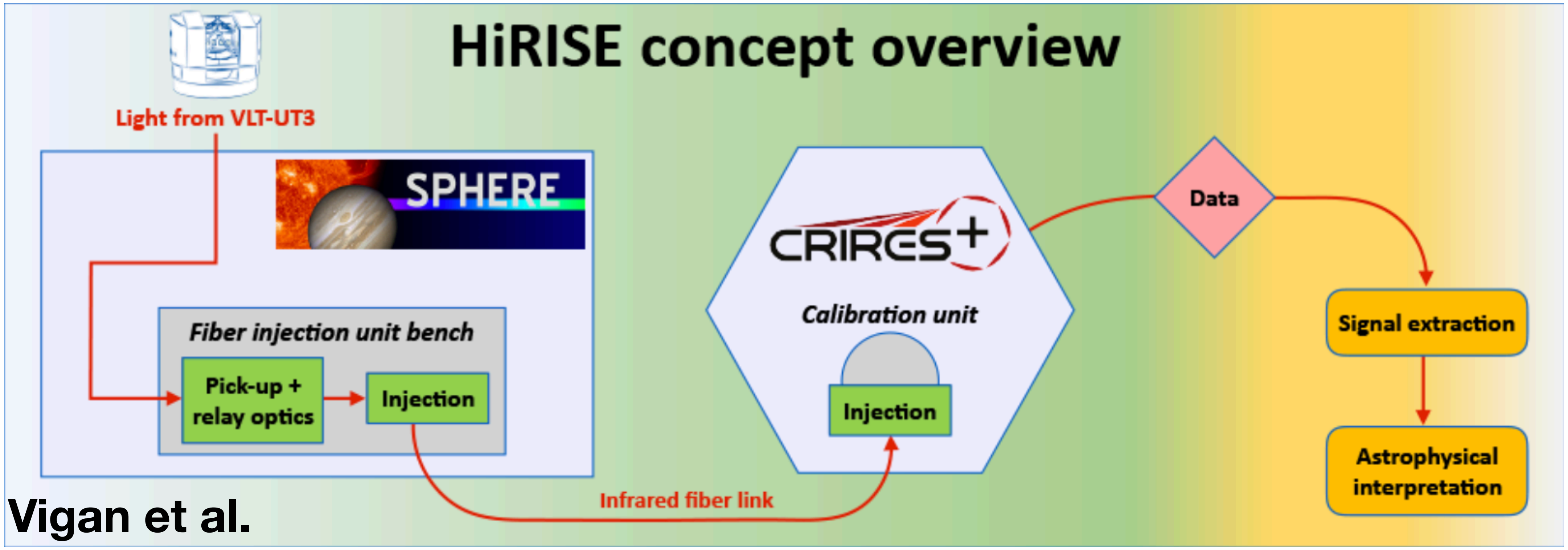
    - Metal-poor stars

    - RV accuracy combined with Gaia pm important to characterize the orbits and dynamics of stellar systems.



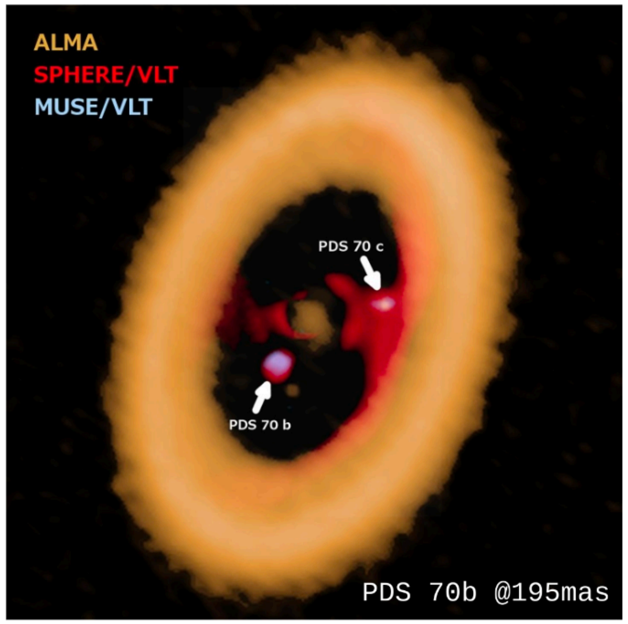

**Simon 2019, ARA&A, 57, 375**

# Crazy idea: UVES+??

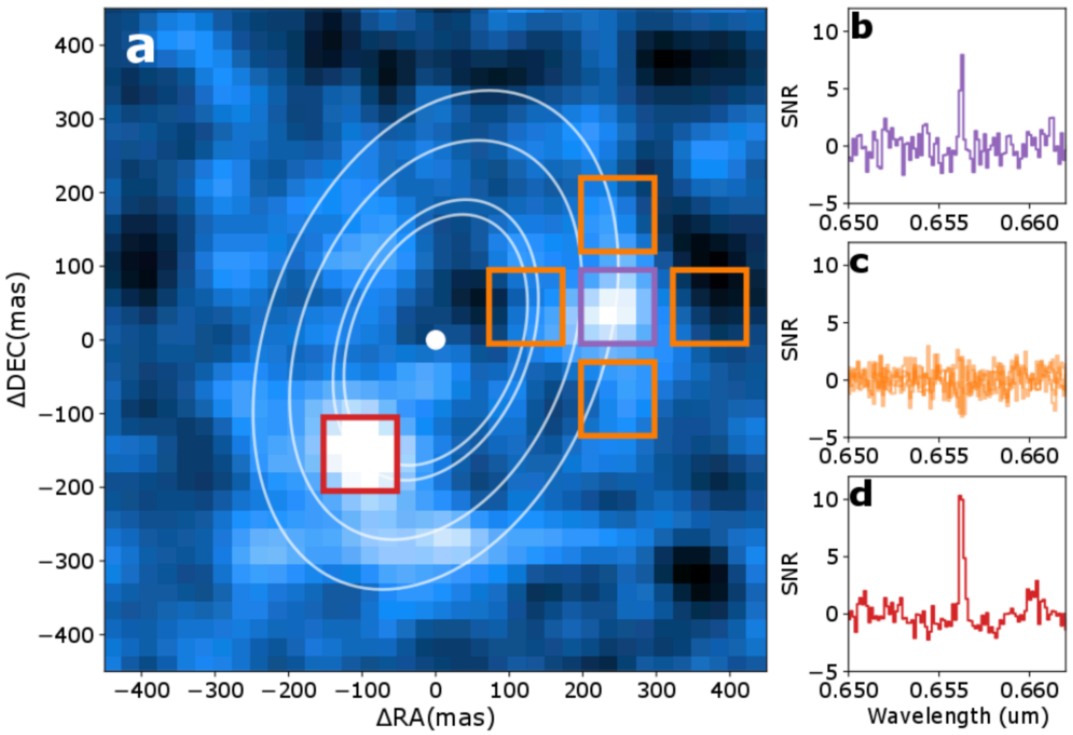



Vigan et al.

## At the cost of spatial info




Keppler+2018, 2019
Mueller+2018
Haffert+2019



# Additional points mentioned

- **Combining CUBES + UVES**
- **Discussion on UVES as a follow-up machine (complementarity 4most)**
- **“what to do with the fibers?”**
- **Huge legacy value from the archive**
- **Instrument that can operate and provide useful science in filler conditions!!**