In memoriam of Yakiv Pavlenko

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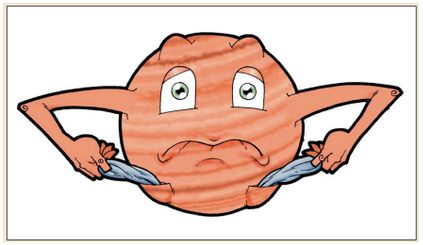
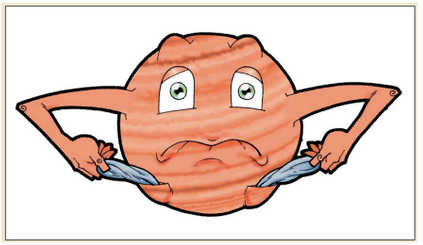
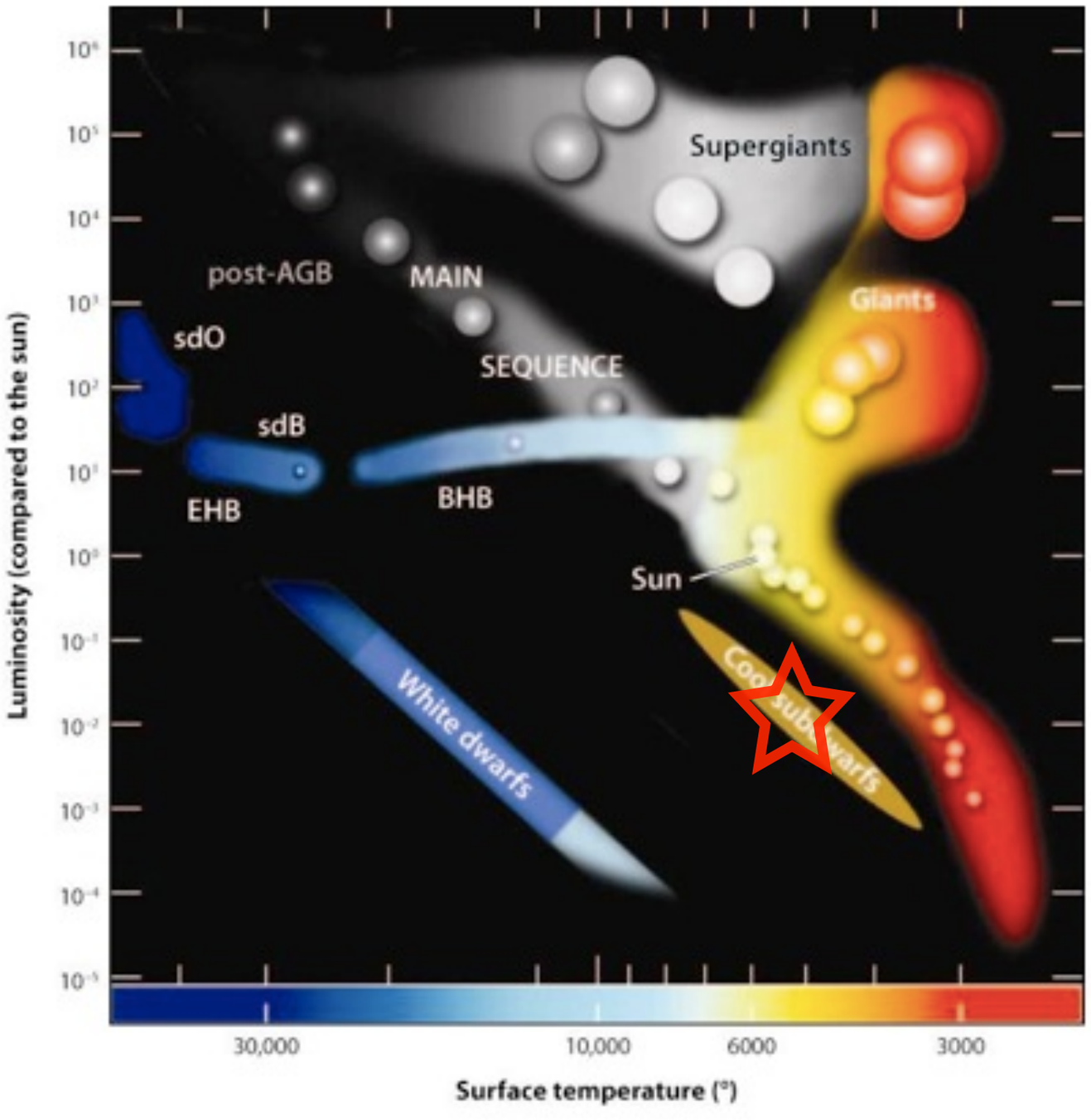
La Gomera

Wednesday 3 September 2025



Definition





Heber U. 2009.
Annu. Rev. Astron. Astrophys. 47:211–51

First generation of stars in our Galaxy

Important tracers of Galaxy enrichment

Population II stars

Dearth of metals in their atmospheres

Large proper motions

Large heliocentric velocities

Thick disk and halo kinematics

Observations

Medium-resolution UVB + VIS + NIR spectra collected with VLT X-shooter for 16 sdM, 16 esdM, 12 usdM and 16 M solar-type dwarfs downloaded from the ESO Science Archive

{ sdM0.0 - sdM9.5
esdM0.0 - edM8.5
usdM0.0 - udM8.5

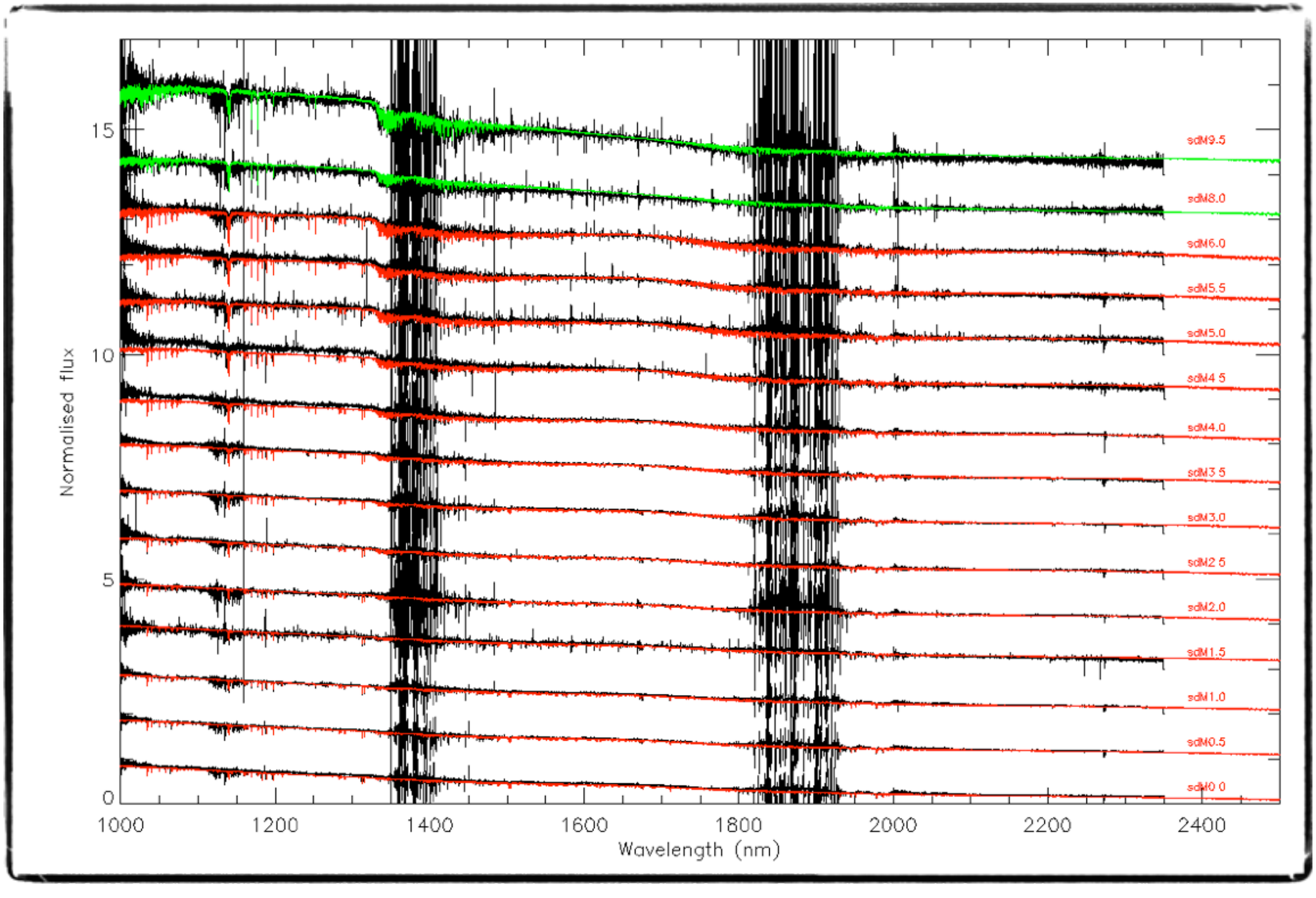
vs

dM0.0 - dM9.0

Arm	λ-range	N. of orders	scale[1]	Slit	Resolution
	(nm)		("/pix)		
UVB	300-560	12	0.16-0.20	1.3"	R=4000
VIS	550-1020	15	0.16-0.18	1.2"	R=6700
NIR [3]	1020-2480	16	0.21-0.28	1.2"	R=3900

sdM: observations vs models

Teff = 3800-2700K; log(g) = 5.5+/-0.5 dex; [M/H] = -1.0+/-0.5 dex

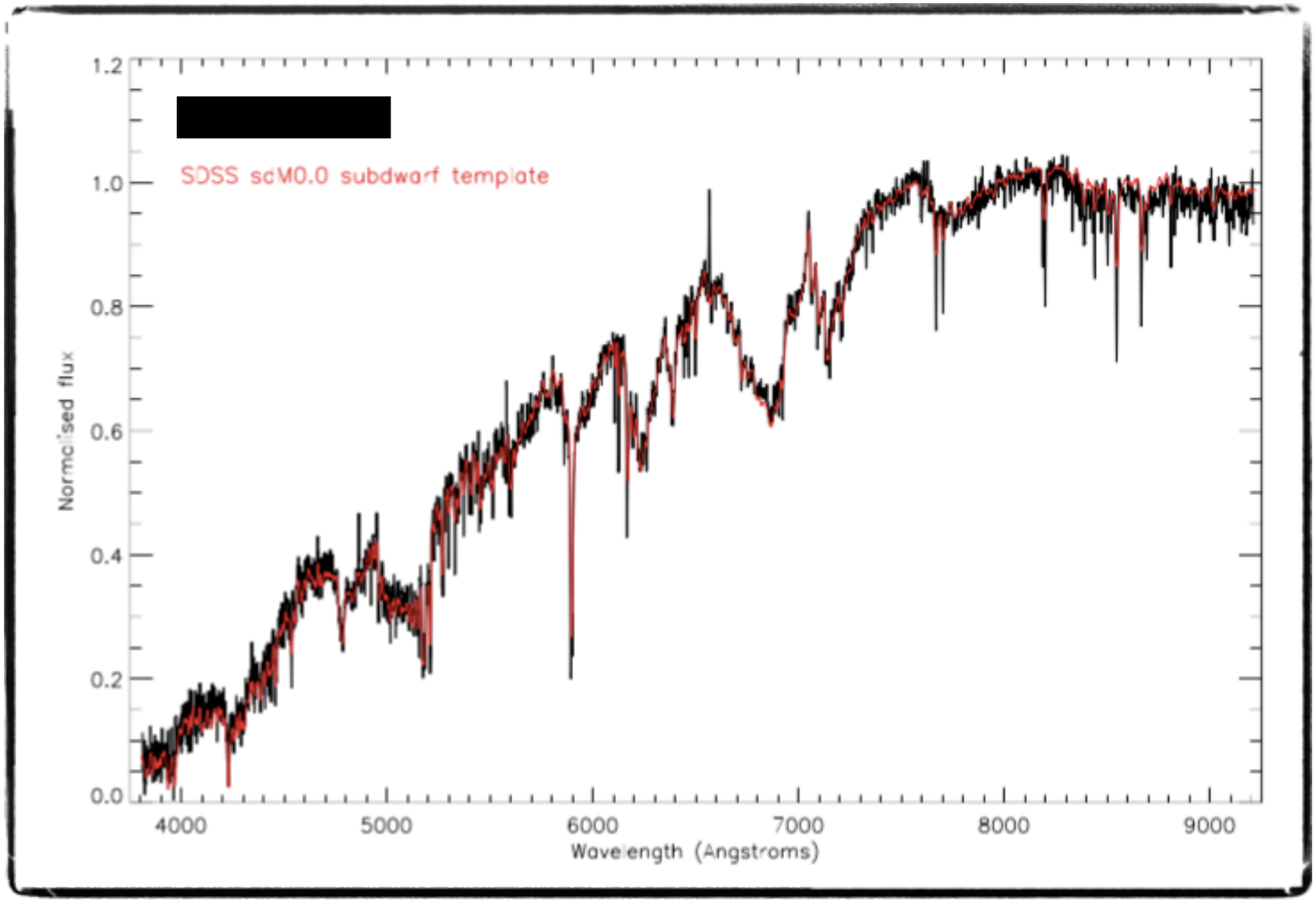


The system

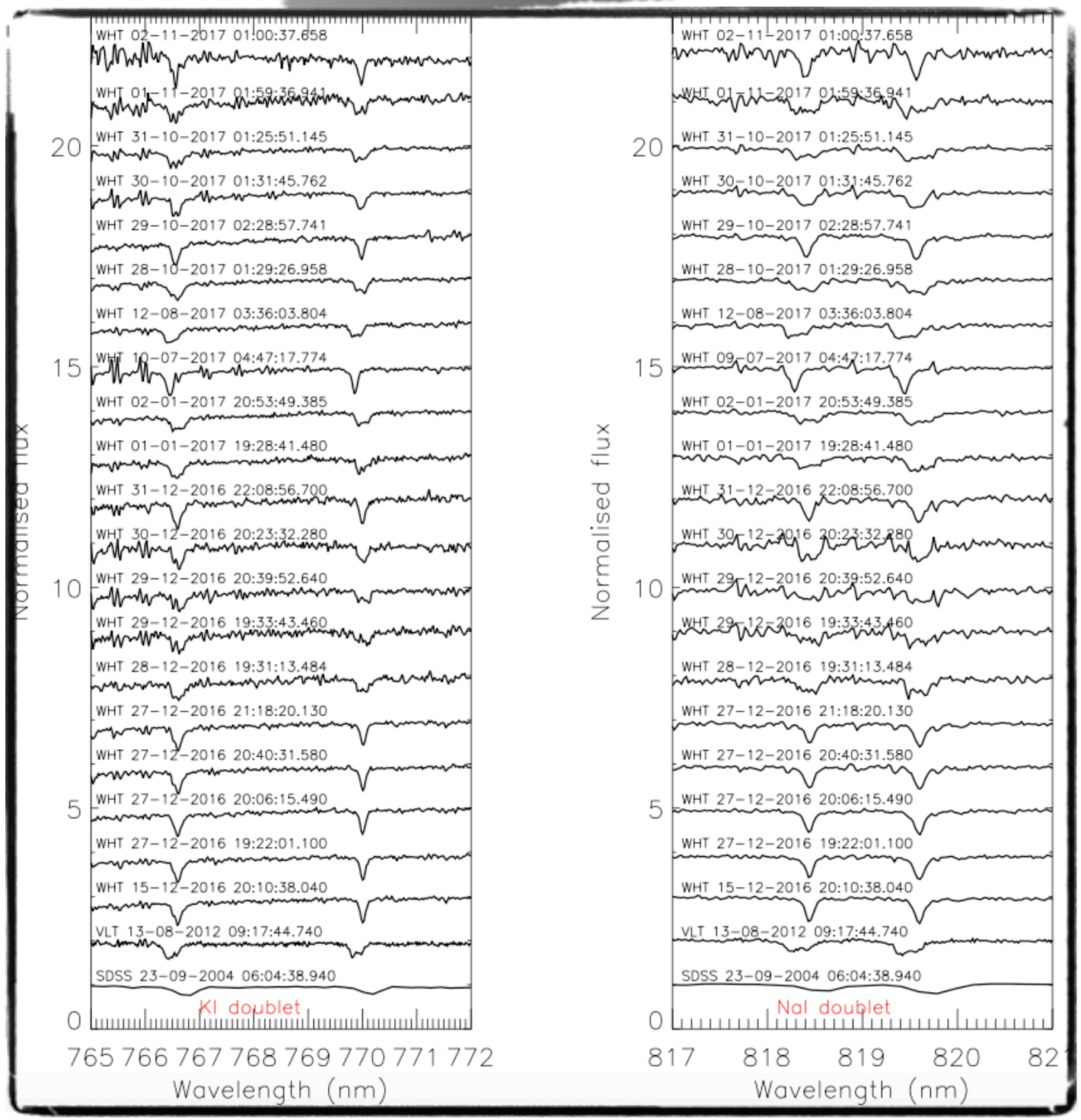
Table 1. Properties [redacted] including coordinates, photometry, proper motion (mas/yr), and spectral type.

[redacted]

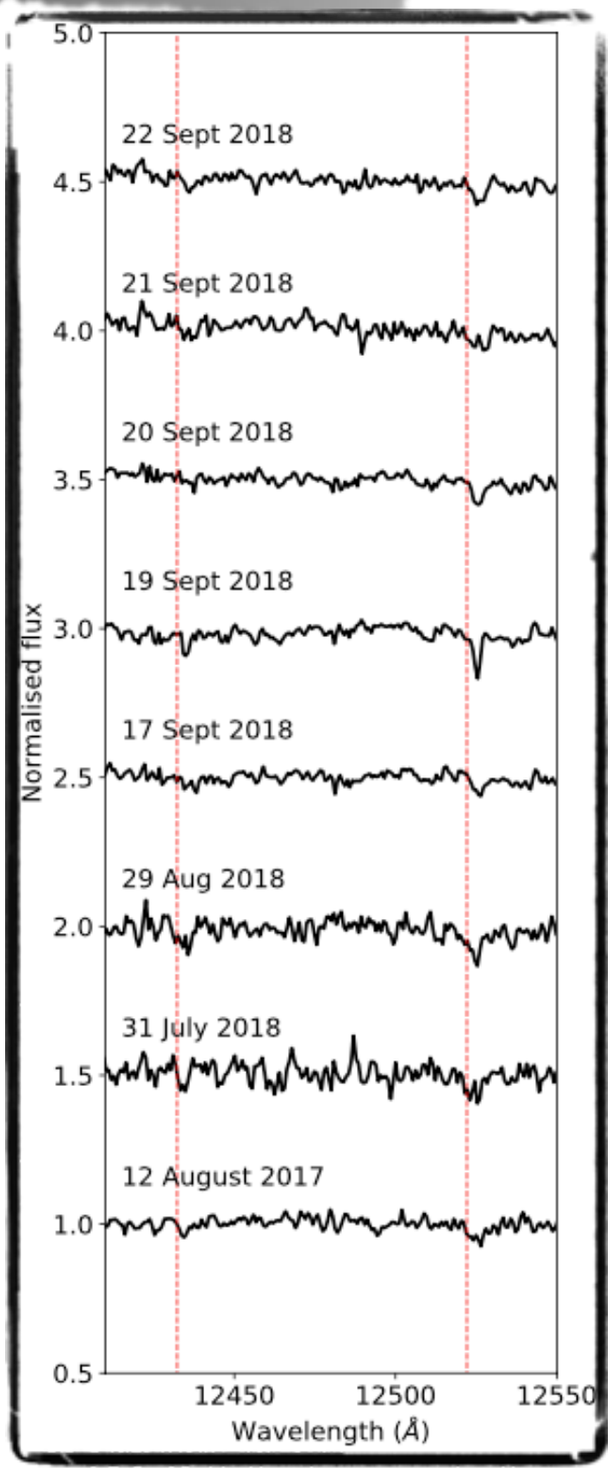
SDSS*u* (SDSS DR13)	20.001±0.037 mag
SDSS*g* (SDSS DR13)	17.401±0.052 mag
SDSS*r* (SDSS DR13)	15.930±0.047 mag
SDSS*i* (SDSS DR13)	15.177±0.048 mag
SDSS*z* (SDSS DR13)	14.725±0.046 mag
I (DENIS)	15.507±0.030 mag
J (DENIS)	13.363±0.120 mag
K (DENIS)	12.530±0.150 mag
J (2MASS)	13.502±0.024 mag
H (2MASS)	12.858±0.027 mag
K_s (2MASS)	12.661±0.027 mag
Y (UKIDSS LAS)	13.896±0.002 mag
J (UKIDSS LAS)	13.440±0.002 mag
H (UKIDSS LAS)	12.900±0.002 mag
K (UKIDSS LAS)	12.700±0.002 mag
*w*1 (AllWISE)	12.579±0.023 mag
*w*2 (AllWISE)	12.473±0.027 mag
*w*3 (AllWISE)	12.187±0.424 mag
$\mu_\alpha \cos\delta$ (NOMAD)	30.0±4.0 mas/yr
μ_δ (NOMAD)	−48.0±3.0 mas/yr
$\mu_\alpha \cos\delta$ (PPMXL)	33.5±4.9 mas/yr
μ_δ (PPMXL)	−55.9±4.9 mas/yr
$\mu_\alpha \cos\delta$ (LAS)	53.1±2.5 mas/yr
μ_δ (LAS)	−33.2±2.5 mas/yr
SpType (SDSS)	M0.0



Spectroscopic observations



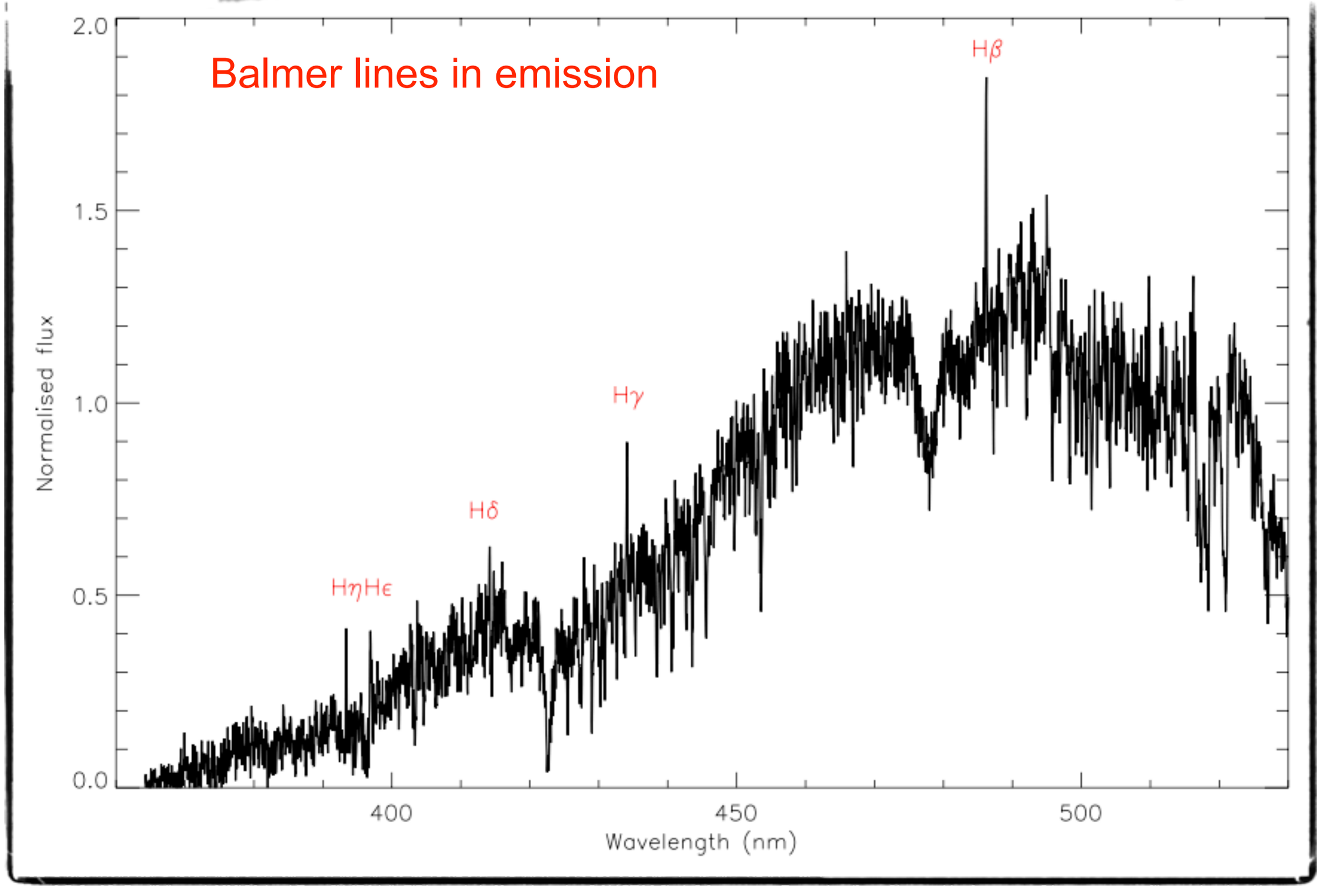
WHT ISIS: 20 epochs
KI and NaI doublets



GTC EMIR: 8 epochs
KI doublets

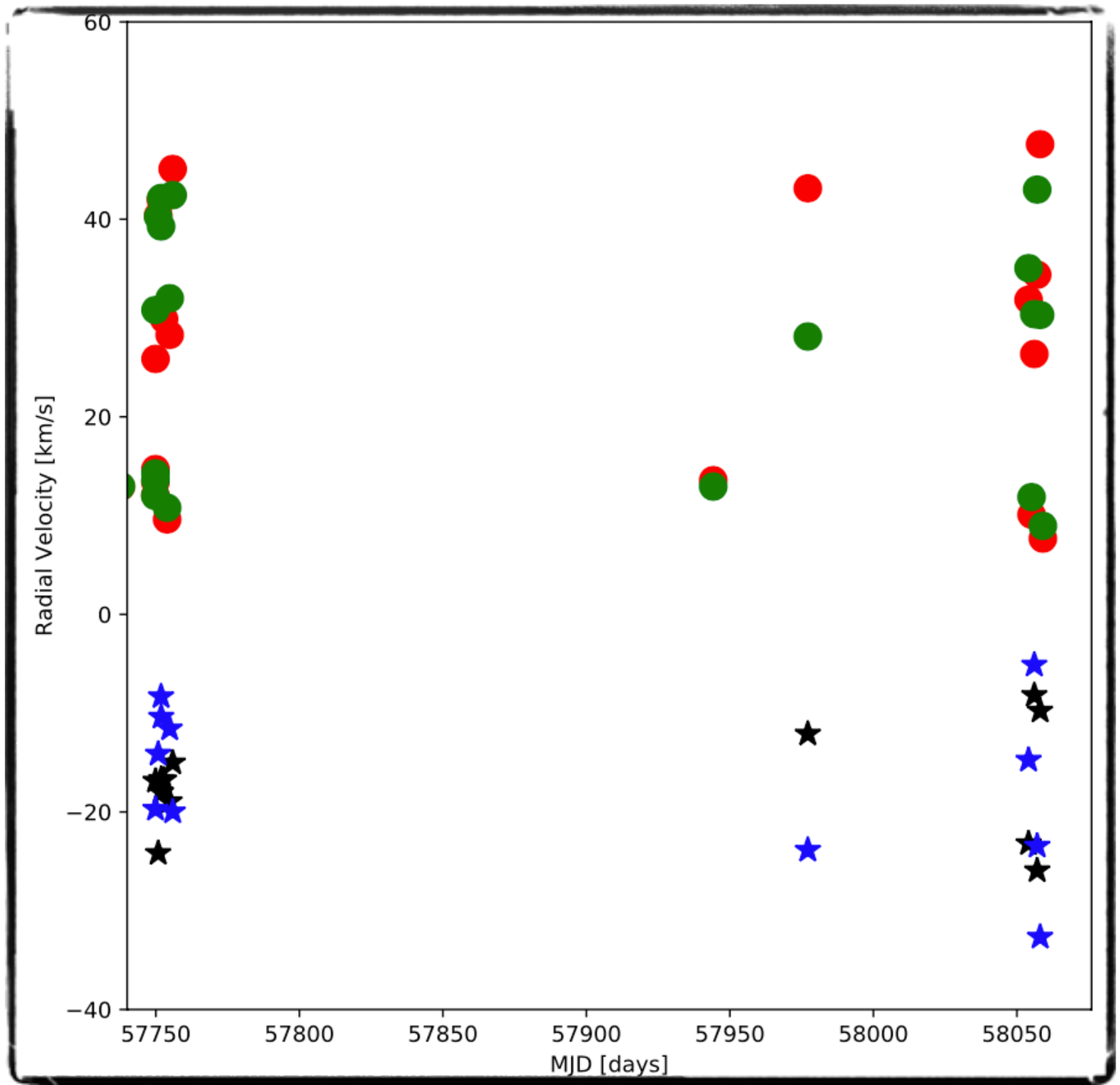
Spectroscopic observations

Balmer lines in emission



Radial velocity curve

P~8d; i=83+/-7d; M1/M2=0.90+/-0.05; M1+M2=0.6+0.5+/-0.1 M⊙



Paper never finished…

A metal-poor low-mass spectroscopic binary

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Lithium in L subdwarfs

A search for lithium in metal-poor L dwarfs⋆,⋆⋆,⋆⋆⋆

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ABSTRACT

Aims. The aim of the project is to search for lithium in absorption at 6707.8 Å to constrain the nature and mass of the brightest low-metallicity L-type dwarfs (referred to as L subdwarfs) identified in large-scale surveys.

Methods. We obtained low- to intermediate-resolution ($R \sim 2500$–9000) optical (~560–770 nm) spectra of two mid-L subdwarfs, SDSS J125637.13−022452.4 (SDSS1256; sdL3.5) and 2MASS J162620.14+392519.5 (2MASS1626; sdL4) with spectrographs on the European Southern Observatory Very Large Telescope and the Gran Telescopio de Canarias.

Results. We report the presence of a feature at the nominal position of the lithium absorption doublet at 6707.8 Å in the spectrum of SDSS1256, with an equivalent width of 66 ± 27 Å at 2.4σ, which we identify as arising from a CaH molecular transition based on atmosphere models. We do not see any feature at the position of the lithium feature in the spectrum of 2MASS1626. The existence of overlapping molecular absorption sets a confusion detection limit of [Li/H] = −3 for equivalently typed L subdwarfs. We provided improved radial velocity measurements of -126 ± 10 km s^{-1} and -239 ± 12 km s^{-1} for SDSS1256 and 2MASS1626, respectively, as well as revised Galactic orbits. We implemented adjusting factors for the CaH molecule in combination with the NextGen atmosphere models to fit the optical spectrum of SDSS1256 in the 6200–7300 Å range. We also estimate the expected Li abundance from interstellar accretion ([Li/H] = −5), place limits on circumstellar accretion (10^9 g/yr), and discuss the prospects of Li searches in cooler L and T subdwarfs.

No Lithium…

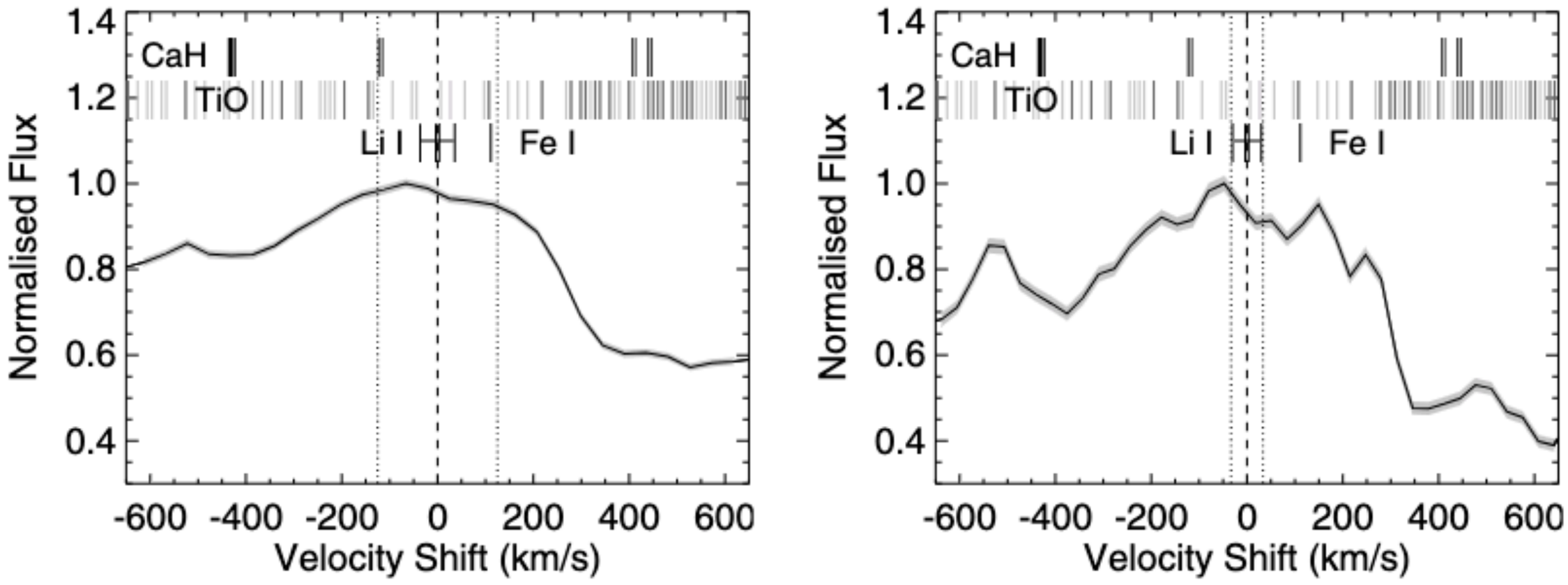

Fig. 2. Zoom-in on the combined spectra (black line) for SDSS1256 (*left*) and 2MASS1626 (*right*) around the Li I line. The grey bands indicate the formal spectral uncertainties while the horizontal error bar indicates the 3σ radial velocity uncertainties. Dotted lines indicate the velocity resolution of the instruments used. Overplotted at the *top* are marked the main features of CaH, Li, Fe, and TiO. We note that TiO is blanketing the entire region with cross-sections of various strengths from 5×10^{-17}, 1×10^{-16}, 5×10^{-16} cm^2/molecules shown in three shades of grey (light to dark).