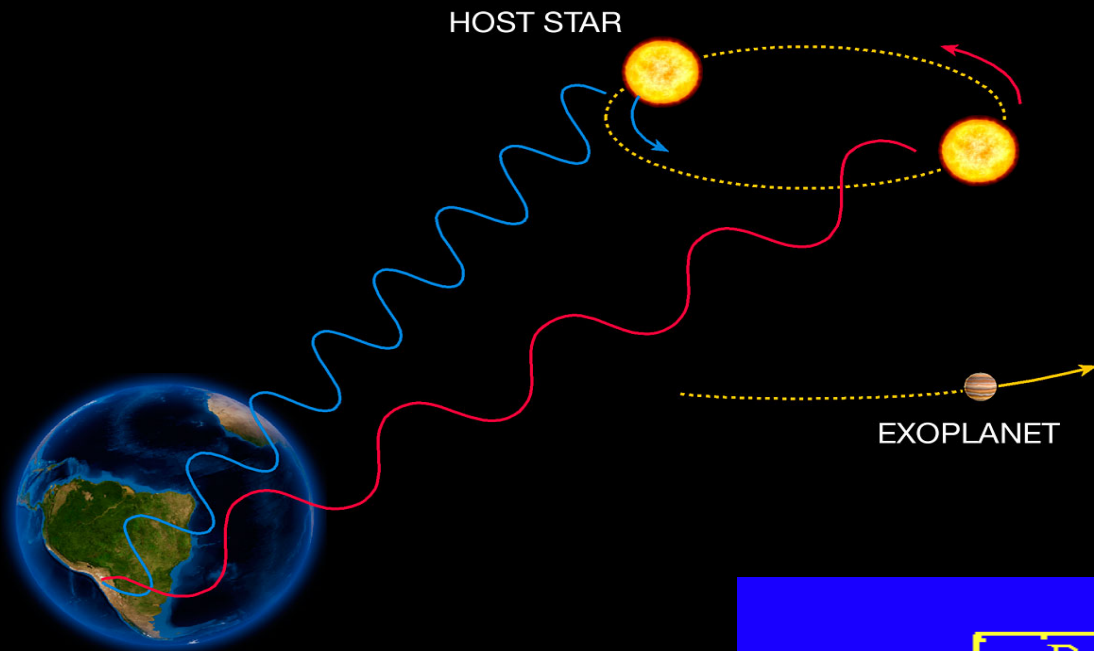


Telluric absorption correction for exoplanet radial velocity measurements

Anastasiia Ivanova
3^d year PhD student.

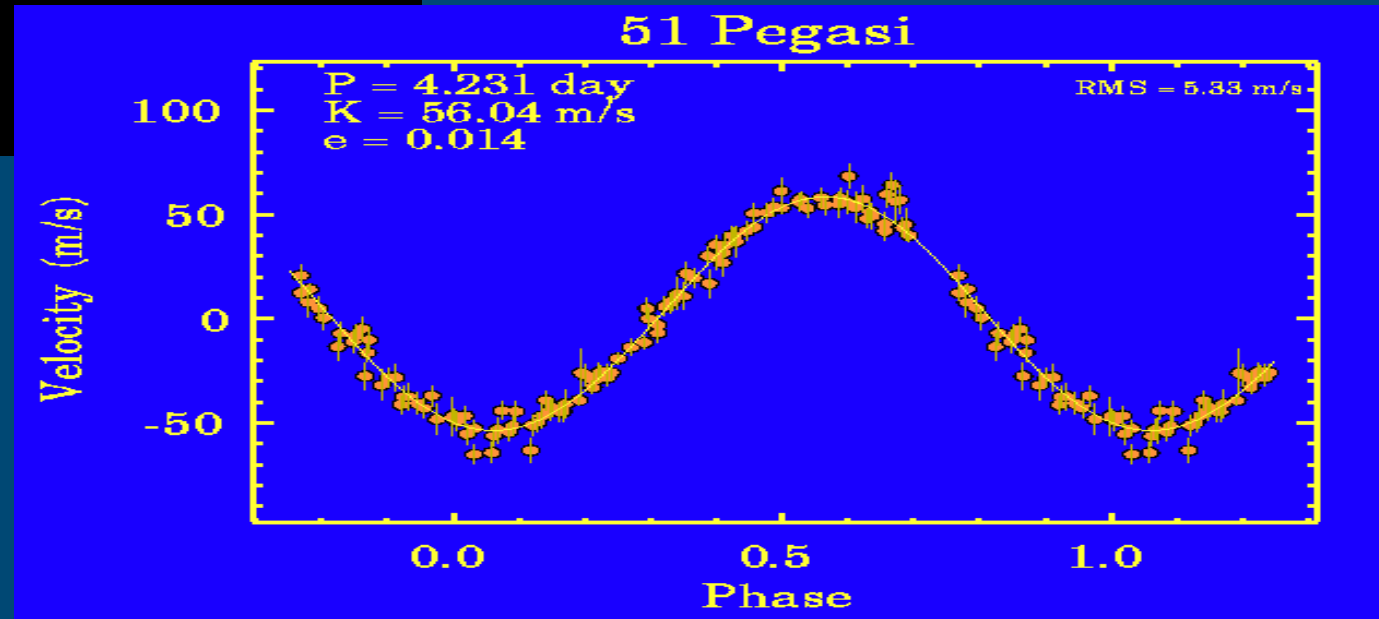
Scientific advisors:
E. Marcq (LATMOS)
R. Lallement (GEPI)
A. Tavrov (IKI RAS)

What is the RV method

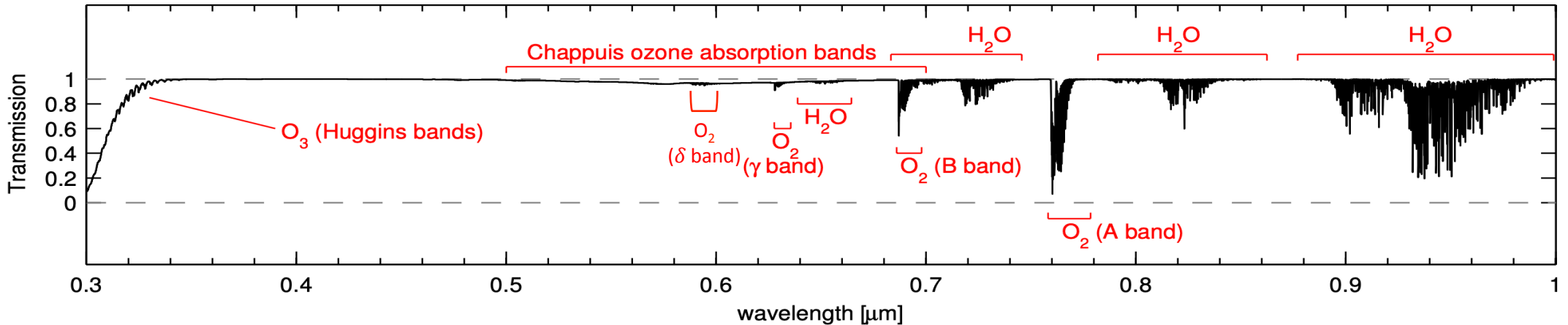


eso.org

Mayor M.; Queloz, D, "A Jupiter-mass companion to a solar-type star" 1995 Nature
02 December



How tellurics could affect spectra



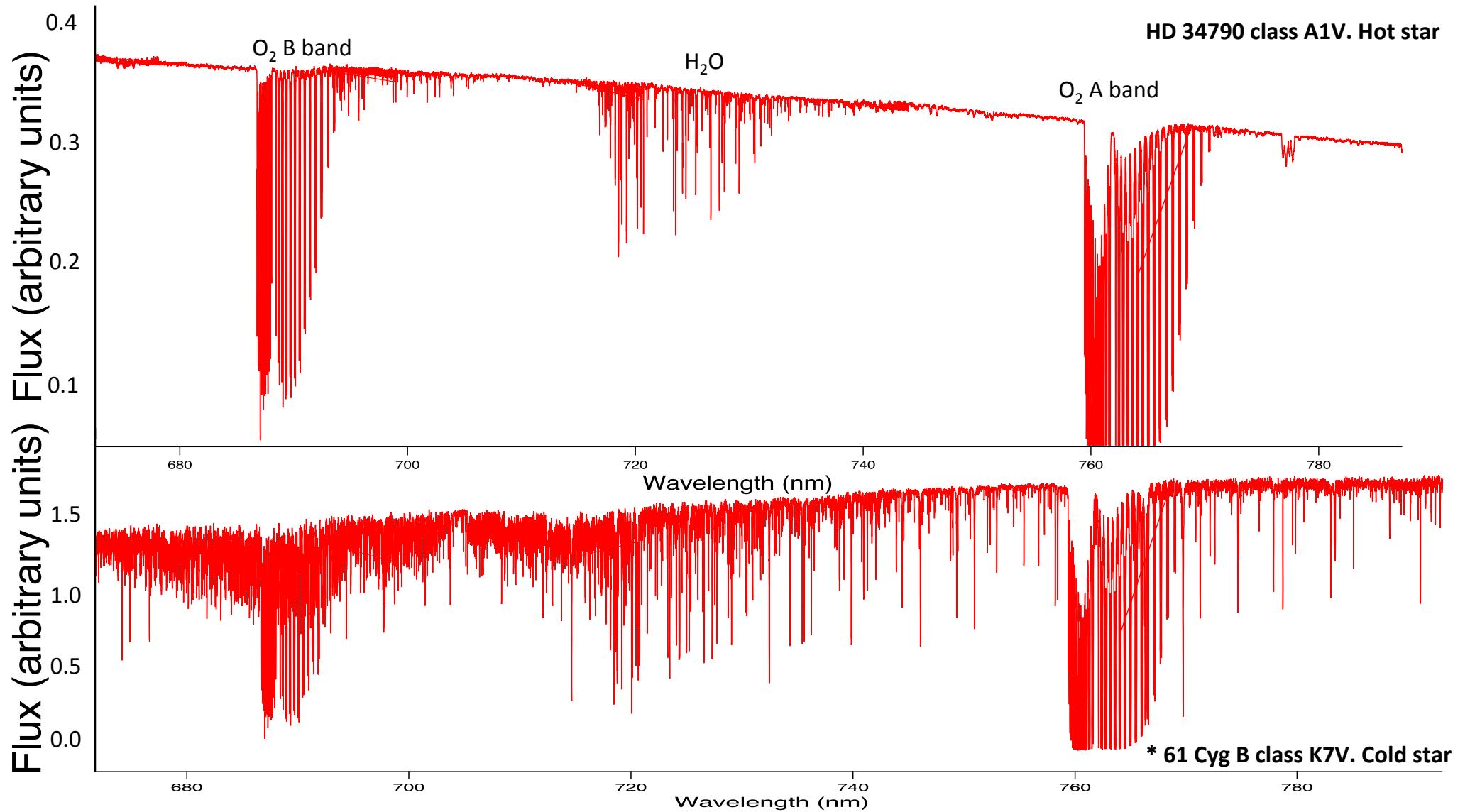
BTA SAO RAS wavelength range (0.4-0.75 μm)

ESPRESSO wavelength range (0.378-0.788 μm)

A. Smette et al. "Molecfit: A general tool for telluric absorption correction" A&A 576, A77 (2015)
DOI: 10.1051/0004-6361/201423932

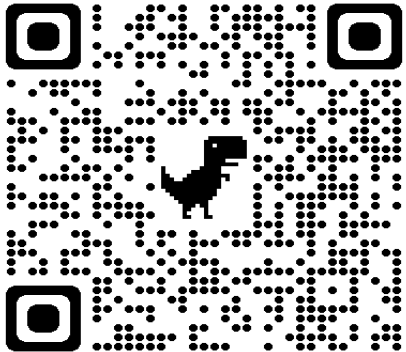
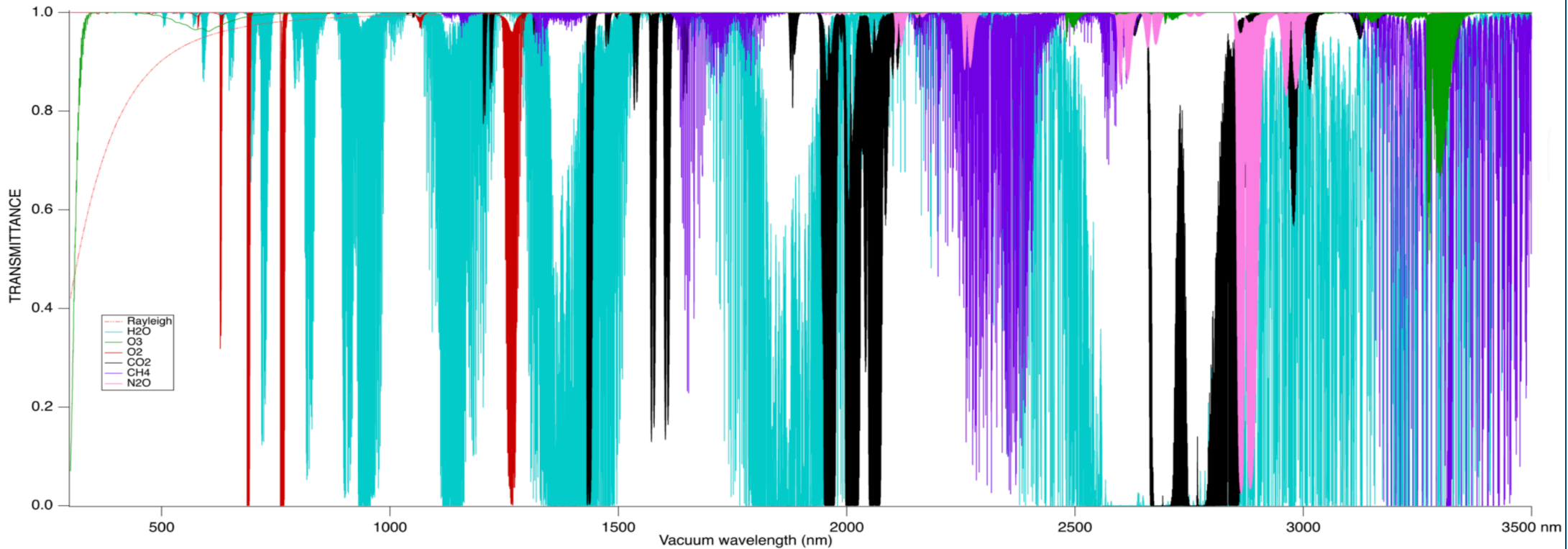


How it looks like: real data



TAPAS

Transmissions Atmosphériques Personnalisées pour l'Astronomie

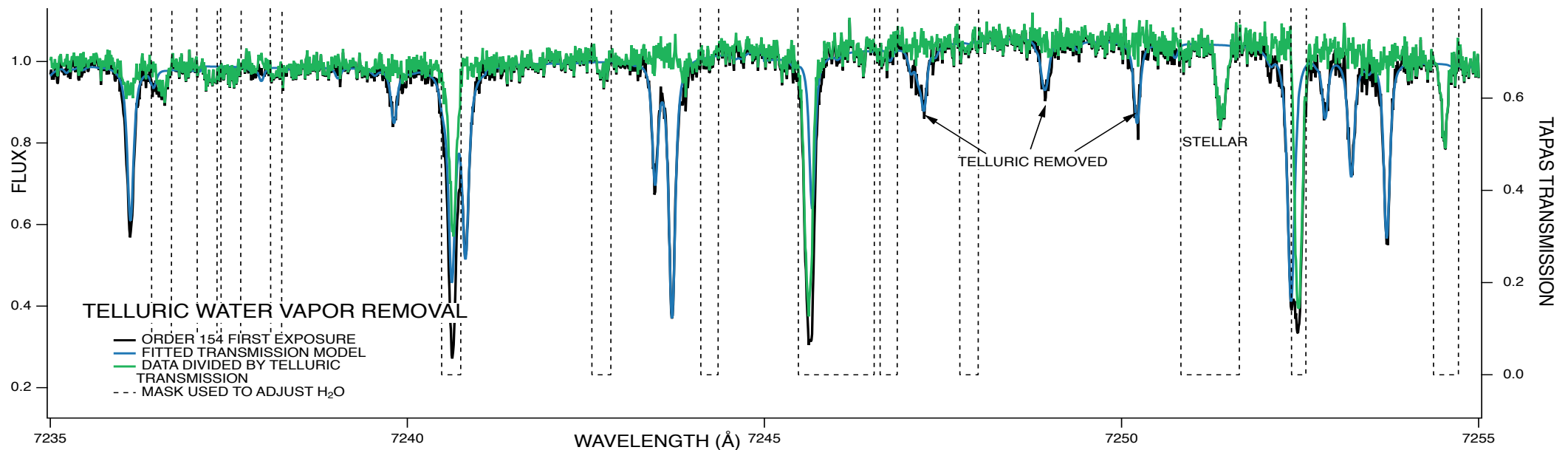


<https://tapas.aeris-data.fr/en/home/>

LATMOS 2022

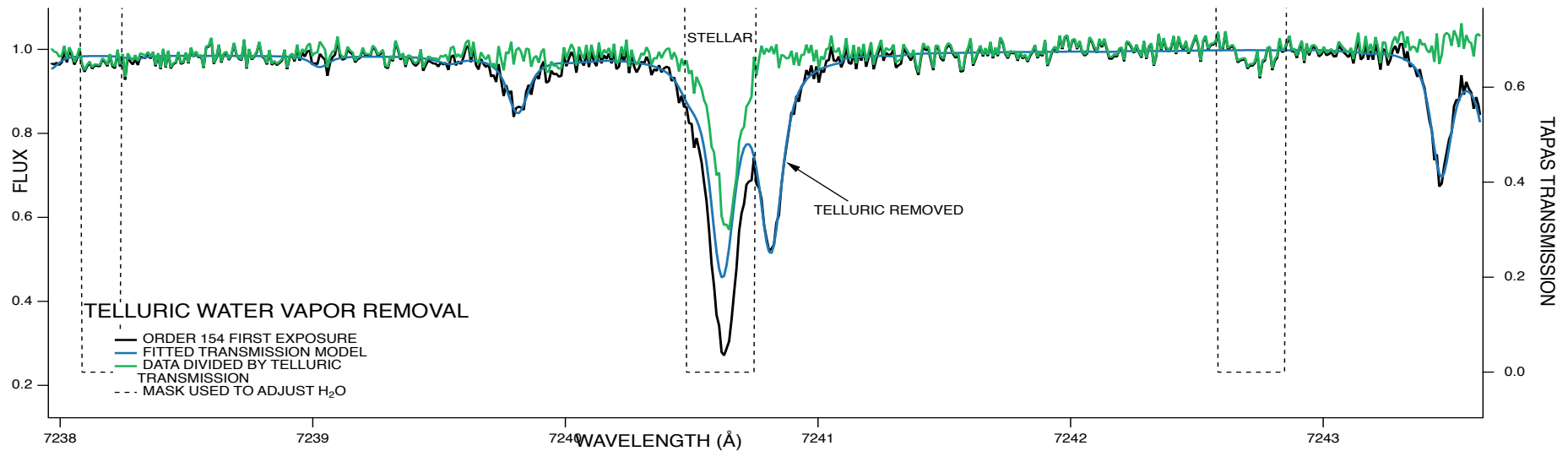


Telluric correction



1. Choose orders with telluric contamination
2. Create mask for stellar lines
3. Fitting data by atmospheric model+stellar mask piece by piece
4. Average obtained fitting values for order
5. Divide data by averaged atmospheric model



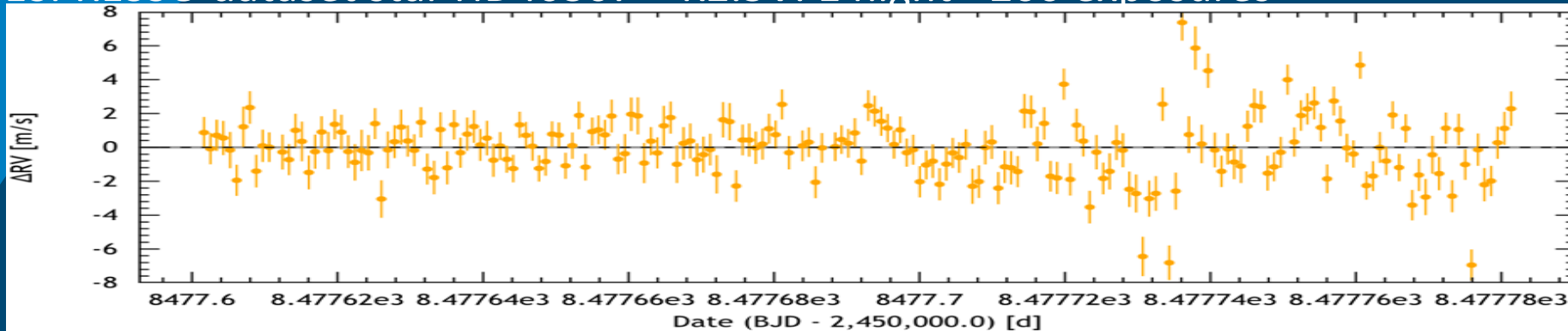


Zoom into short spectral region.

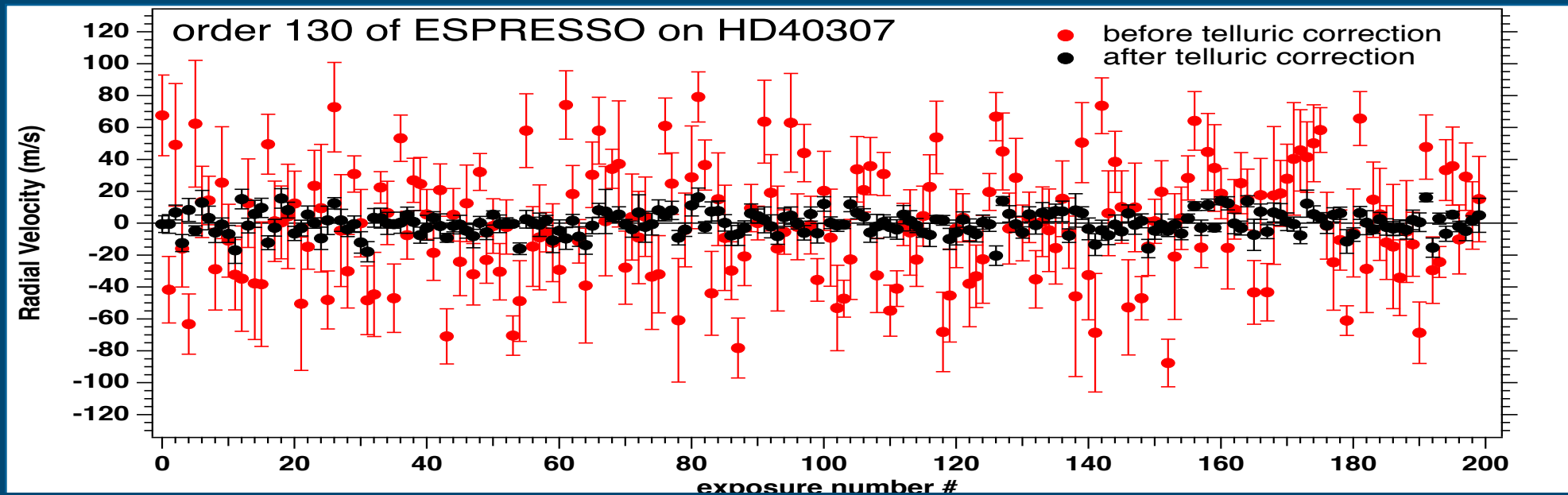
Method works well even for mixed lines

Results on RV measurements

ESPRESSO dataset star HD40307 – K2.5V. 1 night - 200 exposures



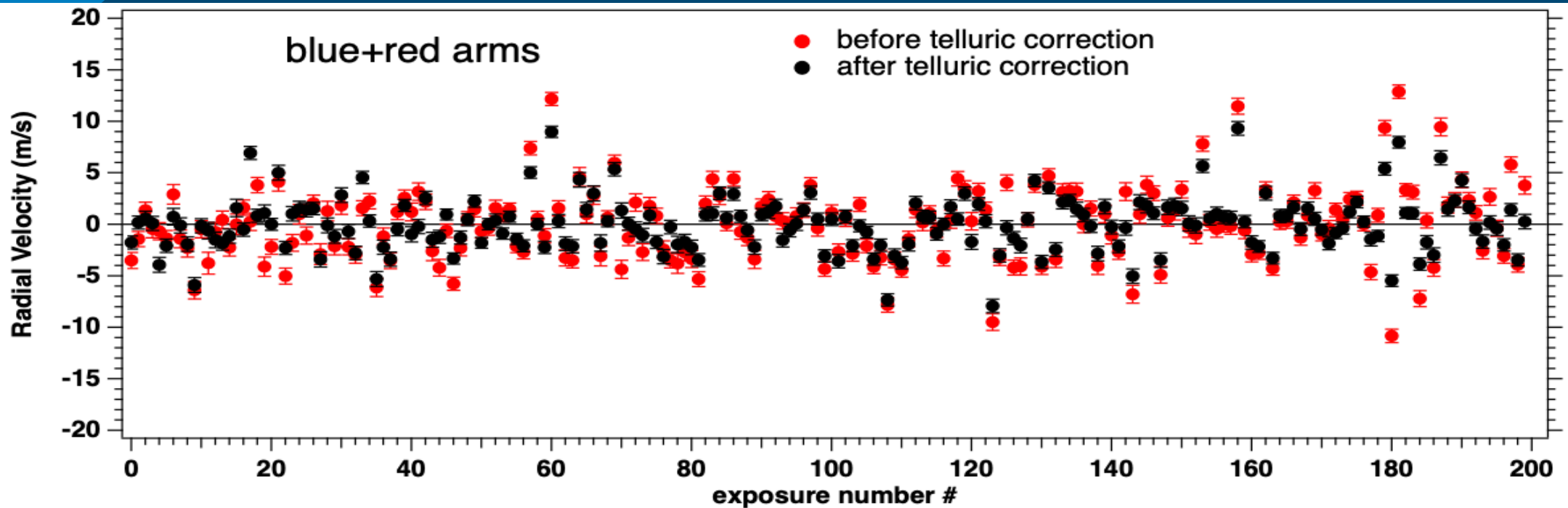
ESPRESSO at VLT On-sky performance and first results Pepe et al. A&A Volume 645, January 2021



Before correction – 3 lines; after 26

Error of unique observation from 22.5 ms^{-1} to 5.3 ms^{-1}

Spread from 35 ms^{-1} to 7 ms^{-1}



Combination of all orders

Error of unique observation from 1 ms^{-1} to 0.7 ms^{-1}

Spread from 2.8 ms^{-1} to 2.3 ms^{-1}

