PHYS 7810: Solar Physics with DKIST

Lecture 12: Hands-on : Spectroscopy

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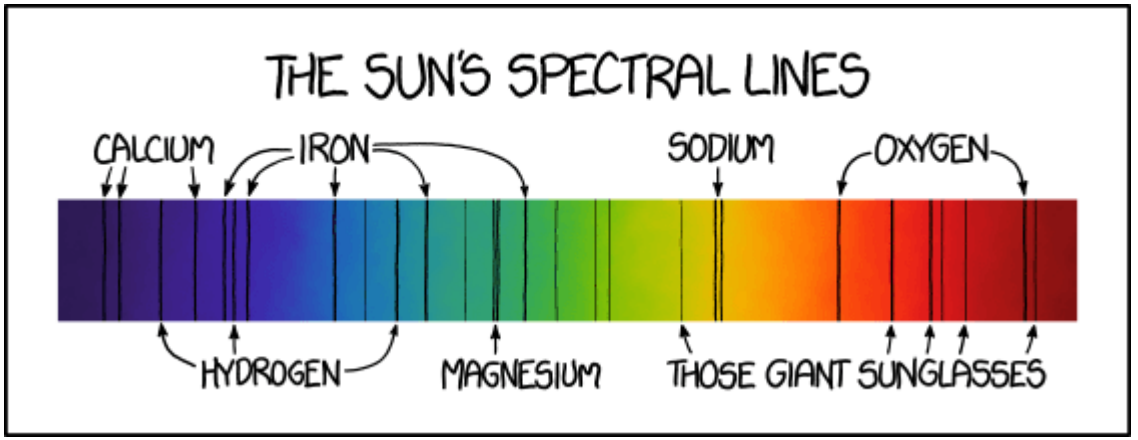


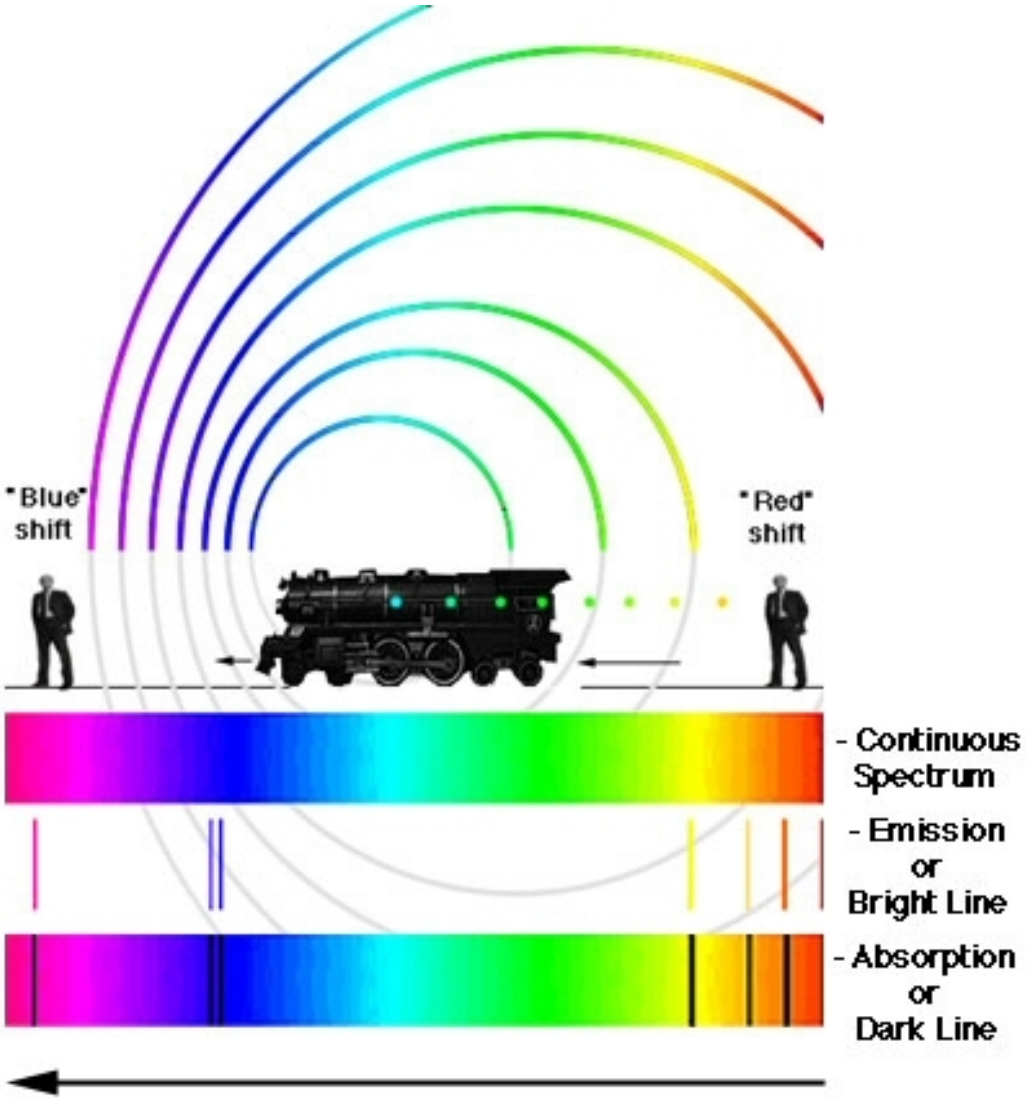
Previous classes

- We started by studying instruments for gathering the light – telescopes
- We moved to the instruments for analyzing the light – filtergraphs and spectrographs
- Then to the instruments measuring polarization state – polarimeters
- To understand polarimetric measurements we have to wait a bit (Zeeman effect, scattering polarization) – second part.
- But we can already try to process some spectroscopic measurements and estimate study some physics from a datacube
- That is the topic of todays hands-on

Doppler effect

$$\Delta\lambda = \frac{v}{c}\lambda_0$$

- So, if we are looking at one spectral line, what kind of spectral resolution do we need to measure velocity down to a 1 km/s precision?
- Let's discuss this for while, and we will demonstrate in the exercise.



Let’s look at the data and discuss

- Where do the spectral lines come from?
- Why is continuum not flat?
- How to infer the wavelengths in this grid?
- What can we learn simply from the intensity distribution of the wavelengths?
- Let’s do it!

To – do:

- Load and visualize the data
- Calibrate the wavelengths using NIST database
- https://physics.nist.gov/PhysRefData/ASD/lines_form.html
- For each pixel, calculate the line centers of two referent lines
- Use them to calculate velocity maps
- Plot and discuss

Next step: downloading and prepping HINODE data:

- Go to https://csac.hao.ucar.edu/sp_data.php
- Pick a dataset (I usually choose my birthday ;))
- Download the data
- Assemble cubes out of individual spectra
- Calibrate the wavelengths
- Determine velocities!
- Enjoy, and wait for the beautiful moment when we add magnetic field determination to this!