

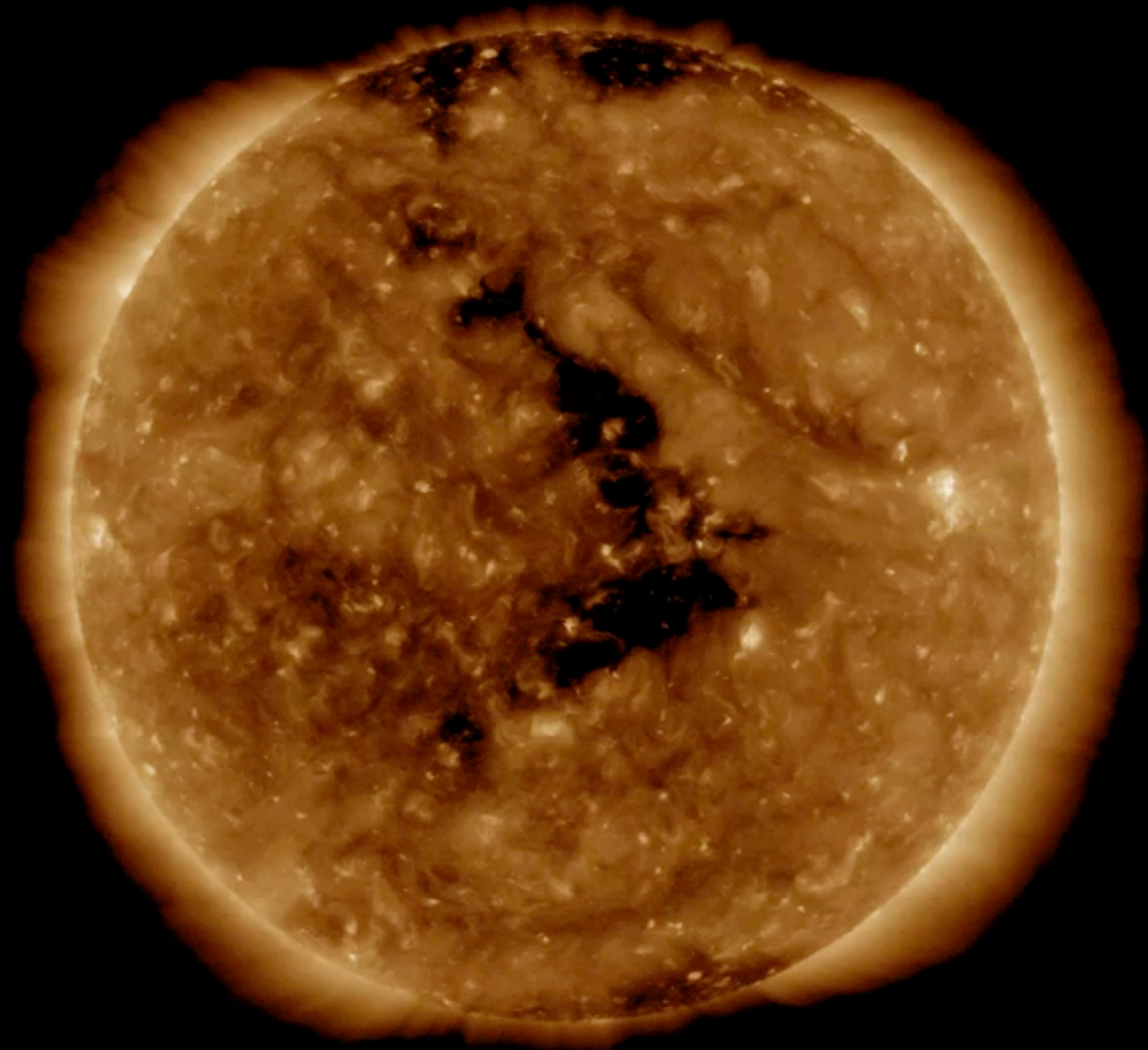


More than meets the eye: using ultraviolet spectra to study the Sun's corona

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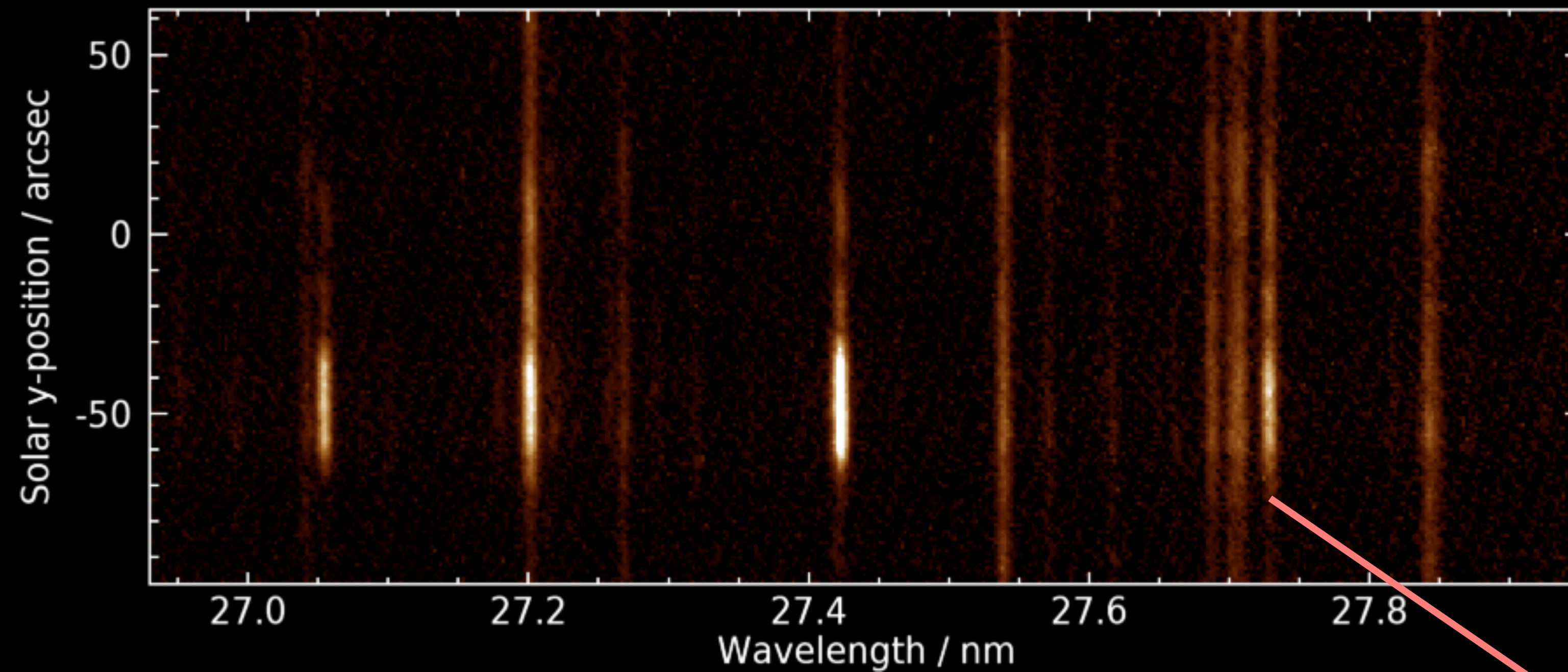
Extreme Ultraviolet Images



AIA 19.3 nm
Shows 1.5 MK plasma

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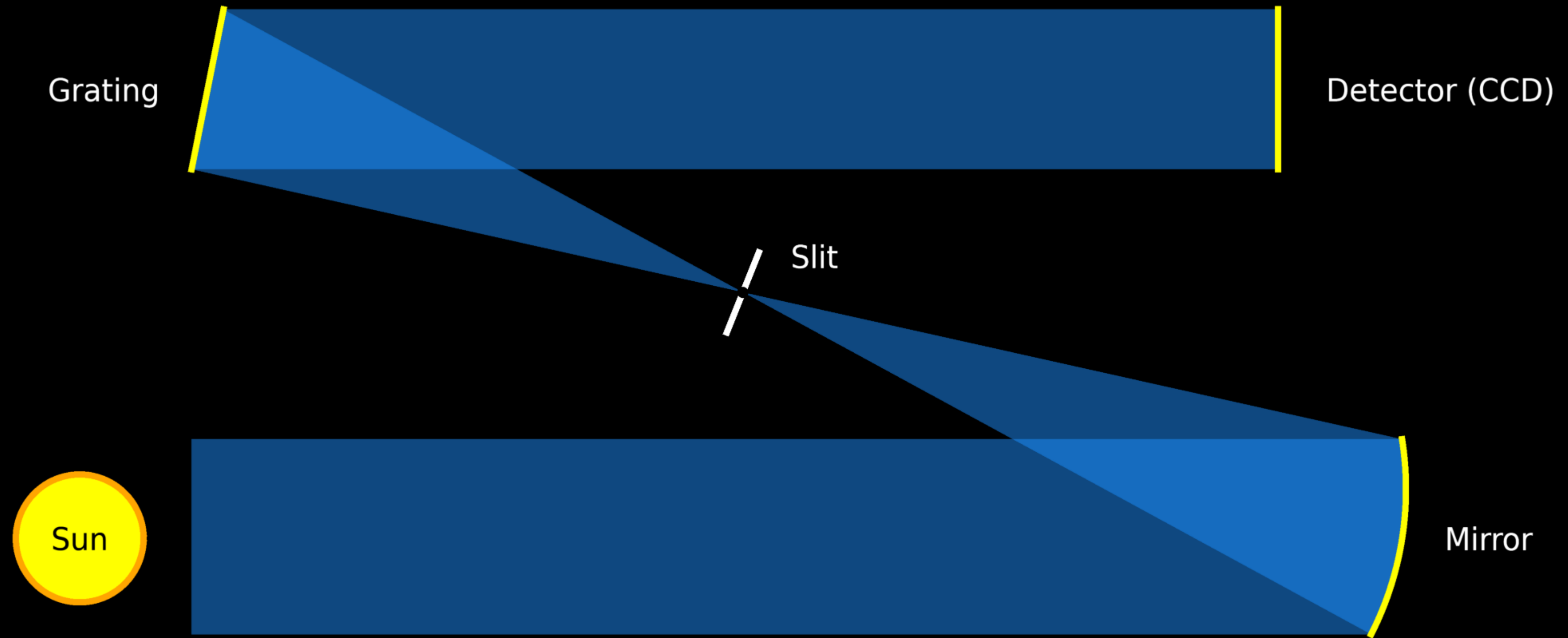
Extreme Ultraviolet Spectra



Example of an extreme ultraviolet spectrum
(from Hinode/EIS instrument)

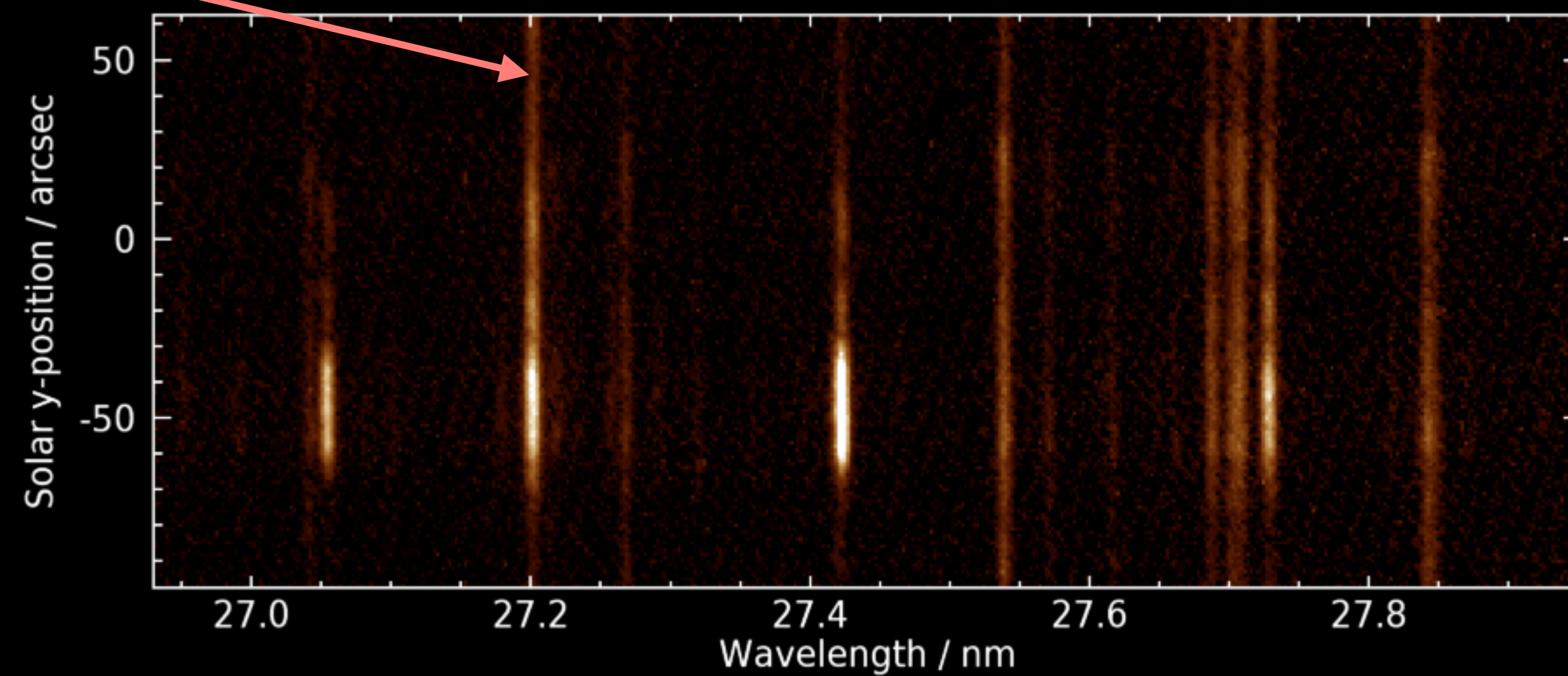
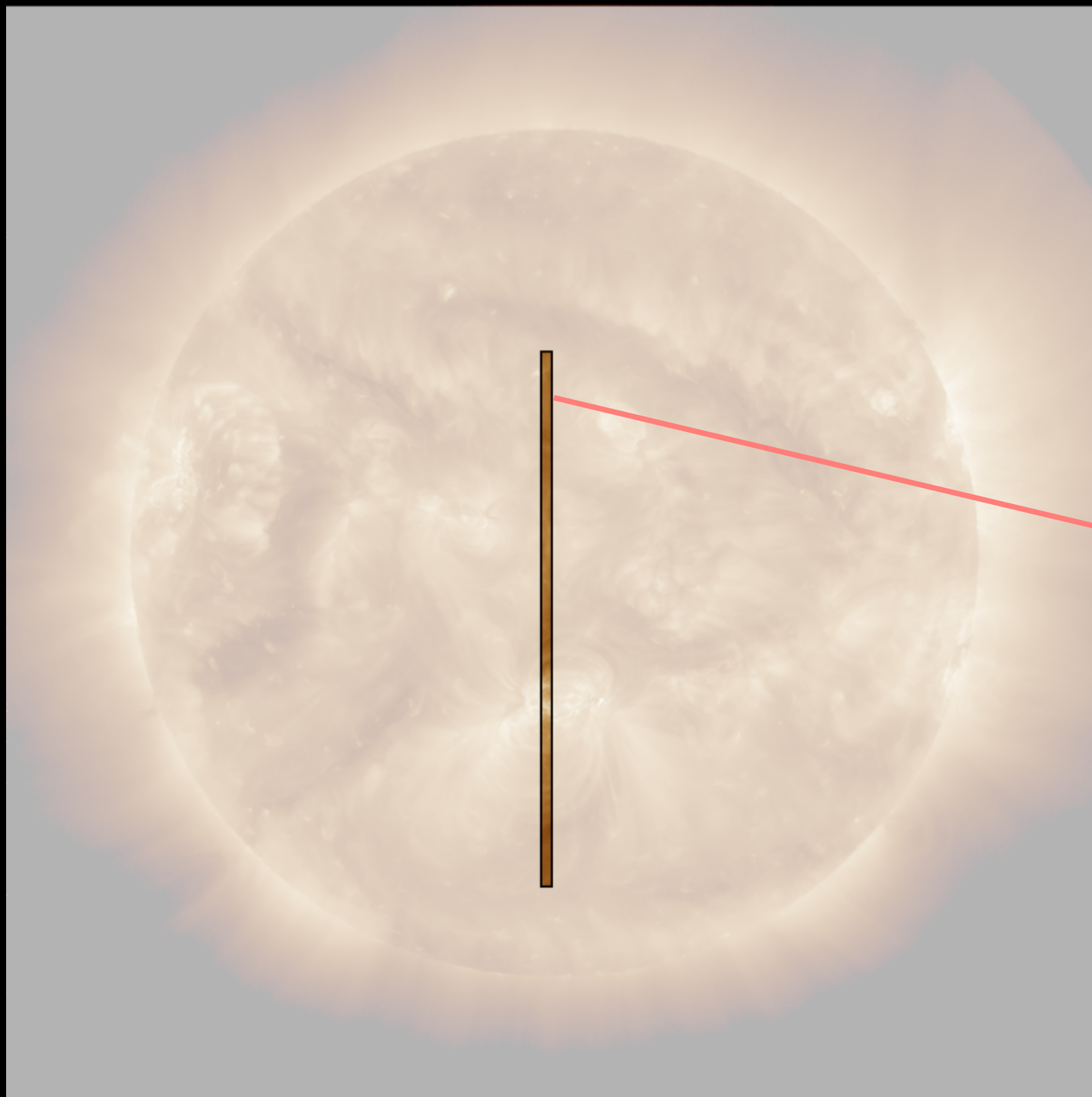
Referred to as spectral "lines"

Spectrometer Design

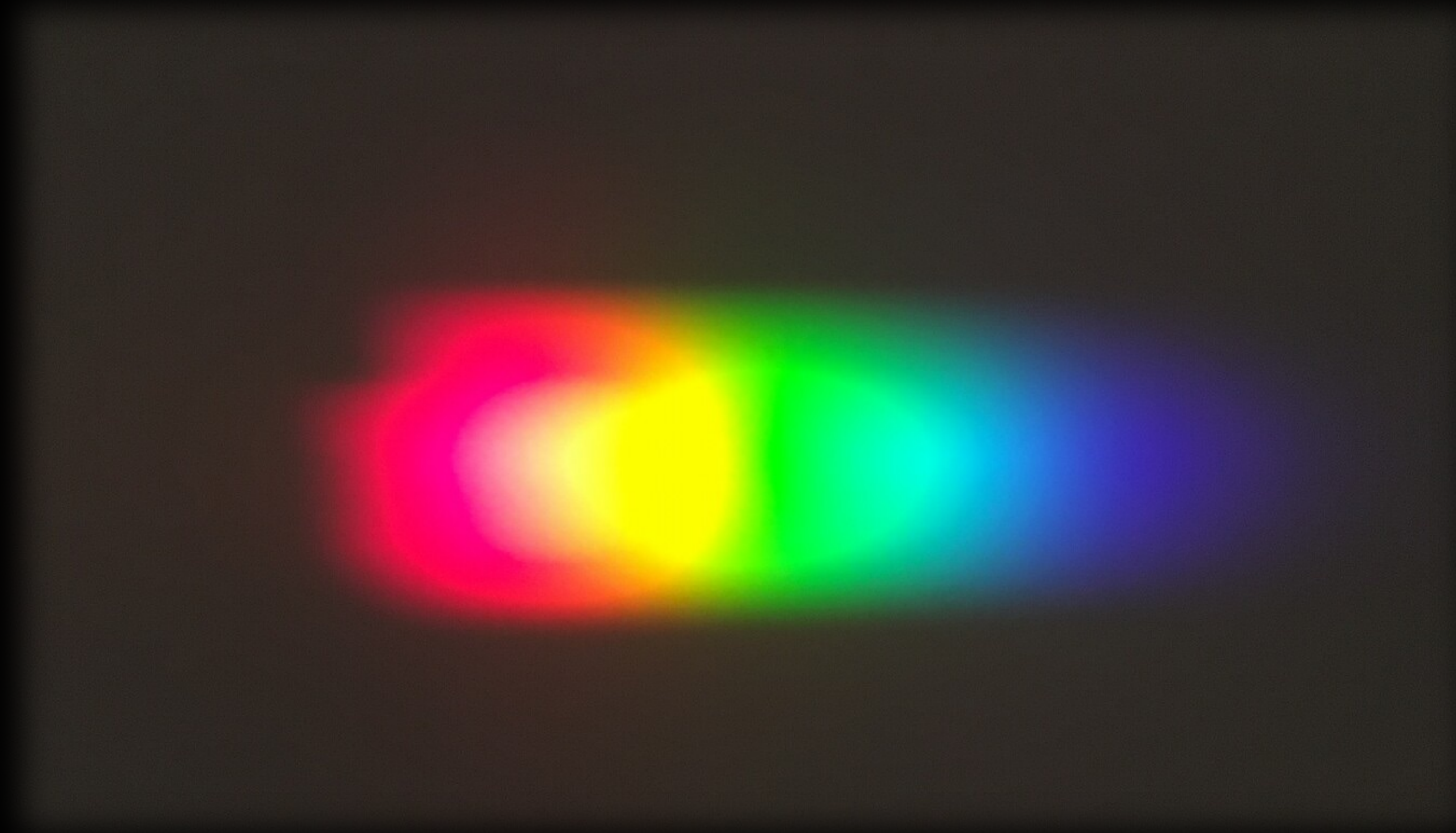


The Spectrometer Slit

To create a spectrum, we need to observe the Sun through a "slit"

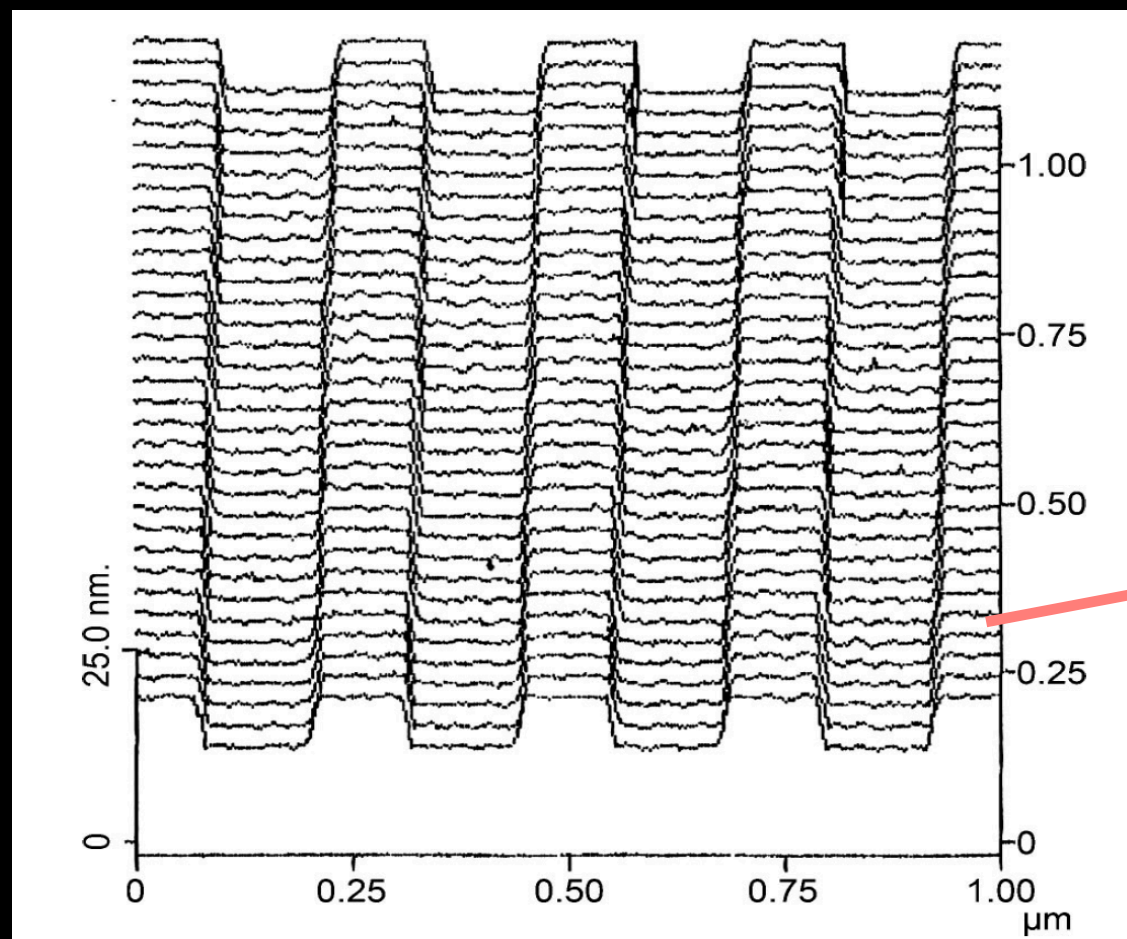
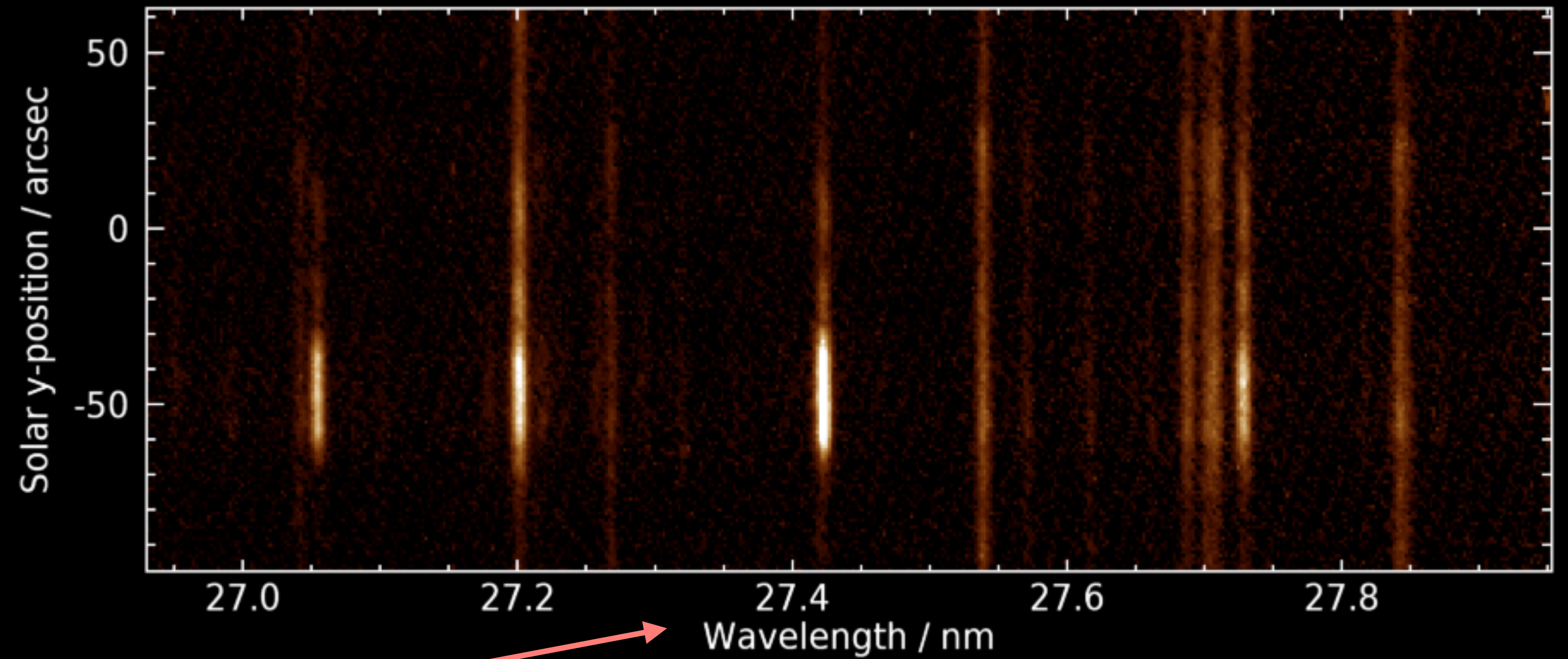


A Prism Spectrum



Prism spectrum of solar light

A Grating Spectrum



Electron microscope scan of grating

Grating gives "dispersion"
of different wavelengths

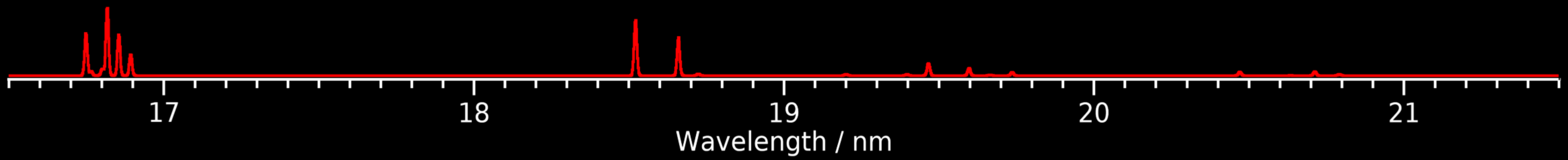


Elements, Ions, Fingerprints

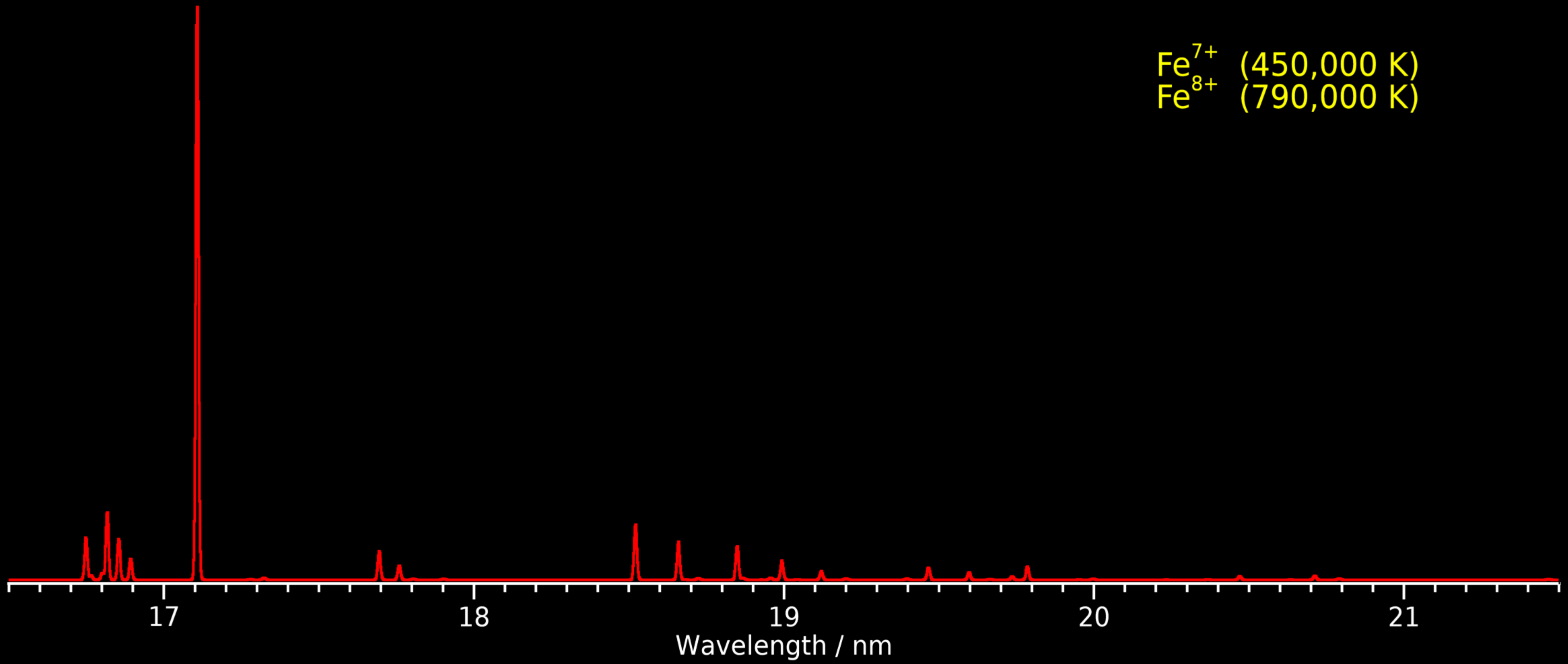
- The EUV contains lines from many **elements** and **ions**.
- Each ion has its own **spectrum fingerprint** through which we recognise it.
- Consider iron (Fe):
 - melting point is 1800 K
 - boiling point is 3100 K
 - first electron is lost at 14,000 K

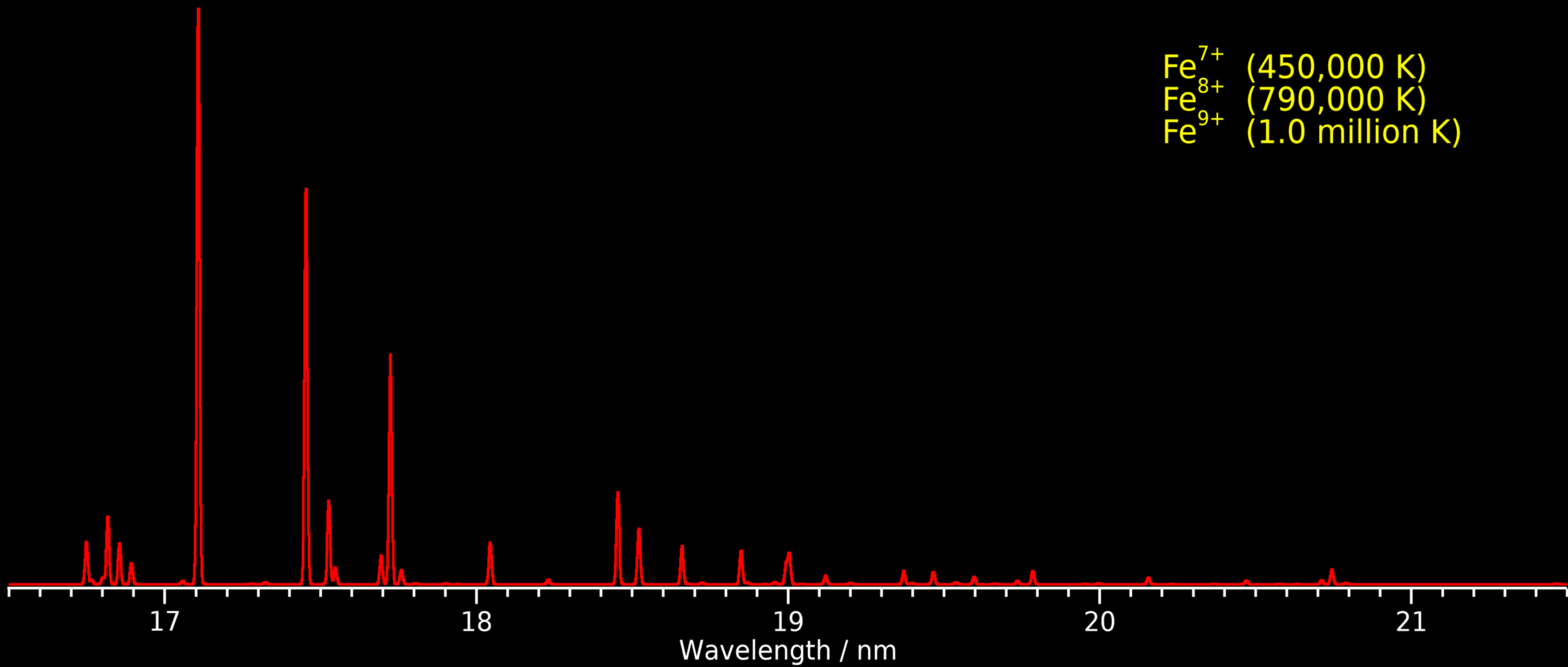


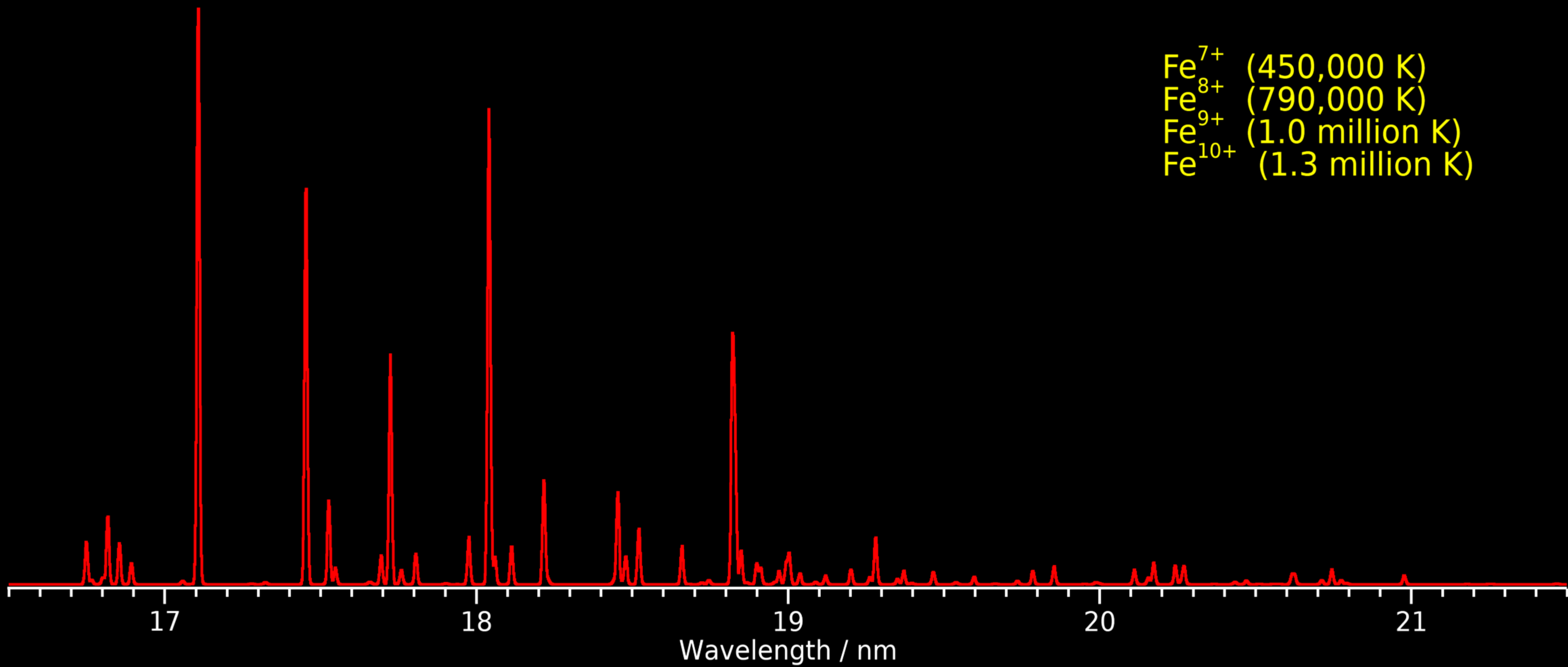
Fe⁷⁺ (450,000 K)

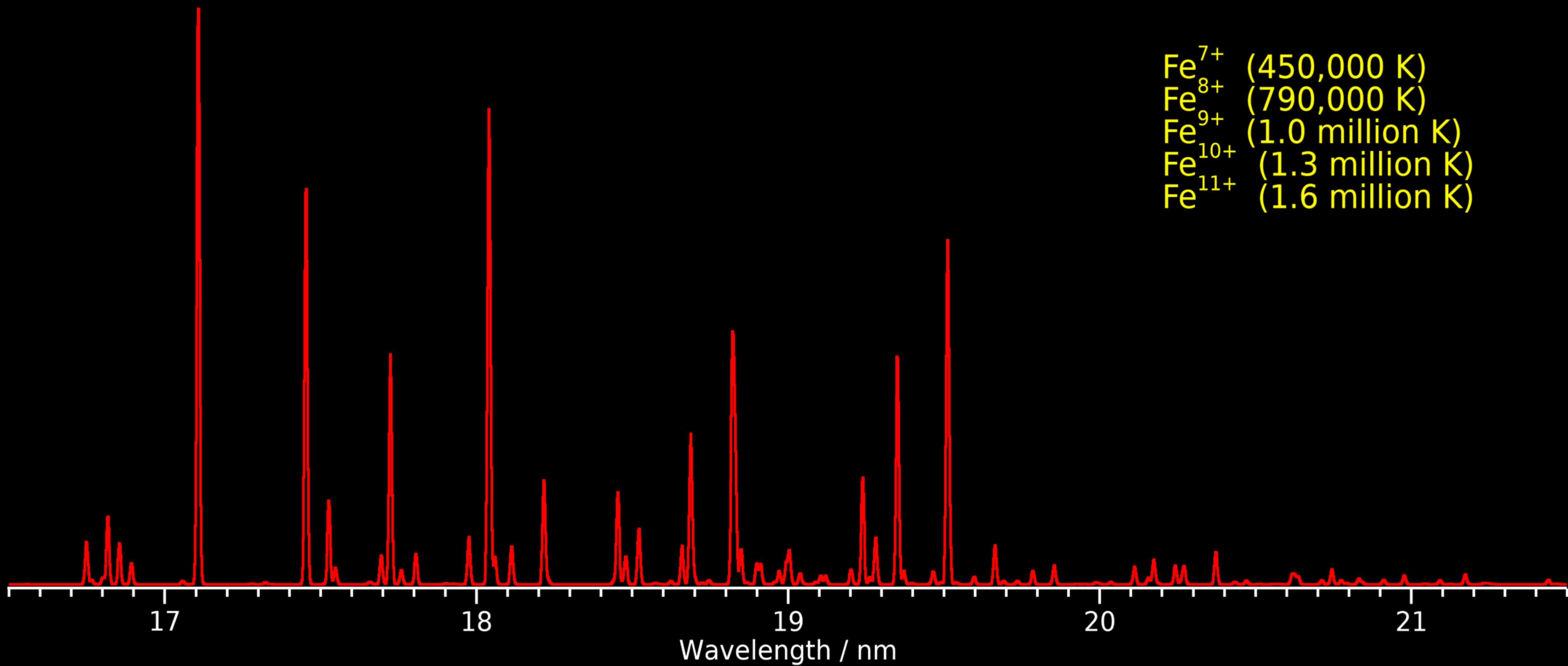


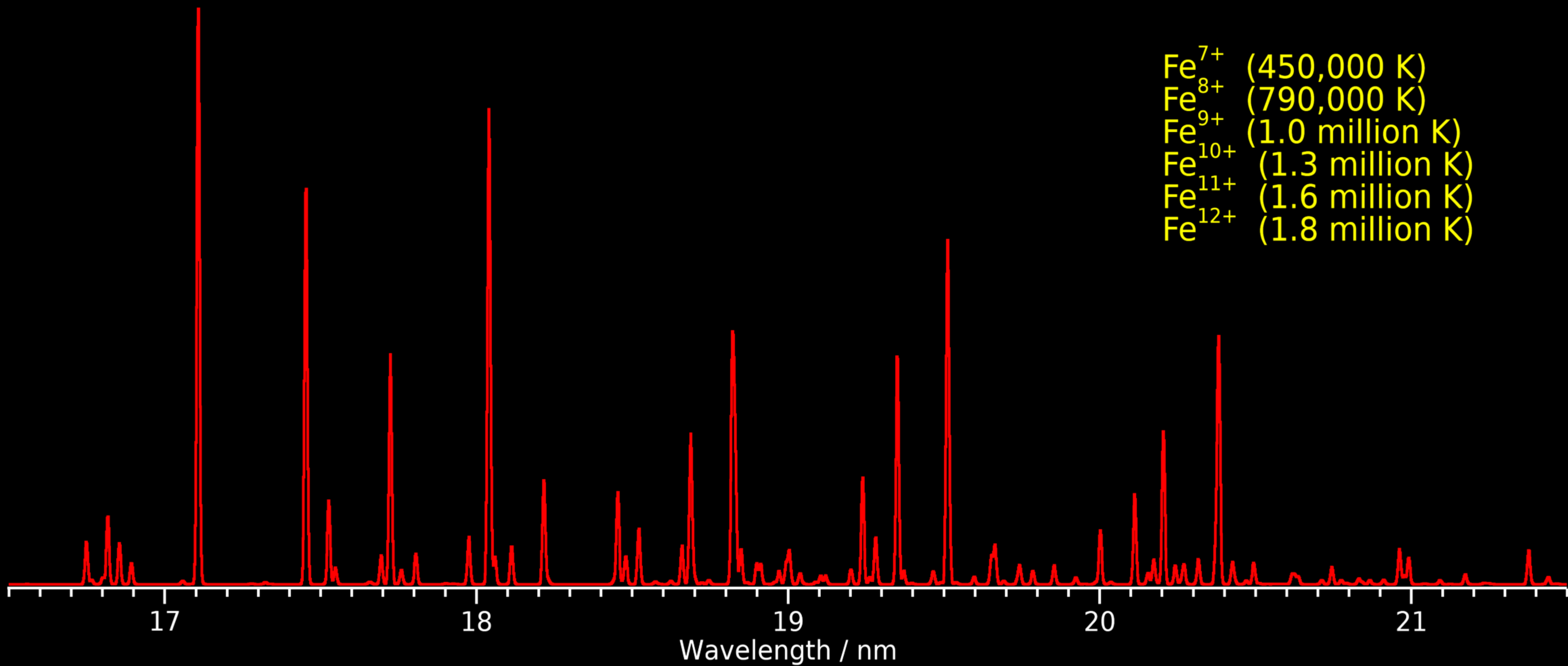
Fe⁷⁺ (450,000 K)
Fe⁸⁺ (790,000 K)

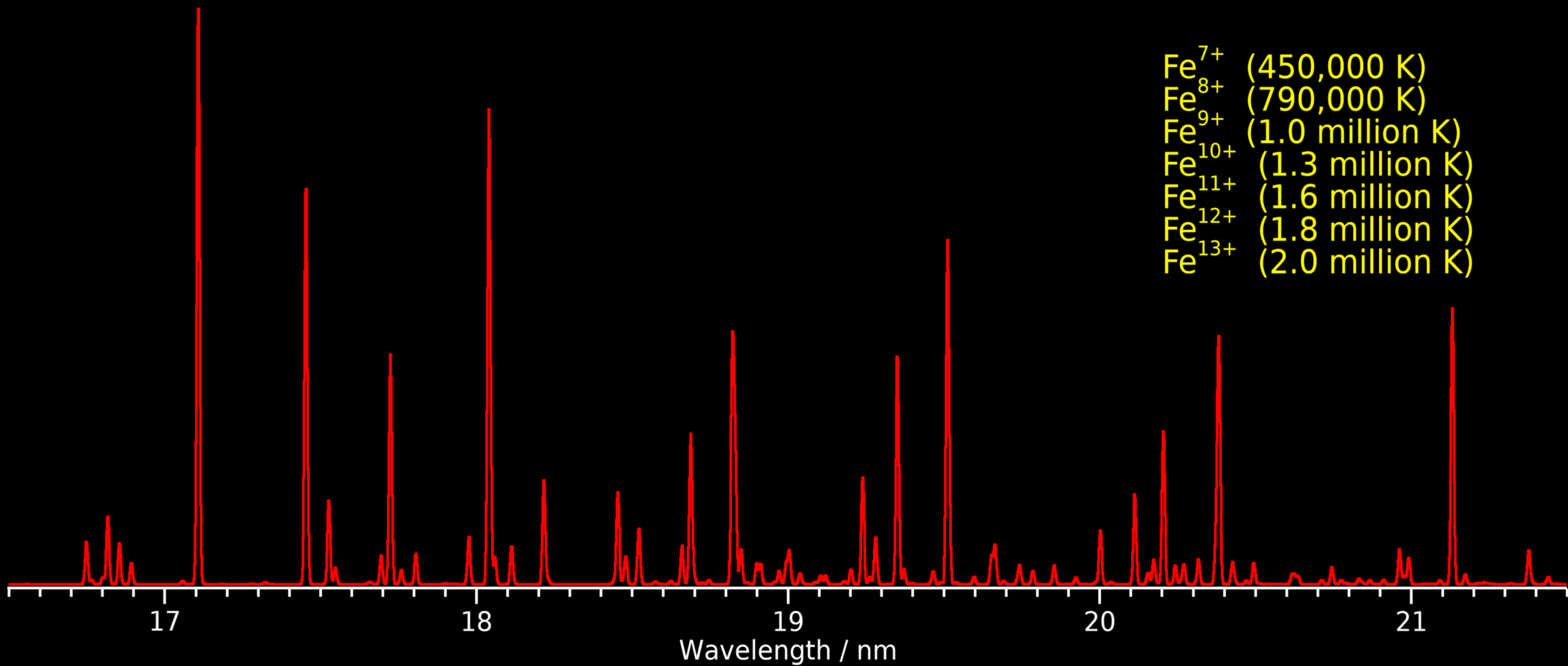


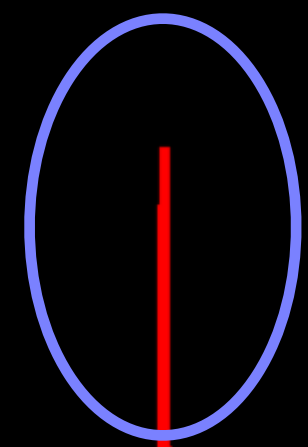




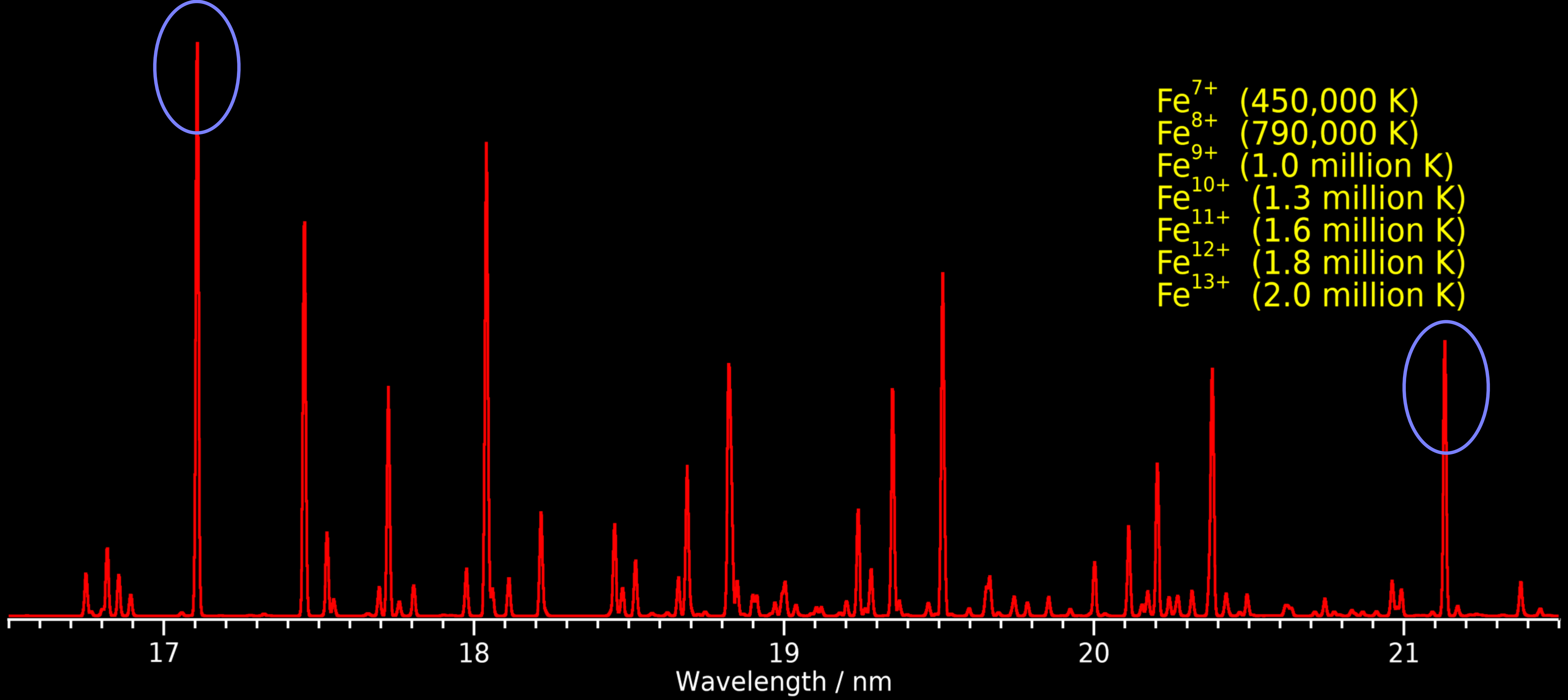
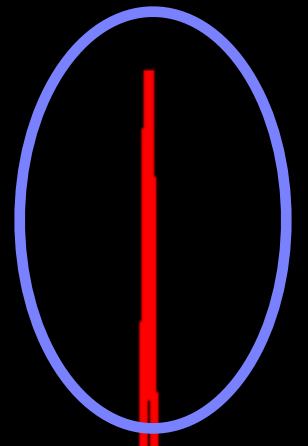




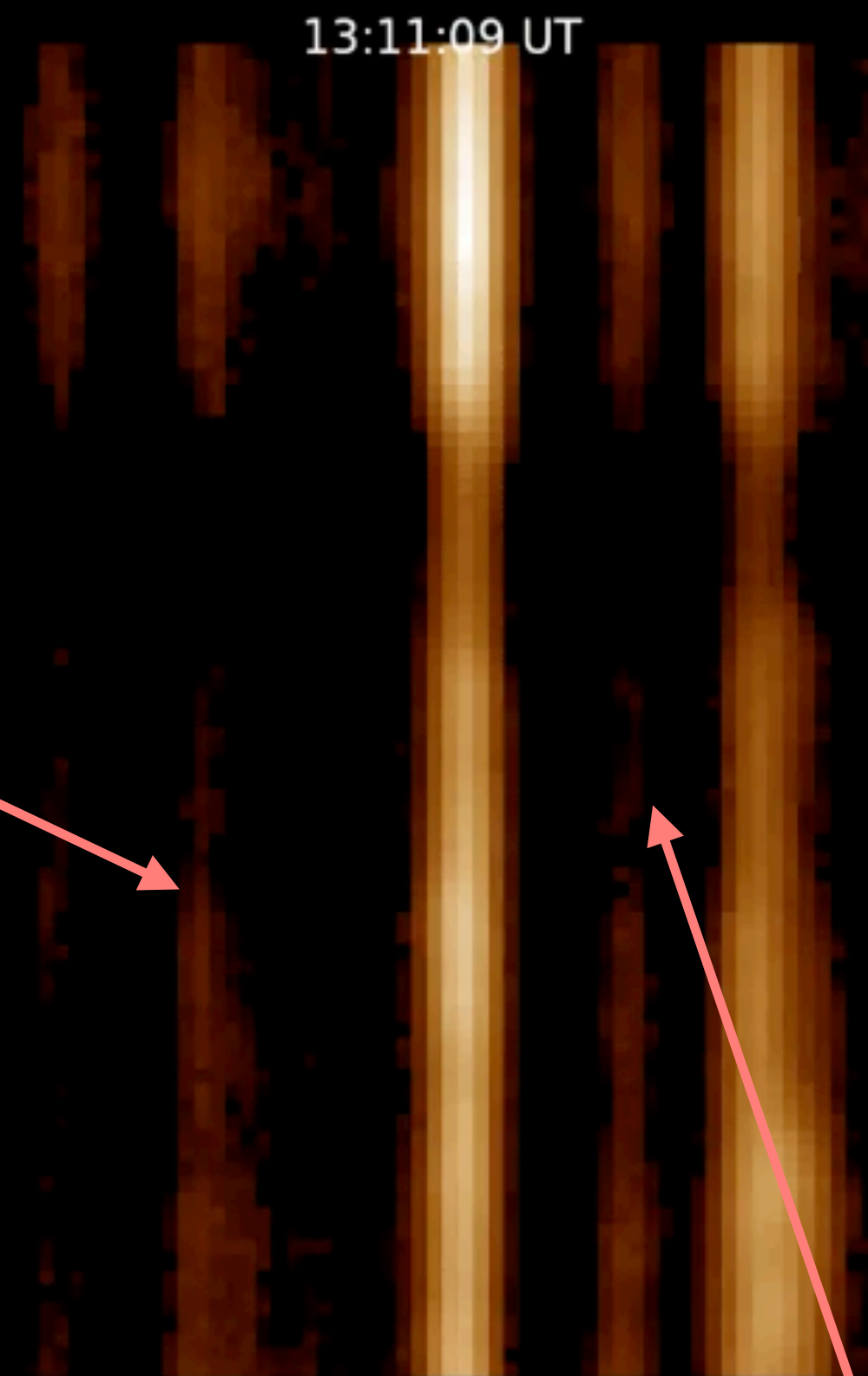




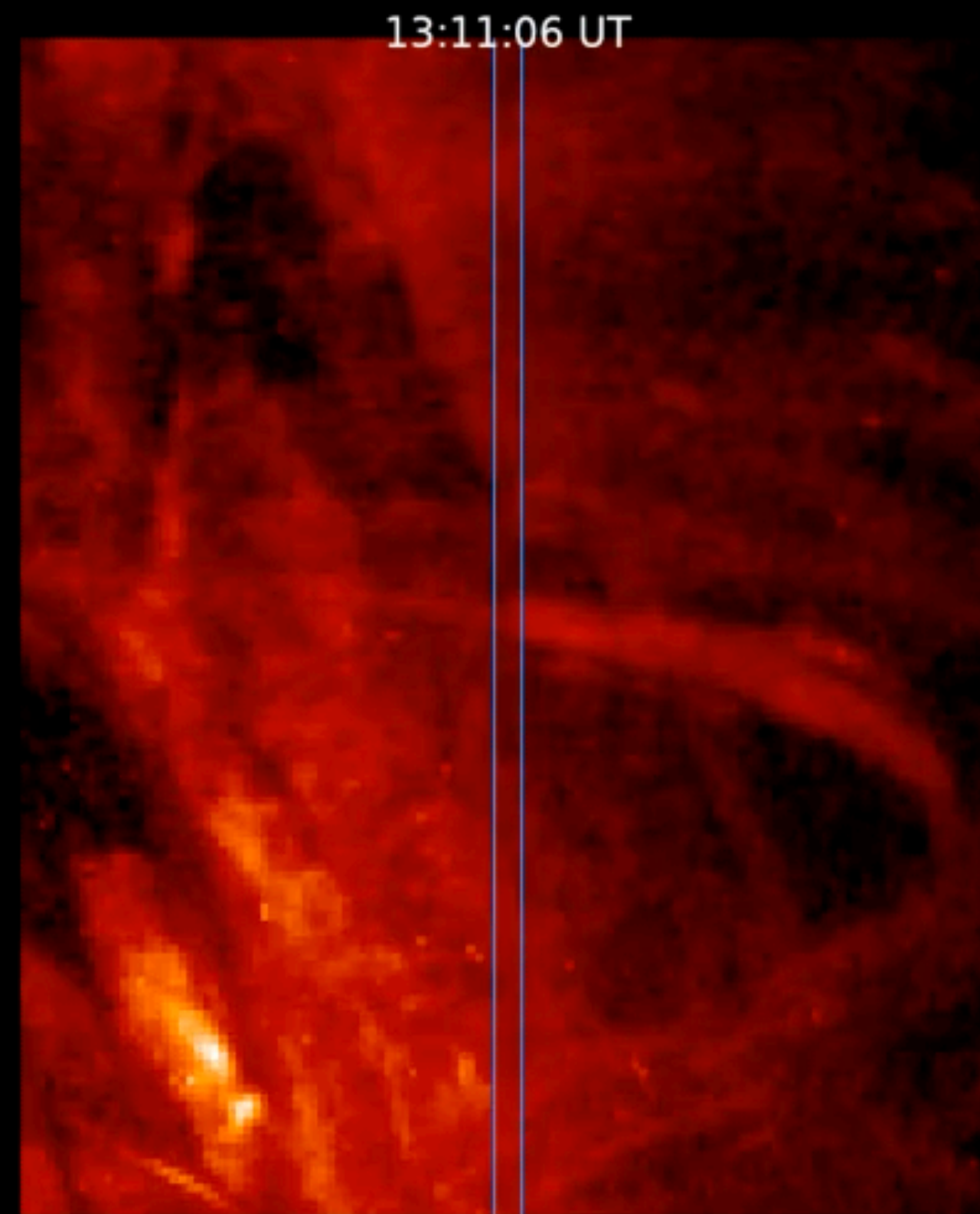
Fe⁷⁺ (450,000 K)
Fe⁸⁺ (790,000 K)
Fe⁹⁺ (1.0 million K)
Fe¹⁰⁺ (1.3 million K)
Fe¹¹⁺ (1.6 million K)
Fe¹²⁺ (1.8 million K)
Fe¹³⁺ (2.0 million K)



2-Apr-2022 Filament Eruption



EUV Spectra
(from Hinode/EIS)



EUV Images
(from SDO/AIA)

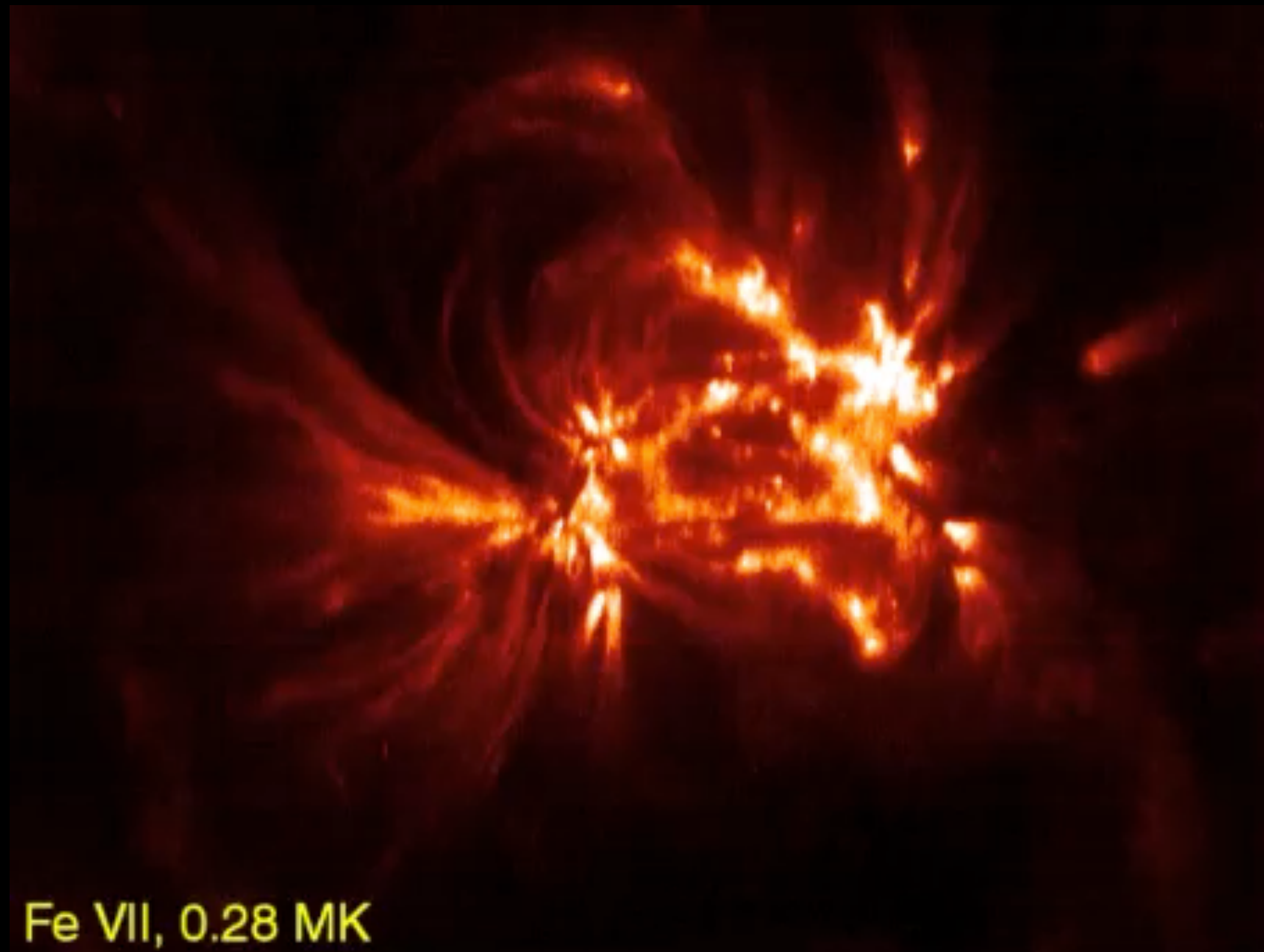
Rare, superhot (20 million K) plasma that “wobbles.”
Sign of structures oscillating after eruption



Filament seen as “blue-shifted” plasma
(i.e., coming towards us)

New Missions: EUVST and MUSE

EUVST	MUSE
One slit	37 slits
Wide temperature regime (whole atmosphere)	Three temperatures
High spatial resolution (300 km)	High spatial resolution (300 km)
Launch: 2027	Launch: 2026
Led by Naval Research Lab (DC)	Led by Lockheed Martin (Palo Alto)



Slices through an active region
(Spectral images from Hinode/EIS)