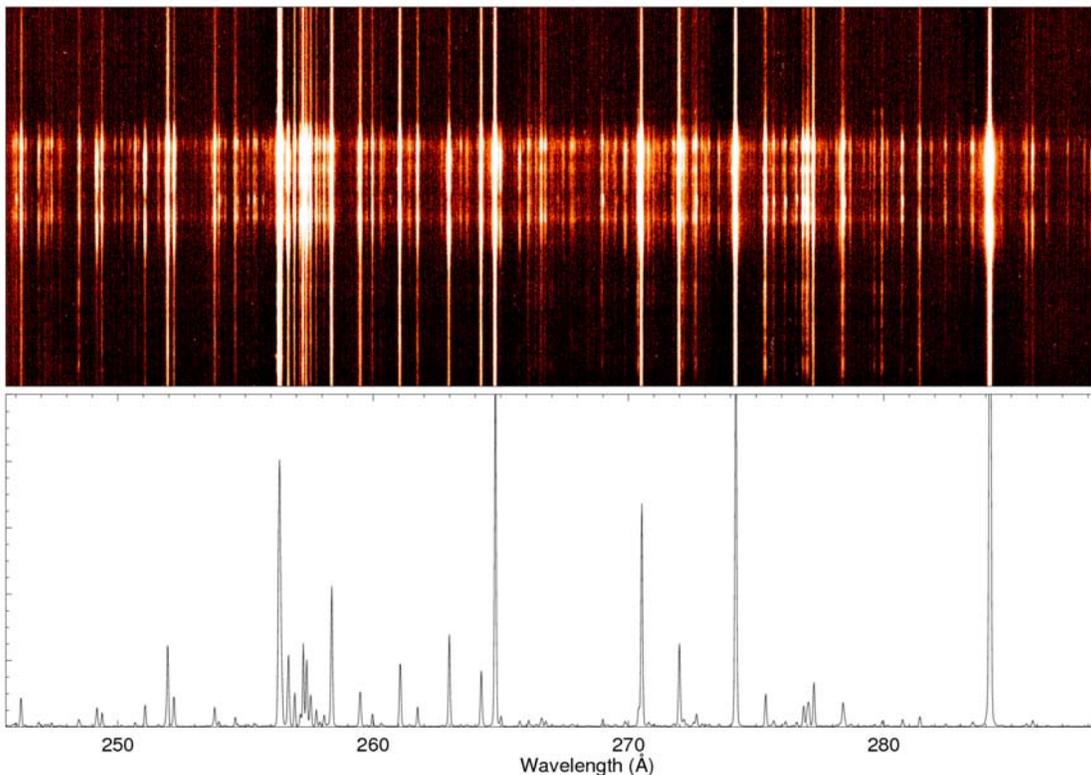


Find the mystery lines...if you can!

2



This is an image (top) from the Hinode satellite's Extreme Ultraviolet Spectrometer (EIS). The figure (below) is a series of atomic spectral lines from known ions. Each line in the bottom graph has an intensity that is indicated by its length along the vertical axis of the figure. The table to the right gives the wavelengths of some spectral lines that fall within the wavelength range of the figure.

Problem 1) What is the scale of the horizontal axis in Angstroms/millimeter?

Problem 2) Using your answer to Problem 1, A) Match up the tabulated lines with the lines shown in the above figure. (*Hint: Use the '250' mark and calculate the number of millimeters to the He II line at 256.32 Å (21.8 mm) and convert to Angstrom units using your answer to Problem 1. Then add this to '250' to get the wavelength of the He II line.*)

Problem 3) Compare the identified lines in the figure, with the solar spectrum from the EIS instrument in the top illustration. Which lines can you match up?

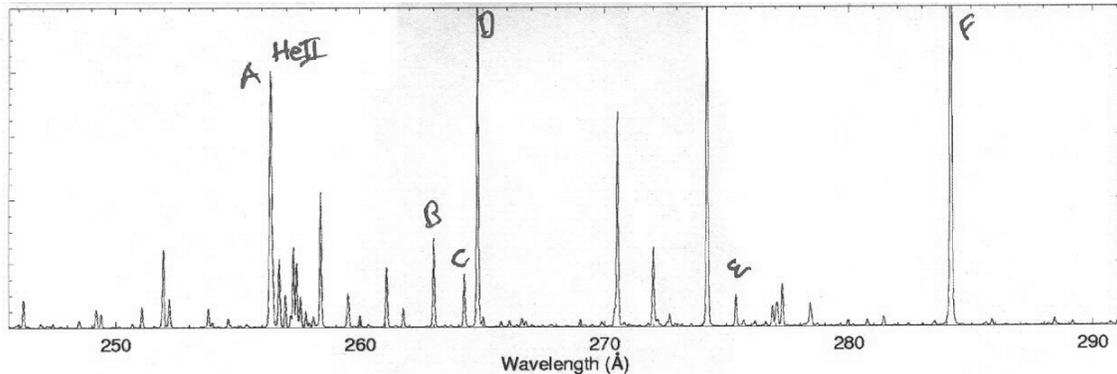
Problem 4) What percentage of lines in the Hinode solar data are not identified?

Inquiry problem: Can you find any resources online that help you identify some of the missing lines?

He II	256.32 Å
Fe XVI	262.98
S X	264.23
Fe XIV	264.79
Si VII	275.35
Fe XV	284.16

Note: Wavelengths in Angstrom (Å) units.
 $1 \text{ Å} = 10^{-8} \text{ cm}.$

Answer Key:



Problem 1) What is the scale of the horizontal axis in Angstroms/millimeter?

Answer: $(290 - 250) \text{ \AA} / 138 \text{ millimeters} = 0.29 \text{ Angstroms / millimeter.}$

Problem 2) Using your answer to Problem 1, A) Match up the tabulated lines with the lines shown in the above figure.

A	He II	$(256.32 - 250) / 0.29 = 21.8 \text{ mm}$
B	Fe XII	$(262.98 - 250) / 0.29 = 44.8 \text{ mm}$
C	S X	$(264.23 - 250) / 0.29 = 49.0 \text{ mm}$
D	Fe XIV	$(264.79 - 250) / 0.29 = 51.0 \text{ mm}$
E	Si VII	$(275.35 - 250) / 0.29 = 87.4 \text{ mm}$
F	Fe XV	$(284.16 - 250) / 0.29 = 117.8 \text{ mm}$

Problem 3) Compare the identified lines in the figure, with the solar spectrum from the EIS instrument in the top illustration. Which lines can you match up?

Answer: All of the known lines in the table can be matched up as shown in the above diagram.

Problem 4) What percentage of lines in the Hinode solar data are not identified?

Answer: There are about 127 lines in the top Hinode spectrum, but only 6 lines are known from the table, so $(121/127) \times 100 = 95\%$ of the lines in the Hinode spectrum are unknown.

Inquiry problem: Can you find any resources online that help you identify some of the missing lines?