Wien's Law, Blackbodies & Spectra

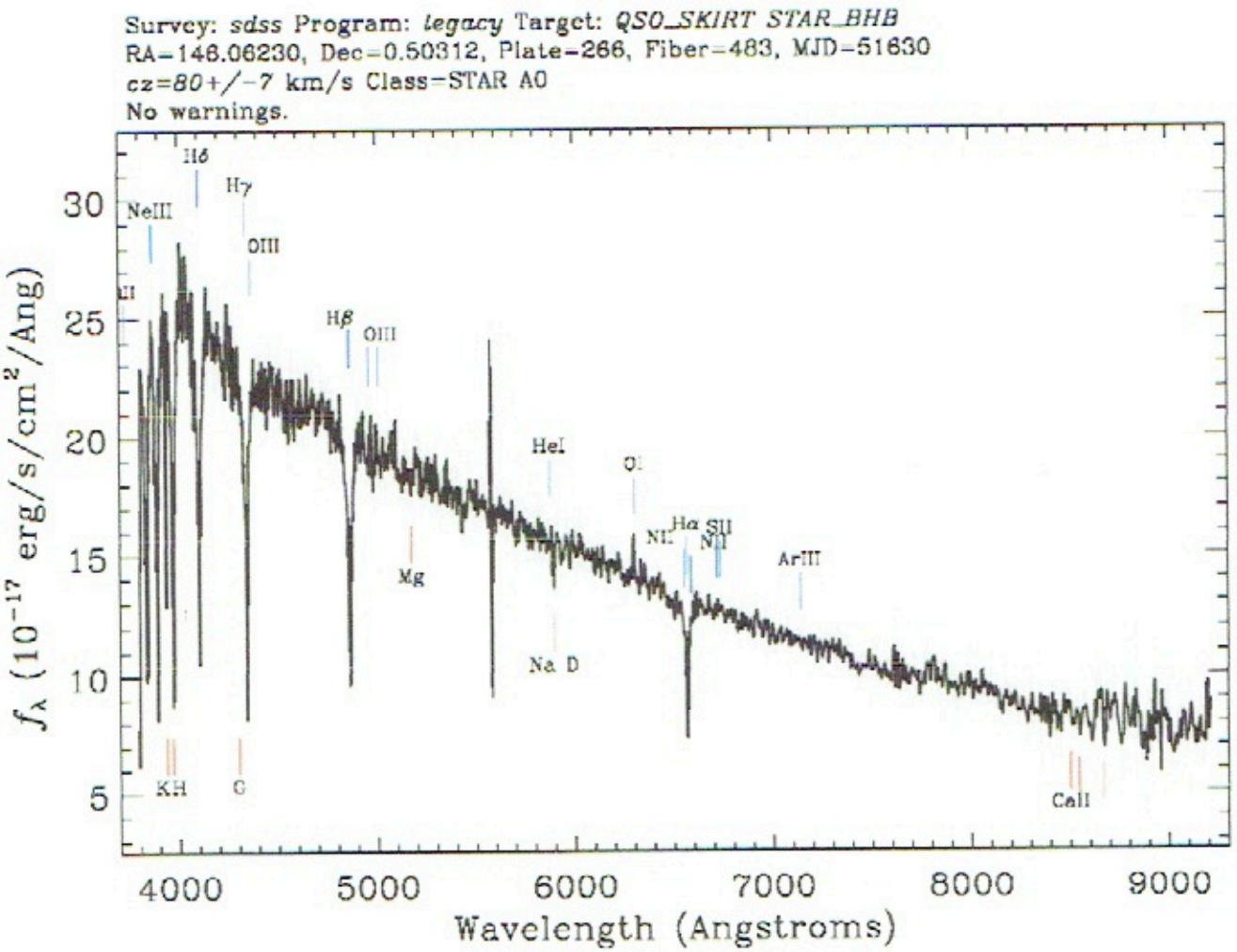
* Required

What is your name? *

Ms Barge Key

Which period are you in? *

Question 1 Image



1. Look at the spectra in Image 1 above to see the spectra of star #1. Use its peak wavelength to determine its temperature. *

peak wavelength ≈ 4100 Angstroms

$4100\ \text{Å}\left(\frac{1\ \text{nm}}{10\ \text{Å}}\right) = 410\ \text{nm}$

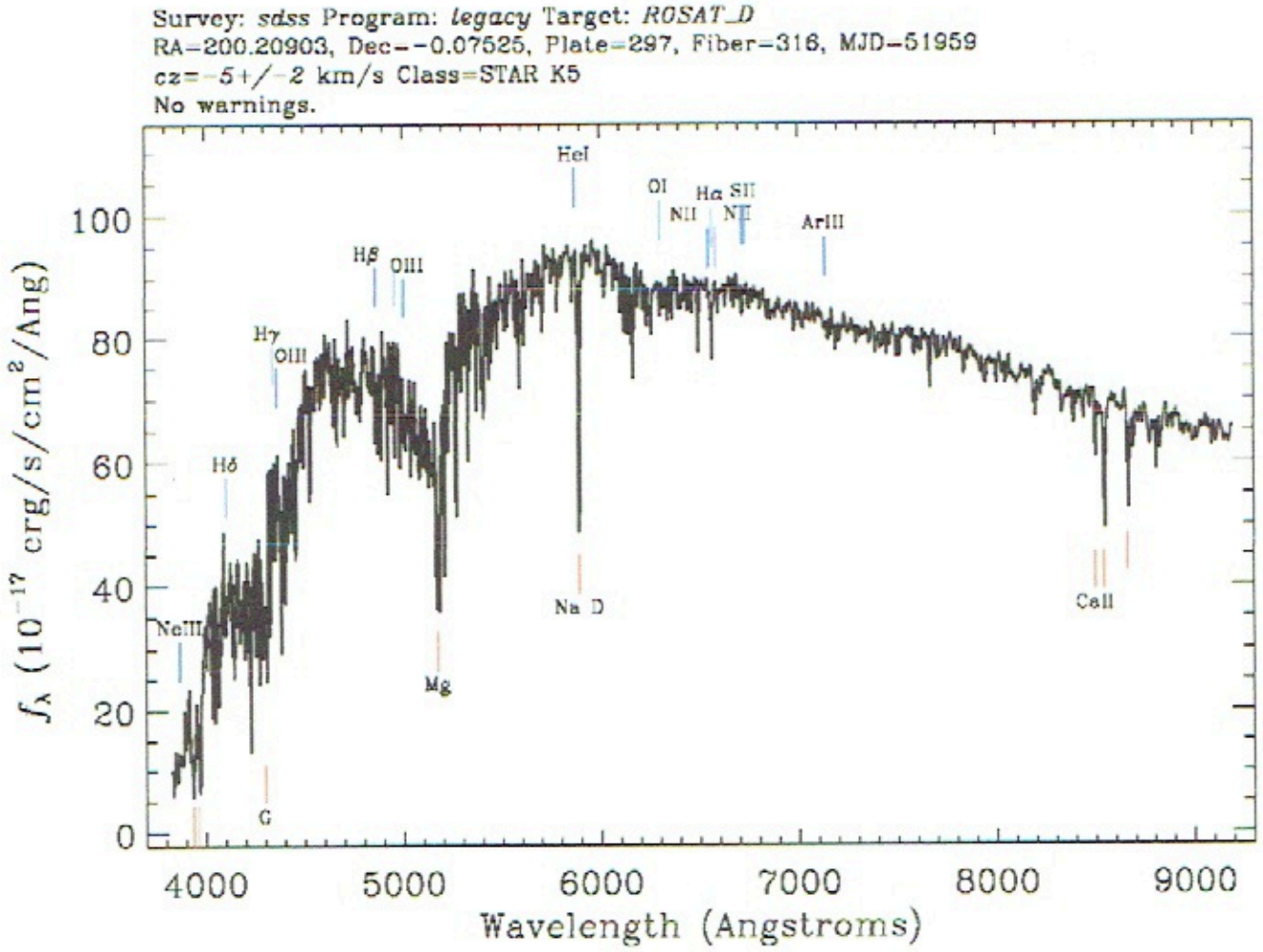
$\lambda = \frac{2.9\times10^{6}\ \text{nm k}}{T}$

$410\ \text{nm} = \frac{2.9\times10^{6}\ \text{nm k}}{T}$

$T = \frac{2.9\times10^{6}\ \text{nm k}}{410\ \text{nm}}$

$T = 7073\ \text{K}$

Question 2 Image



2. Use Image #2 above to determine the temperature of star 2. *

peak wavelength ≈ 5800 Angstrom

5800 Å $\left(\frac{1\ nm}{10\ Å}\right)$ = 580 nm

$T = \frac{2.9 \times 10^6\ nm\cdot k}{580\ nm}$

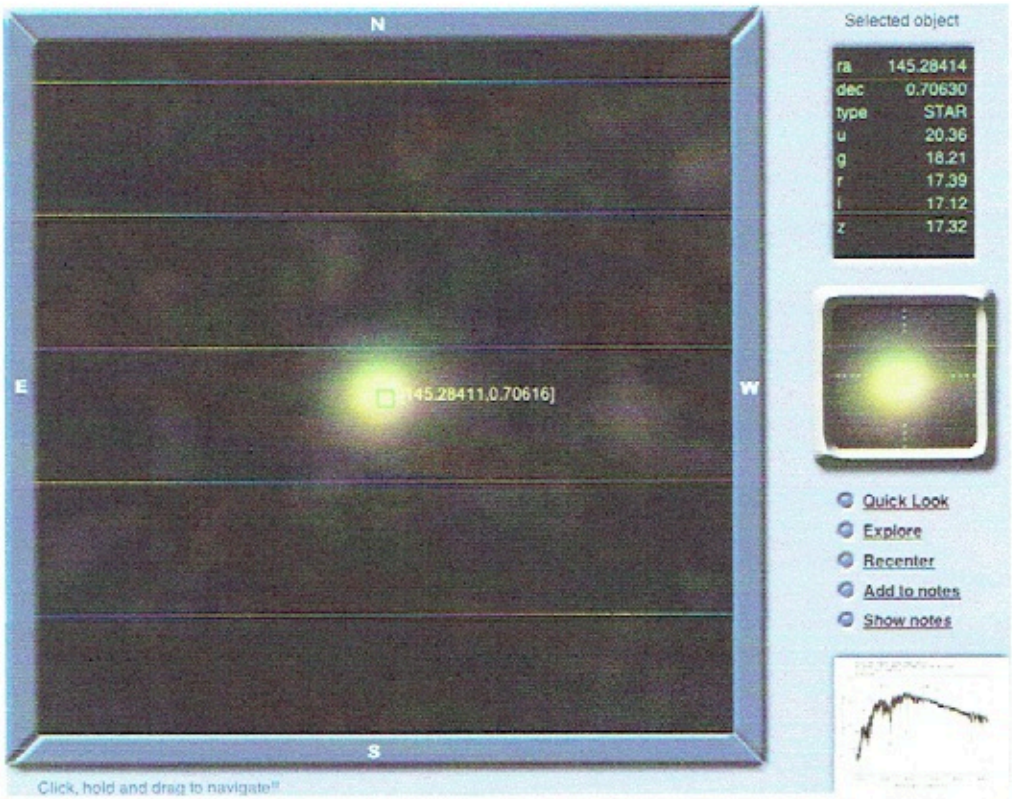
$T = 5000\ k$

3. Look at star #3's image below. This star is a spectral class K star. What can you say about its relative temperature based on its spectral class? *

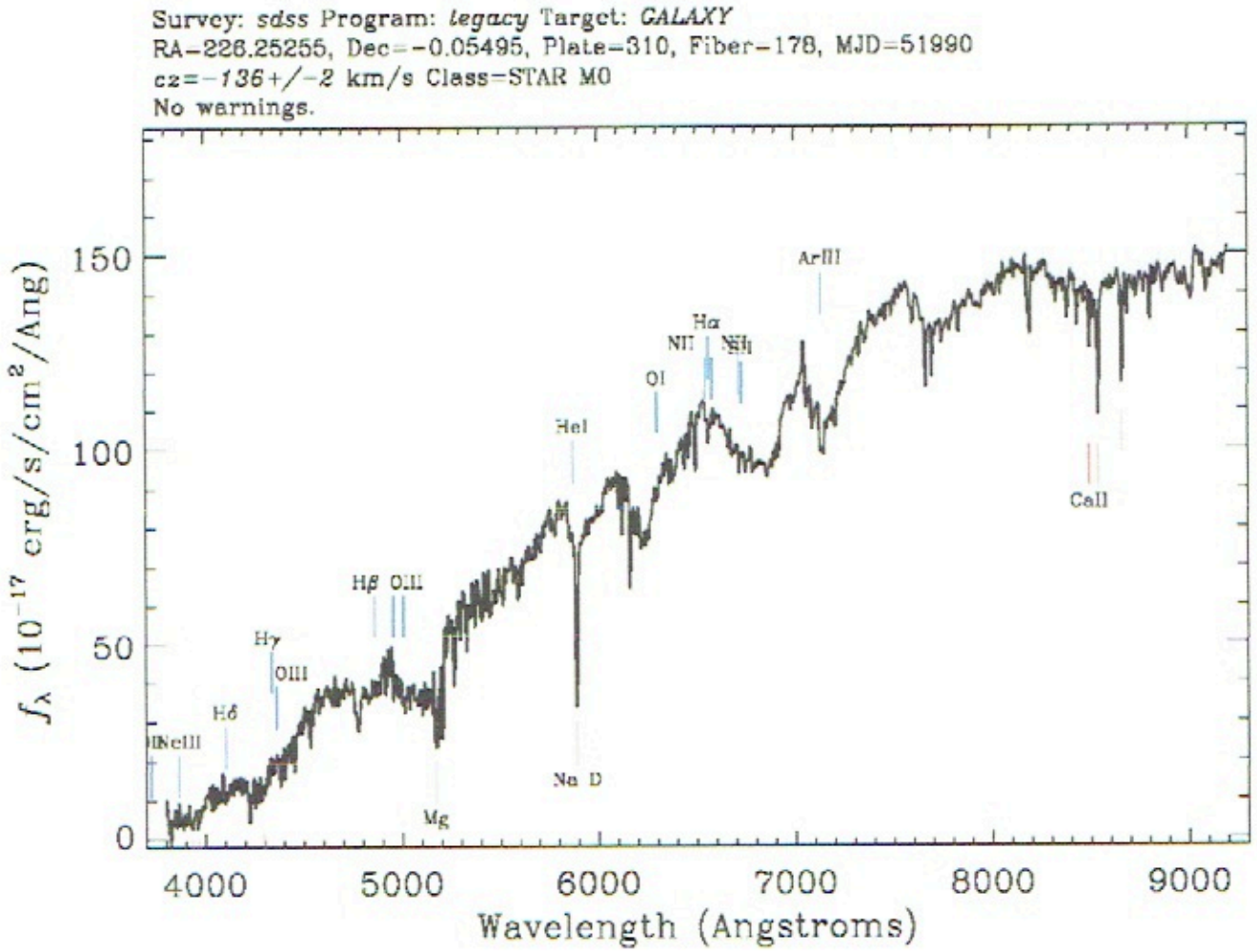
~~O B A~~ F G ~~K M~~

yellow star - middle temperature so probably F or G spectral class

Star 3



Question 4 Image



4. Use Image for question #4 above to determine star 4's temperature. *

peak wavelength $\approx$ 8000 Ang

8000 Ang $\left(\frac{1\text{ nm}}{10\text{ Ang}}\right)$ = 800 nm

$T = \frac{2.9 \times 10^6 \text{ nm K}}{800 \text{ nm}}$

$T = 3625$ K

Spectral Lines and Spectral Class (also know as Spectral Type) - Use this chart for questions 5 - 7.

Spectral Type	Temperature (Kelvin)	Spectral Lines
O	28,000 - 50,000	Ionized helium
B	10,000 - 28,000	Helium, some hydrogen
A	7500 - 10,000	Strong hydrogen, some ionized metals
F	6000 - 7500	Hydrogen, ionized calcium (labeled H and K on spectra) and iron
G	5000 - 6000	Neutral and ionized metals, especially calcium; strong G band
K	3500 - 5000	Neutral metals, sodium
M	2500 - 3500	Strong titanium oxide, very strong sodium

5. Use the spectral line chart above and Star #5's spectra image below to determine what spectral class this star is. Explain your reasoning. *

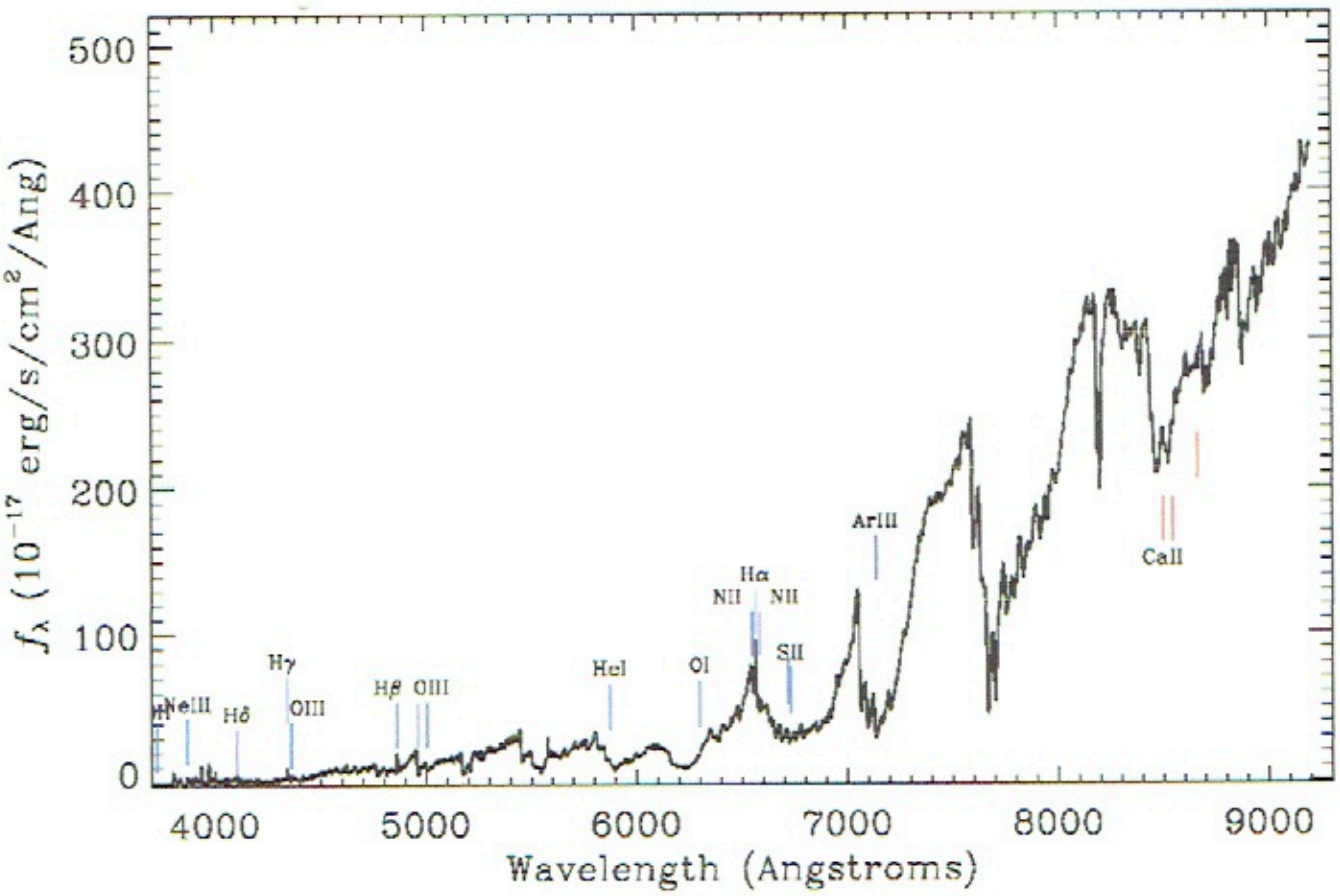
No Hydrogen or ionized Calcium absorption lines so not O, B, A, F

Strong (large) Calcium absorption line so either G or K

No Sodium line so probably not M

So spectral class for star 5 is G or K

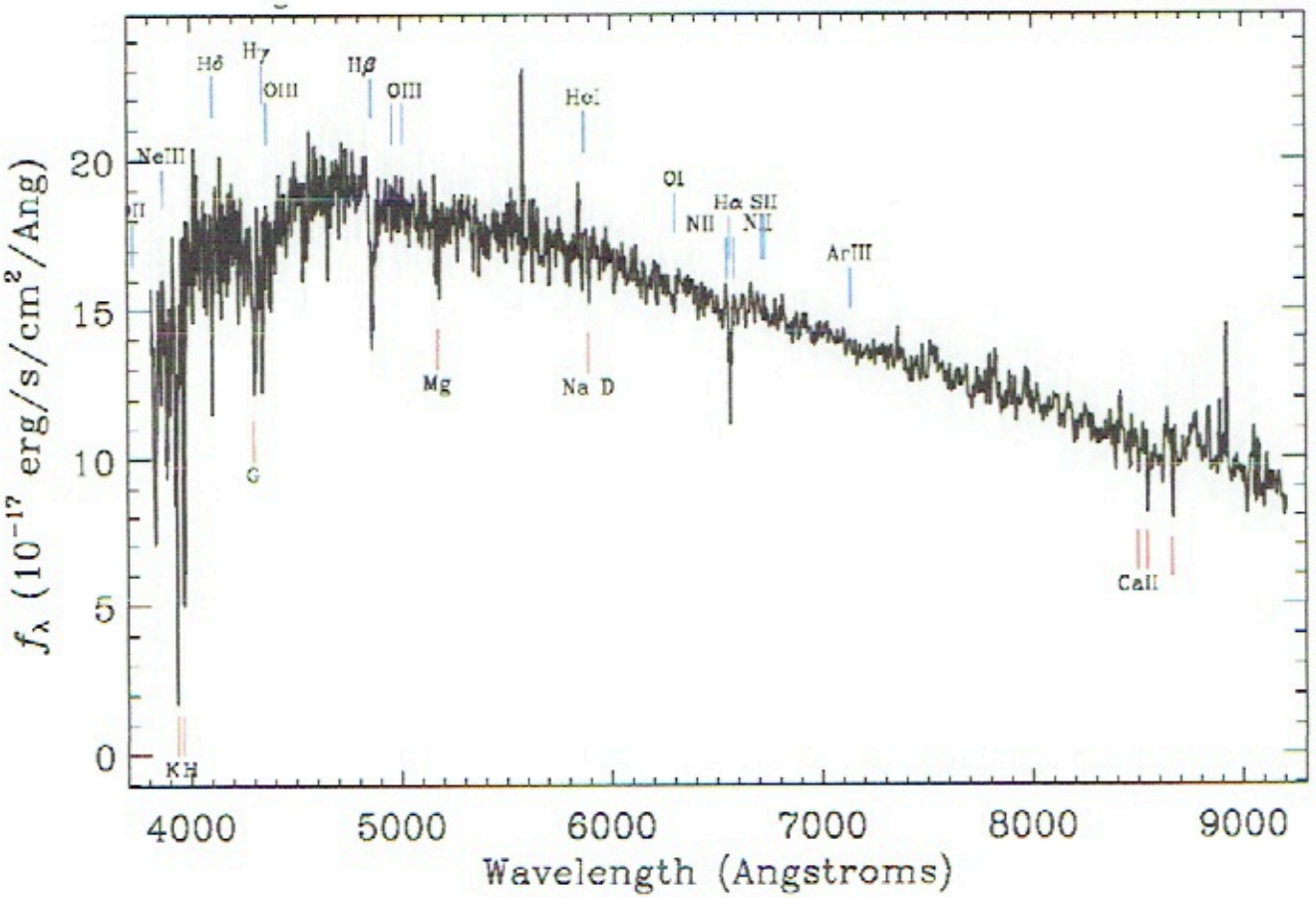
Spectra for Star 5



6. Use the spectral chart above and spectra from Star 6 below to determine what temperature range Star 6 may have. Explain your reasoning for the temperature range you choose. *

peak wavelength ≈ 4700 Ang which give a T of 6170 K.
There is a strong G absorption line and ionized calcium (K H lines by 4000). This matches a spectral class G, F which fits the 6170 temperature.

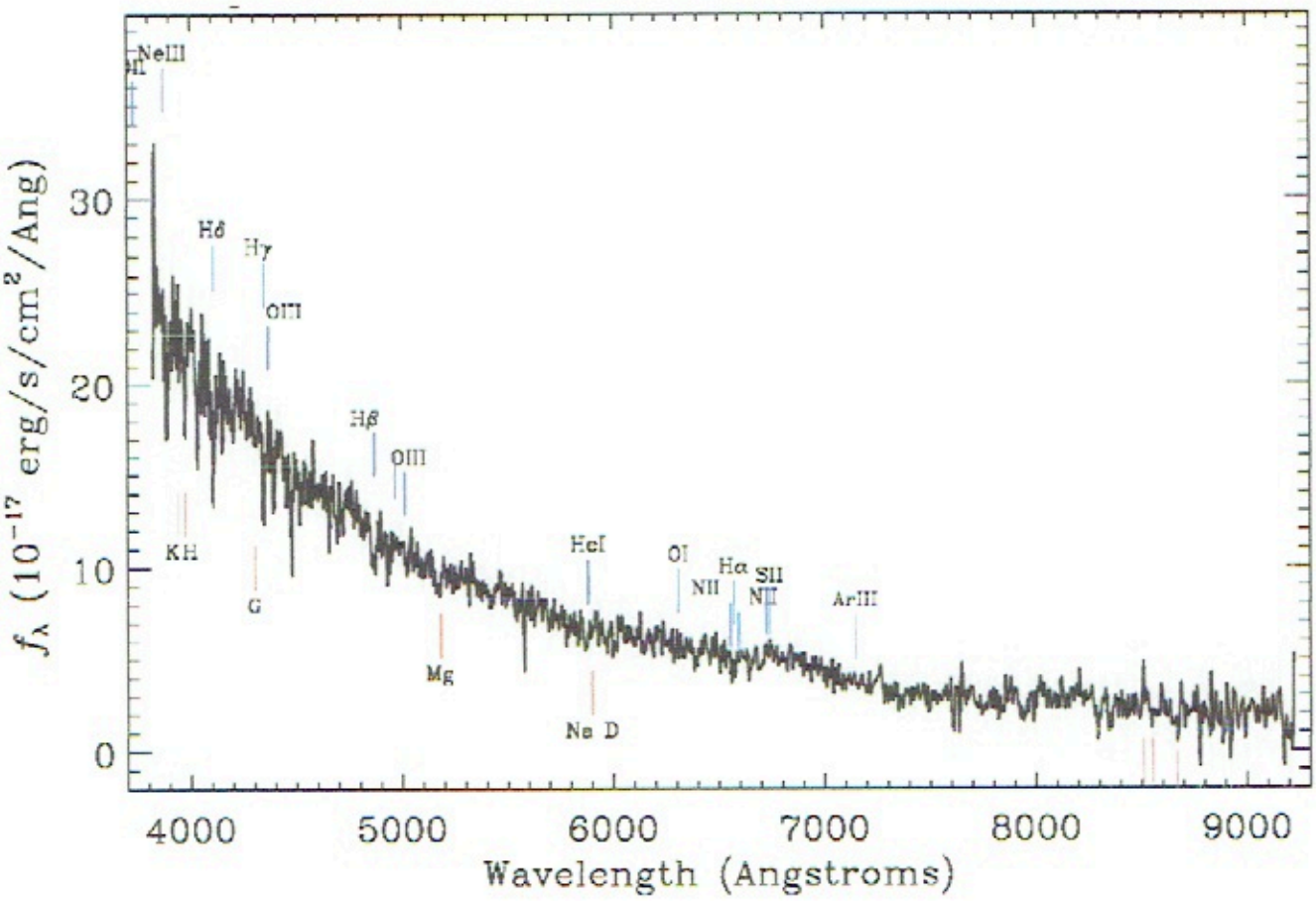
Star 6 Spectra



7. Use the spectral chart above and the image of Star 7's spectra below to determine Star 7's spectral class. Explain your reasoning. *

A lot of ionized elements
Hα Hβ Hγ absorption lines
HeI line
None of the lines are very strong.
peak wavelength ≈ 4000 Angstrom - All of this points to a spectral class of F or A.

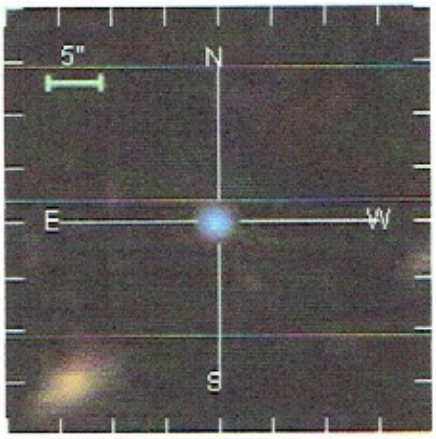
Spectra for Star 7



8. Identify which star is in the image below: Star 5, Star 6 or Star 7. Explain your reasoning of why you think it is the star you chose. *

The picture shows a blue star. That indicates a hot star so the image is star 7.

Image of Star for question 8.



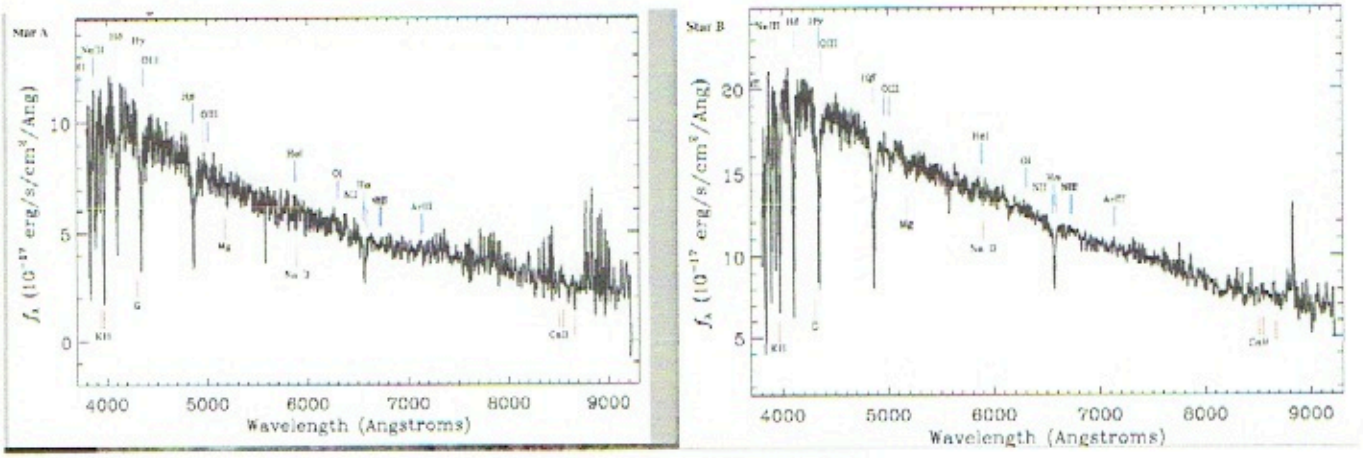
9. Look again at spectra for Stars 5, 6 and 7. a. Which star is the hottest? b. Which star is the coolest? c. Which star is the brightest? *

a. hottest - Star 7 (peak wavelength is shortest λ)
b. coolest - Star 5 (peak wavelength is longest λ)
c. brightest - Star 5 (y axis has the largest range)
Star 5 is about 10-15 times brighter than the other two.

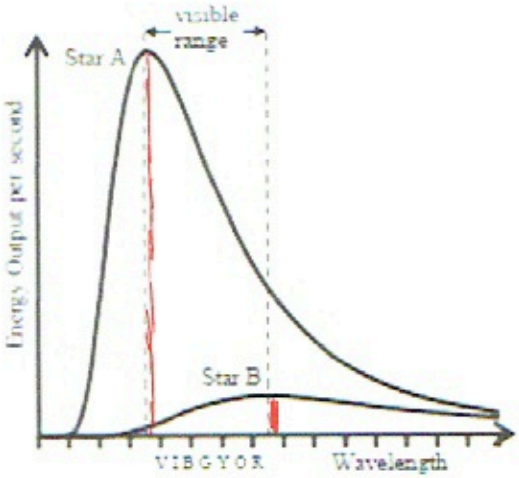
10. Look at the image below of two blackbody curves from two different stars. Both stars are a class A spectral type. Which star is larger? Remember the x-axis is wavelength and the y-axis is flux or energy (you can also think of it as brightness) given off by the star. Explain your reasoning for your answer. *

If both stars have same spectral type then their temperature is basically the same. Their luminosities are almost the same (10 & 20) but star B is brighter so it has to be ~~a~~ bigger.

Image for question 10.



Use the image of blackbody curves below for questions 11 and 12.



11. Which of the two stars (A or B) emits light with the shorter peak wavelength? *

Mark only one oval.

(Yes) Star A – the peak is just past violet (short wavelength)

(X) Star B – the peak wavelength is in the infrared, so a long wavelength

(X) Both stars peak emissions are at the same wavelength. NOT True

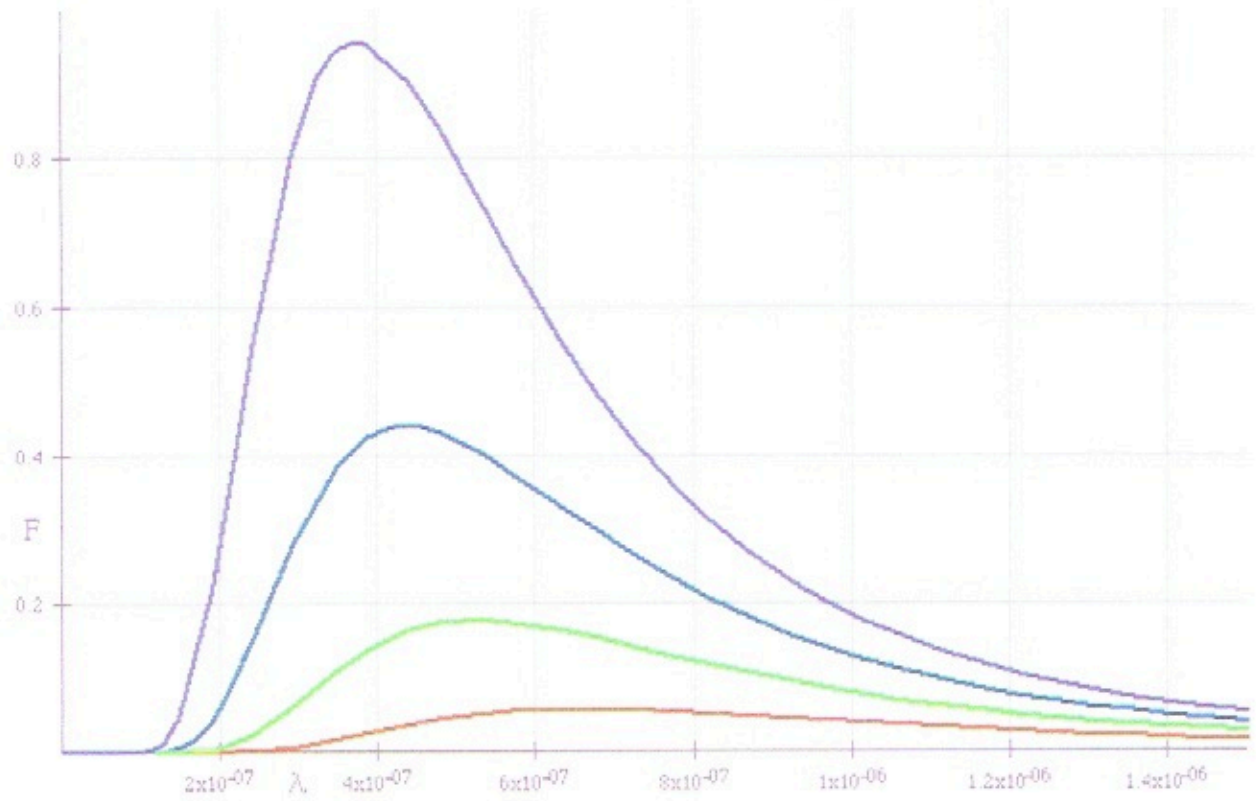
(Y) None of the above are possible. Not true

12. Determine which of the following best describes how Star B would appear as compared with Star A. *

Mark only one oval.

- Star B would appear more blue than Star A. - NO
- Both stars would appear more blue than red. NO - they have different peak wavelength
- Star B would appear more red than Star A. - Yes - its a cooler star
- Both stars would appear more red than blue. - NO - they have different peak wavelength
- None of the above.

Image for question 13



13. The image above shows the blackbody curves for four stars. List the stars in order from the coolest to the hottest. Explain your reasoning. Use the color of the line as the identifier for the star. *

coolest - Red star
Green Star
Blue Star
hottest - Purple Star

14. Using the image above of the four blackbody curves, list them in order of dimmest to brightest. Use the color of the line as the identifier for the star. *

dimmest - red star
green star
Blue star
brightest - Purple star

Question 15 Link

http://skyserver.sdss3.org/public/en/tools/explore/summary.aspx?id=0x112d172f406a0056&spec=0x29ac69d02e019c00&apid=

Use link #15 above and view the SDSS Explore page for SDSS Star 1237670964308344918. Look over the information on that page and the spectral curve and answer the question below. *

1. What is this star's peak wavelength? 2. What is this star's temperature? 3. What is this star's spectral type? 4. Name one element found in this star. 5. Through which filter (ultraviolet/blue, green, red, infrared, far infrared) is this star the brightest?

1. ~ 4700 Angstrom - 470 nm
2. $T = \frac{2.9 \times 10^6 \text{ nm K}}{470 \text{ nm}} = 6170 \text{ K}$
3. Spectral class F
4. Absorption lines for Mg Na Hydrogen (Hα, Hβ) Calcium Ionized Calcium Iron
5. Looking at the Magnitudes, the biggest magnitudes is u at 18.17 which means it is dimmest. The infrared magnitudes are the lowest so they are really the brightest. So this star is brightest at infrared

DR10

SDSS J084948.55+113910.9

Look up common name

Explore Home
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Other Observations
Neighbors
Galaxy Zoo
PhotoTag
Field
Frame
PhotoObj
PhotoZ
PhotozRF
Cross-ID
Spec Summary
FITS
Plate
All Spectra
SpecObj
spoLines
galSpecLine
galSpecIndx
galSpecInfo
Fit Parameters
spoParams
StarformingPort
PassivePort
emissionLinesPort
PCAWiscBC03
PCAWiscM11
FSPSGranEarlyDust
FSPSGranEarlyNoDust
FSPSGranWideDust
FSPSGranWideNoDust
NED search
SIMBAD search
ADS search
Notes
Save in Notes
Show Notes
Print

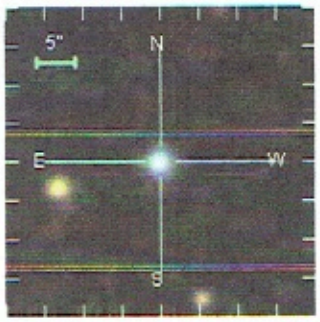
Type	SDSS Object ID
STAR	1237670964308344918

RA, Dec

Decimal	Sexagesimal	Galactic Coordinates (*l*, *b*) *l*	*b*
132.45230, 11.65305	08:49:48.55, +11:39:10.97	215.67315	31.50332

Imaging

Flags STATIONARY BINNED1



ultraviolet/blue

green

red

Infrared

Far infrared

Magnitudes

u	g	r	i	z
18.17	17.10	16.73	16.59	16.55

Magnitude uncertainties

err_u	err_g	err_r	err_i	err_z
0.01	0.00	0.00	0.00	0.01

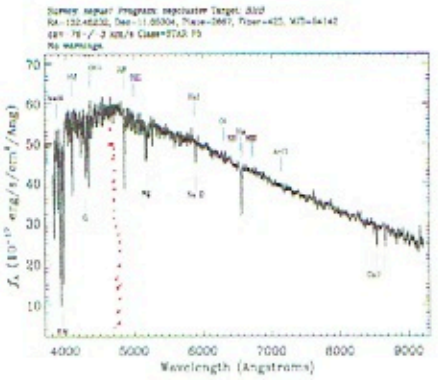
Image MJD	mode	Other observations	parentID	nChild	extinction_r	PetroRad_r (arcmin)
53710	PRIMARY	2	1237670964308344917	0	0.08	1.40 ± 0.005

photoZ (KD-tree method) photoZ (RF method) Galaxy Zoo 1 morphology

Cross-identifications Show

Optical Spectra SpecObjID= 3002891394395249664

Interactive spectrum



Spectrograph class	Redshift (z)	SDSS Redshift error
STAR	-0.000	0.00001

Redshift flags OK

plate	mjd	fiberid
2667	54142	423

survey	programname	primary	Other spec
segue1	segcluster	1	0

subclass	Velocity dispersion (km/s)	veldisp_error
F5	0.00	0.000

segue1_targeting_flags1	segue1_targeting_flags2
SEGUE1_CHECKED	SEGUE1_BHB

Absorption lines show which elements are in the star

Abs peak will give temp

Temp can give you spectral type (use chart in #5-7)

type also listed here

To read more of blackbody radiation, temperature, peak wavelength and color of stars, read the first several sections of chapter 11 in textbook Cosmos.

2nd edition of The Cosmos, pages 217 - 227. Section titles are below.
3rd edition of The Cosmos, sections "Colors and Temperatures" "The Spectral Types of Stars" "Luminosity" A Closer Look boxes "Using Absolute Magnitudes" "A Star's Luminosity"