

# THE COLOR OF THE STARS

## INTRODUCTION

There are few finer sights in the heavens than the double star Albireo in Cygnus - blue and gold stars set against a backdrop of the summer Milky Way. Stars with vivid hues like the Albireo system hold a special place in the hearts of all lovers of the sky. However, the color of a star is not only aesthetically appealing, it also indicates a fundamental physical property, namely, the stellar surface temperature. This follows from the black body radiation law which states that the energy radiated by a hot, dense object such as a star will be greatest at an electromagnetic wavelength determined by the object's temperature. In the visible (or optical) region of the electromagnetic spectrum wavelength always corresponds to a particular color.

## SUMMARY OF EXPERIMENT

- (1) Observe a number of bright stars with a telescope and estimate their color.
- (2) Use the color to estimate the surface temperature of each star and its spectral classification.

## EQUIPMENT

*Telescope or Binoculars*

## PROCEDURE

- (1) The accompanying tables (one for spring, one for fall) contain lists of stars to observe. About half of these stars have given temperatures. Begin the experiment by observing the stars of known temperature and record an estimate of their colors. Your color estimate should be recorded as a number using the following scale:

- 0 Blue
- 1 Bluish White
- 2 Pure White
- 3 Yellow White
- 4 Yellow
- 5 Yellowish Orange
- 6 Light Orange
- 7 Orange
- 8 Reddish Orange
- 9 Red

- (2) Observe the remaining stars and record their colors as well.
- (3) When you are in from the field, prepare a graph using the graph paper provided. The X-axis represents color, while the Y-axis represents temperature. Plot the stars with **known temperatures**. Draw a **smooth** curve between these points. **Do not connect the stars dot to dot**. Instead, draw a smooth curve in such a way that approximately half of the points are above the curve and the other half is below it.
- (4) After you have determined a suitable curve, plot the unknown stars by **placing each star on the curve** at a point corresponding to its color. This will allow you to read off the temperatures of the **unknown** stars. Fill in the color-temperature table after making this determination.
- (5) Use the spectral classification vs. temperature chart to estimate the spectral class of all of the stars.

Stars for Color Exercise  
Autumn Stars

Star	RA hr min	Dec ° ' "	Color	Temperature (K)	Spectral Class
Alperatz ( $\alpha$ Andromeda)	00 05	28 49		12,000	
Caph ( $\beta$ Cassiopeia)	06 54	59 52		6,900	
Mirak ( $\alpha$ Perseus)	01 07	35 21		3,500	
Polaris ( $\alpha$ Ursa Minor)	02 12	89 02		6,200	
Aldebaran ( $\alpha$ Taurus)	04 33	16 25		4,000	
Vega ( $\alpha$ Lyra)	18 36	38 44		11,000	
Deneb ( $\alpha$ Cygnus)	20 41	45 12		9,700	
Altair ( $\alpha$ Aquila)	19 49	08 49		8,200	
Scheat ( $\beta$ Pegasus)	23 01	27 49		3,100	
Markab ( $\alpha$ Pegasus)	23 02	14 58			
Fomalhaut ( $\alpha$ Piscis Aus)	22 54	-29 53			
Alderamin ( $\alpha$ Cephus)	21 17	62 22			
Enif ( $\epsilon$ Pegasus)	21 17	09 39			
Schedir ( $\alpha$ Cassiopeia)	00 39	56 25			
Algol ( $\beta$ Perseus)	03 04	40 46			
Hamal ( $\alpha$ Aries)	02 00	23 14			
Almak ( $\gamma$ Andromeda)	02 00	42 05			
Capella ( $\alpha$ Auriga)	05 13	45 57			

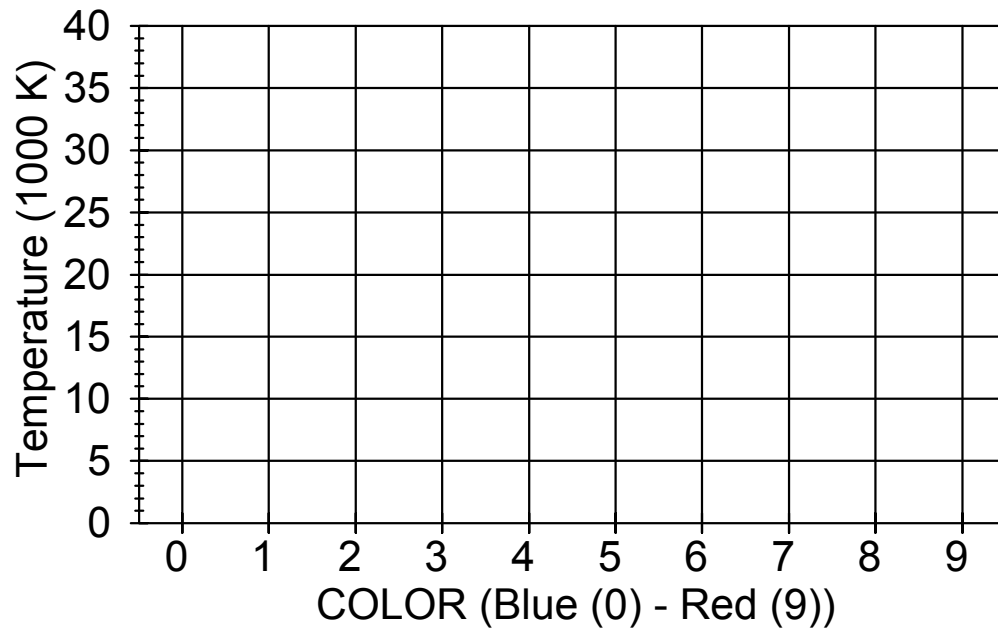
Stars for Color Exercise  
Spring Stars

Star	RA hr min	Dec ° ' "	Color	Temperature (K)	Spectral Class
Polaris (α Ursa Minor)	02 12	89 02		6,200	
Aldebaran (α Taurus)	04 33	16 25		4,000	
Capella (α Auriga)	05 13	45 57		5,400	
Algieba (γ Leo)	10 19	58 19		5,000	
Castor (α Gemini)	05 32	-00 17		9,000	
Sirius (α Canis Major)	06 43	-16 39		10,200	
Pollux (β Gemini)	07 42	05 21		5,200	
Arcturus (α Bootes)	14 13	00 06		4,800	
Betelgeuse (α Orion)	05 54	07 24			
Rigel (β Orion)	05 12	-08 15			
Bellatrix (γ Orion)	05 22	06 18			
Procyon (α Canis Minor)	07 36	28 09			
Alphard (α Hydra)	09 26	-08 05			
Regulus (α Leo)	10 07	12 06			
Dube (α Ursa Major)	11 02	61 54			
Spica (α Virgo)	13 24	11 00			
Kochab (β Ursa Minor)	14 50	74 22			
Zubeneschamali (β Libra)	15 14	-09 12			

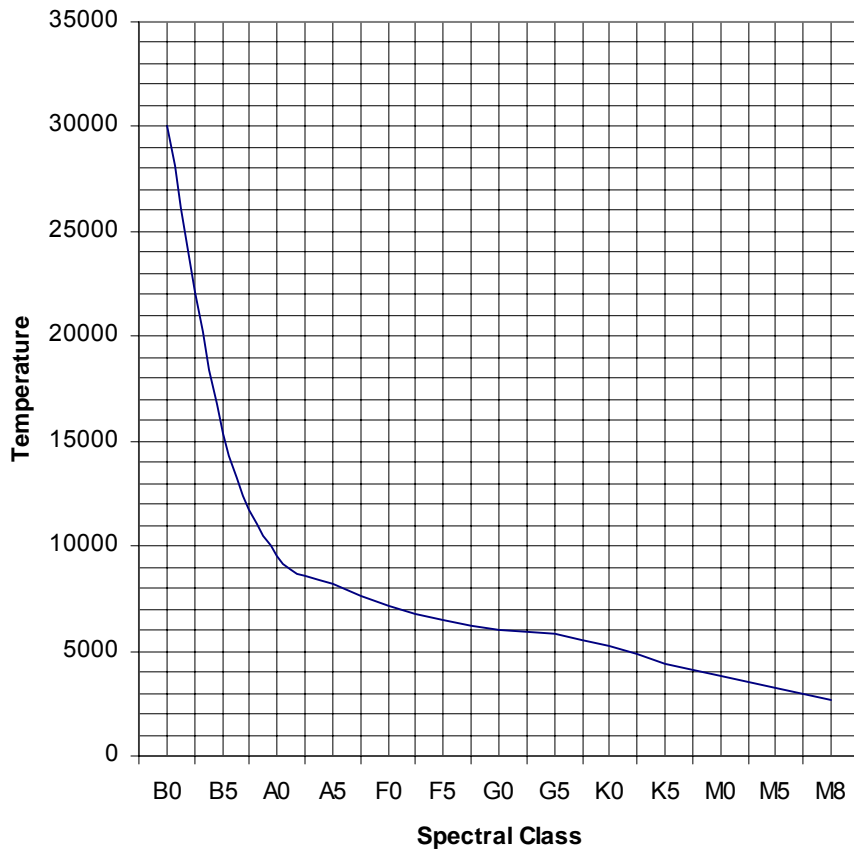
Stars for Color Exercise  
Summer Stars

Star	RA hr min	Dec ° ‘	Color	Temperature (K)	Spectral Class
Antares ( $\alpha$ Scorpius)	16 29	-26 25		3,000	
Arcturus ( $\alpha$ Bootes)	14 15	19 10		5,000	
Spica ( $\alpha$ Virgo)	13 25	-11 09		29,000	
Polaris ( $\alpha$ Ursa Minor)	02 12	89 02		6,200	
$\delta$ Scorpius	16 00	-22 37		30,000	
Vega ( $\alpha$ Lyra)	18 36	38 44		12,000	
$\beta$ Corvus	12 34	-23 23		5,900	
Altair ( $\alpha$ Aquila)	19 50	08 52		8,200	
$\gamma$ Draco	17 56	51 29		4,000	
$\gamma$ Aquila	19 46	10 36			
Deneb ( $\alpha$ Cygnus)	20 41	45 12			
Alphard ( $\alpha$ Hydra)	09 26	-08 05			
Regulus ( $\alpha$ Leo)	10 07	12 06			
Dube ( $\alpha$ Ursa Major)	11 02	61 54			
Spica ( $\alpha$ Virgo)	13 24	11 00			
Kochab ( $\beta$ Ursa Minor)	14 50	74 22			
Zubeneshchamali ( $\beta$ Libra)	15 14	-09 12			
Zubenelgenubi ( $\alpha$ Libra)	14 50	-15 59			

## COLOR-TEMPERATURE SCALE



**Temperature vs. Spectral Class**



**Temperature vs. Spectral Class**

