Stars Activity

Objectives: Demonstrate the variety in colors, sizes, temperatures, and lifetimes of typical stars by setting up a scale model of the solar neighborhood.

Materials: Colored balloons (red, yellow, orange, blue), rulers, tack, (small candy optional)

Table 1. The Solar Neighborhood

Star	Spectral Type	Distance (in light years)	Star Family
Proxima Centauri	M – MS	4	Alpha-Cen
Alpha Centauri A	G – MS	4	Alpha-Cen
Alpha Centauri B	K – MS	4	Alpha-Cen
Barnard's Star	M – MS	6	
Wolf359	M – MS	8	
Lalande21185	M – MS	8	
Sirius A	A – MS	9	Sirius
Sirius B	A – WD	9	Sirius
Luyten 762-8 A	M – MS	9	Luyten
Luyten 762-8 B	M – MS	9	Luyten
Ross 154	M – MS	10	
Ross 248	M – MS	10	
Epsilon Eridani	K – MS	11	

This table lists the 13 closest stars to the sun, some of which are gravitationally bound to one another in double or triple star systems. Their "spectral types" are listed in the second column according to the spectral classification scheme OBAFGKM, with O stars being the hottest, biggest and brightest and M stars being the coolest, smallest and dimmest. After the spectral classification each star is listed as being either a normal main sequence (MS) star that is still burning hydrogen in its core or a white dwarf (WD), the "dead" remnant of an ordinary star. The distance to each star from the sun in light years is listed in the third column and will be used to set up our scale model of the solar neighborhood.

Step 1: Color and Size

Blow up a yellow balloon to a diameter of 5in. This yellow balloon is the Sun and will be placed at the center of the room. Each participant will be assigned a star from the table above. Give them a balloon colored according to the table below (red for M star, yellow for G, etc.). Instruct them to blow up their balloons to the approximate diameters listed in the Table 2.

Discussion topics: What causes color differences in stars? How does is correspond to their temperatures? Why are some stars larger in size than others? How do color/temperature and size affect stellar brightness? Are stars of the same color always the same size/brightness?

Step 2: Distance

With the "Sun" at the center of the room have each star pace out a distance equal to their distance from the Sun in light years (2 steps = 1 light year). Keep in mind that stars from the same family should stick together.

Discussion topics: If the stars in the table represent the closest stars to the Sun, what is this model telling you about relative numbers of star types? What is the most common type of star? What type of stars are we most likely to see from Earth?

Table 2. Main Sequence Balloon Specs

Spec. Type	Color	Diameter	Diameter in model
A	blue	$2R_{Sun}$	10in
G	yellow ~~orange~~	$1R_{Sun}$	5in
K	orange ~~yellow~~	$0.75R_{Sun}$	4in
M	red	$0.5R_{Sun}$	2.5in

Table 3. White Dwarf Specs

Spec. Type	Color	Diameter	Diameter in model
A	blue	$0.01R_{Sun}$	.05in (Too small to use a balloon)

Step 3: Lifetime

Start a time clock. When a star's lifetime runs out pop their balloon.
Every second =10 Million years in our model (shown in Table 4).

Optional Addition

Put candy representing the white dwarf left behind when each star dies inside each balloon. These white dwarf remnants should be very small (0.05in or .12cm) and dense.

Discussion topics: What causes a star to die? Why does it die? What really happens when it "pops"?

Table 4. Stellar Main Sequence Lifetimes

Spectral Type	Lifetime in Billions of years	Time in our Model	Remnant
A	.2	20 sec	WD
G	10	1000 sec (14 min)	WD
Age of the Universe	13.7	1370 sec (23 min)	
K	45	4500 sec (73 min)	WD
M	Over 200	20000+ sec (300+ min)	___