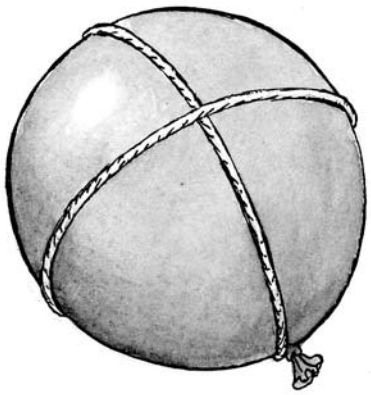
Dense, Denser, Densest?

Black holes are some of the most intriguing objects in the universe. They have tremendous mass and density, so nothing can escape once it has fallen in, not even light. But how do black holes form? In this activity, you will use a model to investigate this question. You will use your hands to apply force to aluminum foil, making it into progressively smaller spheres. In nature, gravitational force does this job inside massive stars. Just how dense can you make your model star?



Procedure

1. To make your star model, obtain a balloon from your teacher and blow it up until your piece of string fits around the widest part. Once you've done that, tie it off. Measure the diameter of the balloon in centimeters in two different directions and average your two measurements. Then calculate the average radius from that.
2. Compute the volume of the balloon ($V = 4/3\pi R^3$). Record your answer in the table below.
3. Form your piece of aluminum foil into a loose ball that represents the core of your balloon star. Use the balance to find the mass of the aluminum in grams.
4. Compute the density of the stellar core (Density = Mass/Volume).
5. Crush the aluminum foil (gently) into a smaller ball. This represents the core as your star burns through fuel it has.
6. Find the volume, mass, and density of the new stellar core.
7. Now use your hands and compress the aluminum into the smallest ball you can. This represents the star's iron core that cannot be compressed any smaller.
8. Find the volume, mass, and density of your compressed stellar core.
9. Next, pop your balloon (your star has just gone supernova!). Bring your foil ball to your teacher, who will use a hammer to crush it down as far as possible to represent the neutron star you have just created.
10. Find the volume, mass, and density of the new neutron star model prepared by your teacher.
11. Report your data points to the teacher, who will be graphing each team's data on an overhead.

Data Table

	DATA				CALCULATED VALUES	
Trial #	**Mass (g)**	**Radius$_1$ (cm)**	**Radius$_2$ (cm)**	**Radius$_{avg}$ (cm)**	**Volume (cm^3)**	**Density (g/cm^3)**
1						
2						
3						
4						