Solar System Soup: The Formation of the Solar System

Background
Over the last four centuries, many theories have been formulated to explain the origin and evolution of the Solar System. Today, the theory most commonly held by scientists is known as the accretion theory. The theory was originally formulated in the 1940s but it has been refined over the last few decades.

The theory explains that the Solar System began to form at a time when the Sun had acquired enough mass to begin to attract material from what is known as the interstellar medium. The interstellar medium is simply the gas and dust that are spread throughout our galaxy. Since the Sun was spinning when it began to attract the gas and dust, what originally formed was a huge rotating disc of material with the Sun at its center. Astronomers believe that this disc looked very much like the satellite pictures of hurricanes which you have probably seen on television weather reports. Over billions of years, the material in the disc accreted, or clumped together, to form the planets presently in the Solar System. Prior to the accretion theory, no one could explain why the planets farther away from the Sun revolved more slowly than the ones closer to the center of the Solar System.

This activity will model what the very early Solar System would have looked like, as predicted by the accretion theory, and demonstrate that the material on the edge of the disc revolves more slowly than the material at the center.

Procedure
1. Fill a bucket (or comparable container) three-fourths full with water.
2. Using the graduated cylinder, measure about 15 mL of vermiculite and pour it on top of the water.
3. Stir the mixture vigorously with a stirring rod in a circular motion. When you have a funnel-shaped pattern in the water, stop, remove the stirring rod, and observe.
4. In the space provided on the following page, sketch the

Objective
The objective of this activity is to observe a model of how the Solar System would have originated according to the accretion theory.

Materials
For each group of students:
- 1 stirring rod
- 1 bucket (11 L) for student exercise
- basin for collecting used water
- 15 mL of vermiculite

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pattern of vermiculite that you observe. Label what parts of the pattern might form the inner planets and outer planets of a Solar System.

Questions and Conclusions

1. What did you observe happening to the vermiculite once you stopped stirring the water?

2. Describe the pattern of vermiculite on the surface of the water.

3. Did all of the vermiculite spin around in the bucket at the same speed? If not, what parts spun faster and what parts spun more slowly?

4. Why did the vermiculite eventually slow down and stop? Why has the same thing not happened to the Solar System?

5. Think about how big your bucket of water and vermiculite is compared to the size of the Solar System. Why do you think it took millions of years for the Solar System to form? Can you think of reasons other than size?