

The scientific method - The formation of the Earth

From GeoClasses

This introductory assignment describes the formation of the solar system, the shapes and changes in planetary orbits, and introduces the concepts of orbital parameters (Milankovitch cycles).

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Materials

For this lab you will use the models

- Nebula formation (http://lurbano-5.memphis.edu:16080/GeoMod/index.php/Nebula_Model_Instructions)
- Ellipticity model (http://lurbano-5.memphis.edu:16080/GeoMod/index.php/Ellipticity_Model_Instructions)
- Solar system model (http://lurbano-5.memphis.edu:16080/GeoMod/index.php/Solar_System_Model_Instructions)

Download the models to your desktop, and read the instructions on the websites.

Nebula formation

Currently, the best theory that explains the formation of our and other solar systems is that it formed from the gravitational collapse of a cloud of gas and dust called a nebula. To examine this theory we will experiment with a small model. It is a simple model of a cloud of particles that are gravitationally attracted to one another.

- The gravitational attraction between any two masses is described by the **Gravity equation**

$$F = G \frac{m_a m_b}{r^2}$$

- Newton's law of gravity, where;
 - F = attractive force
 - G = gravitational constant
 - m_a and m_b = masses of two bodies
 - r = distance between two bodies

The gravity equation

a. Is the attractive force greater for larger masses or smaller masses? (Hint)

b. Is the attractive force greater or smaller if the masses are farther apart?

The nebula computer model

- Start up the nebula (http://lurbano-5.memphis.edu:16080/GeoMod/index.php/Nebula_Model_Instructions) model and observe the results.
 - Try clicking on the particles and the buttons
 - Press the "s" and "g" keys to stop and start the simulation.
 - If you run into trouble or want to restart the simulation simply close the window and restart the program.
- The following movies are from the same model but with a lot more particles.
 - Scene 1 - early in the simulation
 - Scene 3 - shows trails of 3 particles
 - Scene 10 - late in the simulation

This model is aimed at testing the theory that solar systems can form from the gravitational collapse of dust clouds. With that in mind, describe what you see in the simulation.

Does the model support the theory based on what you know about the solar system?

- Yes
- No
- Maybe

Try the Solar System model

(http://lurbano-5.memphis.edu:16080/GeoMod/index.php/Solar_System_Model_Instructions) .

- It shows the current orbits of the planets around the Sun
- Note this is not to scale. All the planets are enlarged (by 1000,000 times) so that they can be visible.

What aspects of the nebula simulation support the theory?

What aspects of the nebula simulation **do not** support the theory?

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