

## 1.1: Your Model of the Universe

### Learning Objectives

- You will articulate your own model of the universe
- You will be able to compare your model with the one in the powers of ten video

### WHAT DO YOU THINK: MODELING

The Stargazers Club meets every summer at Crystal Lake for a weekend of camping, hiking, and, of course, stargazing. Alicia and Brianna drive over to pick up Chris. When they get there, they find him in his garage working on a large diorama, complete with miniature trees, grass, and even a polished laminate for the water.

**Brianna:** "What are you doing?"

**Chris:** "I'm making a model of Crystal Lake,"

**Brianna:** "Why?"

**Chris:** "Because I want to have a perfect model of the lake, so I know the best places to hike and fish and where the best places to set up the telescopes are."

**Alicia:** "Well, it can't be perfect."

**Chris:** "Why not?"

**Alicia:** "Because if you want to know where the best places to fish are ... you'll need to not only know where the fish actually are, but you'll have to put miniature fish into your lake there. And for the telescopes, you may find where good open spaces are, but your model doesn't take into account how cloudy it is on any given day."



A model is a representation of an object or a set of ideas that helps us understand the object. Sometimes models can be actual physical replicas, like the model planes and ships that many of us built as children. Sometimes, the models can be a picture (like a map). Other times, the models are represented by equations or sets of equations. Sometimes, the equations can be solved by hand, and sometimes, they must be solved by using computer simulations.

If we ask you to describe the planet Earth in terms of its geography, its size, and its contents, you could probably do a reasonably good job. For instance, you probably know that Earth's surface is divided into continents, with oceans occupying the area between them. You might indicate on your model that these continents have different political regions called countries, and each of these contains provinces or states, cities, towns, and roads. In addition, the continents have different geographical features, like mountains, plains, deserts, forests, lakes, etc. You could probably give a rough estimate for the sizes of the continents, cities,

mountains, and other familiar features. Granted, there is a range in the sizes of any of these, but you probably have some idea what that range is; if we asked you to create a “descriptive list” of Earth and its contents, you would probably create a fairly detailed list.

Could you make a similar list for the contents of the Universe as a whole? Would you be able to rank list items from large to small and give a characteristic size for each? Could you make a list such that “things below are contained in things above?” If not, don't worry. Throughout this chapter, we will be discussing the size and scope of the Universe. Before we do that though, it is important that you sketch out what you already think about the Universe. We want to make you more conscious of your own current beliefs about science and the Universe, so that the information you learn as you work through the modules will be more meaningful. Over time, you will want to reflect on your ideas and how you have come to them, and see how they change as you work through the modules.

### Your Model of the Universe

We would like you to create your own model of the Universe in the form of a written description. Your model should convey what you think the Universe is, what objects it contains, how they are arranged, and the size and distance scales involved.

As a start, make a list of the features and objects your model will contain. Then describe as many size and distance scales as possible. Finally, describe the relationships between the objects you have listed.

Remember, the idea here is not to see who is “right” or “wrong” in their beliefs. The most important thing for this activity is that you be as honest and clear as possible about what you really think. This will give you a starting point for your learning.

You probably found that you were not able to create your model Universe to scale. Depending on what you included, you might have found that some items were much, much smaller than other items. For instance, if you had decided that one kind of object contained in the Universe was an atom, and that another kind of object was a star, it would already be impossible to represent both of them to scale on a single drawing, at least if you used a linear scale. This scale problem is one that is frequently encountered in science. The Powers of Ten video in the next activity illustrates the range of scales we face while studying the Universe.

### Powers of Ten

In addition to illustrating the relevant size scales in the Universe, the video also lists many different objects in the Universe. After watching the video, answer the questions below.



How do the lists you made for your model of the Universe compare with the contents of the Universe that the film mentioned? Were there objects in the film that you did not think of, or objects you considered that the film left out? How did your size and distance scales compare to those in the video?

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