Tips for Helping a General Audience Understand Multiverses

Ideas for helping Cosmic Café speakers and moderators make the topic of a Multiverse accessible

Physicists and lay audiences often think about *The Fabric of the Cosmos* topics differently. As a result, the challenge is to break the scientific ideas down in ways that make sense to lay audiences. Below are some ideas for helping people see how physicists approach the topic of a Multiverse

As you (or your invited speaker) prepare your 10–12 minute presentation, consider organizing your remarks so that the audience will leave understanding the **Key Message**. Also, one goal of the *Cosmic Cafe* outreach campaign is to help people understand how *Cosmic* topics relate to their lives. The **Relevance** section provides ideas for connecting the show's theme to people's lives. Use the **Conversation-Starter Questions** as ways to kick off a general discussion.

Key Message for the Multiverse

Our universe may be just one of an infinite number of universes. In this view, there are frequent Big Bangs, each creating its own new universe. We may actually live in an expanding "sea" of multiplying universes: a "Multiverse."

Relevance to people's lives

The Big Bang may have been caused by "repulsive gravity," which repels everything around it. The expansion of the universe may be driven by Dark Energy. As physicists learn more about these phenomena, which are central to the multiverse hypothesis, they may gain insights into the universe's fundamental forces and transform our technologies and ideas about the cosmos and ourselves.

Big idea #1: The multiverse is a hypothesis, but has its supporters.

Everyday understanding: There is one universe, and we live in it and can observe it.

Physicist's understanding: The multiverse hypothesis postulates that a collection of universes may exist. With its complexity and no predictive power, the hypothesis remains unconfirmed. To date, however, it is the only hypothesis that can explain a number of facts, but it's not so convincing that everybody believes it. Physicists tend to say, "Let's follow the logic." And the logic seems to lead to the possibility of there being a multiverse. However unfamiliar and strange the idea might seem, a growing number of scientists think it may be the final step in a long line of radical revisions to our picture of the cosmos.

Concrete example: What's the evidence for a multiverse? Well, first we'd need to understand how a universe can begin. The theory that physicists call "Inflation" explains how the universe expanded after the Big Bang. Next, we'd need to know that our Big Bang wasn't the only one, and "Eternal Inflation" indicates that big bangs are happening all the time. Finally, we'd want to understand that there are many different ways a universe can be put together, and "String Theory" says that there are more than we can even imagine. It's like three legs of a stool: inflation/eternal inflation, string theory, and dark energy. None of these alone is proof of a multiverse. But taken together, they suggest that the possibility of a multiverse cannot be ignored.

CONVERSATION–STARTER QUESTION: IS THE CONCEPT OF A MULTIVERSE IN THE REALM OF SCIENCE, SCIENCE FICTION, METAPHYSICS, PHILOSOPHY, OR RELIGION?

The answer to these questions depends on your point of view. Science proceeds based on insights gained through repeated, verifiable testing. Metaphysics and philosophy examine the fundamental ideas by which people understand the world, including existence, one's actions, and the nature of the world. Religion is a

belief system that relates to humanity's spiritual and moral values. And science fiction typically examines people's responses to future technologies, alien beings, and alternate realities.

Additional Questions

- Science has repeatedly knocked humans off their pedestal. In astronomy, Copernicus found that Earth is not the center of the universe. In physics, Newton found that physical laws govern every object in the universe. In chemistry, Dalton found that our bodies and everything in the universe is made of tiny particles called atoms. In biology, Darwin explained that the life that exists today evolved from earlier, simpler forms. In genetics, Watson and Crick found that we are the product of our genome. Now, the multiverse hypothesis threatens to render our universe insignificant. **How would this finding affect how you live and how you think about things? How do you think this knowledge would affect humankind?**

  From the show: Since light from any of these other universes could never reach us, the existence of a multiverse cannot be confirmed. Right now, the multiverse hypothesis can't be used to make predictions, it can't be tested; you could make the case that it's not really science. But many ideas seem outrageous when they are first proposed, but today, we don't even question them. And if we do verify the multiverse hypothesis? Well, we'll know then that our universe, as vast as it is, is just one of billions, and our place in the cosmos infinitely smaller than we think.

- The multiverse hypothesis may sound like science fiction. Have the audience think of examples of scientific ideas from the past that seemed improbable in their day (e.g., Earth being round, the sun being the center of the solar system/universe, blood circulating, phlogiston and ether, plate tectonics, landing humans on the moon). **What led people to change their thinking about these ideas? What are some current ideas in science that seem improbable?**