

STUDY GUIDE: SPACE AND EXPLORATION: HUMANS IN A VAST UNIVERSE

By Dr. Joshua M. Moritz

VIDEO SUMMARY: The scientific study of the universe has revealed a number of surprising details about the origins, structure, history, and size of the cosmos. According to current estimates, the universe came into existence 13.8 billion years ago in an enormous burst of energy, which then developed over time into matter, stars, and galaxies with solar systems and life. Today we believe that our Sun is just one of 1,000,000,000,000,000,000,000 stars in the observable universe. Moreover, recent discoveries of exoplanets and research in astrobiology suggest that we might not be alone in the cosmos.

CONTRIBUTORS

Dr. David Charbonneau is a professor of astronomy at Harvard University and an astronomer at the Harvard-Smithsonian Center for Astrophysics. His research focuses on the development of novel techniques for the detection and characterization of planets orbiting nearby Sun-like stars. He led the first studies of the compositions of exoplanets and of their atmospheres, and he is a member of the NASA Kepler Mission to find Earth-like planets.

Dr. Guy Consolmagno is director of the Vatican Observatory and curator of the Vatican's meteorite collection. His research explores the connections between meteorites and asteroids, and the origin and evolution of small bodies in the solar system. His work in asteroid and meteorite studies prompted the International Astronomical Union to name an asteroid, 4597 Consolmagno, after him in 2000. He is author of *The Heavens Proclaim: Astronomy and the Vatican* (2009) and *Would You Baptize an Extraterrestrial?* (2014)

Dr. Jennifer Wiseman is a senior astrophysicist at the NASA Goddard Space Flight Center, where she studies the formation of stars and planetary systems using radio, optical, and infrared telescopes. As an undergraduate at MIT in 1987, she discovered comet Wiseman-Skiff. Dr. Wiseman is also Director of the AAAS Dialogue on Science, Ethics, and Religion (DoSER) program.

DISCUSSION QUESTIONS

In this film, astrophysicist Jennifer Wiseman references the Big Bang Theory, saying, "We now have evidence that the universe is about 13.8 billion years old, beginning with an enormously spectacular burst of energy."

1. Do you think the Big Bang Theory answers the philosophical question, "Why is there something rather than nothing?" Why or why not?
2. Consider the scientific observation that the universe has a beginning. In your opinion, does the scientific discovery of a beginning of the universe support the idea of a Creator God? Why or why not?
3. If scientists were to provide a plausible scientific description of *how* the Big Bang occurred through natural causes (or what caused it to occur), how would this impact your answer to question 2? Why or why not?

Wiseman explains that based on current evidence, the energy of the early universe "transformed over time into a mixture of *matter* and energy." At first, lighter elements (e.g., hydrogen and some helium) condensed into the earliest stars and galaxies. "Generations of stars" created heavier and heavier elements and these heavier elements are what Earth, biological life, and humans are made of. As a result, says Dr. Wiseman, "We are very intimately connected with the rest of the universe in a very practical way. Our bodies actually do contain atoms that were forged in stars. In fact, most of the elements that we are familiar with, we don't know how to create them originally other than in stars."

Discussing the literary context of Genesis 1, Hebrew Bible scholar Richard Hess explains that the "days of creation" are best understood as "phases" where each phase sets the stage for the next. "Rather than a chronological order, the result is a logical one in which each day prepares for the next and so anticipates it or 'begets' it." Dr. Hess describes how "the pattern of the days in Gen. 1, with its recurrent formula, corresponds to the pattern of the generations in the genealogies" found in the subsequent chapters of Genesis. The central concern here is "the *forward movement* of God's creative work. Each day accomplishes something new, bringing about a greater completion of the work of creation. Each day 'begets' the next. . . . The events of the

first three days are a necessary background for and correspond to what occurs in the fourth through to the sixth day.” (Richard Hess, “Genesis 1–2 in Its Literary Context,” *Tyndale Bulletin* 41, no. 1 (1990))

4. Do you think there is an essential conflict between the description of cosmic origins given by Dr. Wiseman and the description of creation given by Dr. Hess? Why or why not?

Astronomer David Charbonneau says, “We are able to look back in time through telescopes. So telescopes are sort of like a time machine.”

5. Consider how telescopes are like time machines that enable us to “see” the development of the cosmos from the beginning. Do you find any theological significance in this scientific fact as it relates to the Jewish and Christian idea of God as a being who works in and through history?

Dr. Wiseman says, “In the visible universe, there are something like 400 billion galaxies...and each galaxy can have hundreds of billions of stars. It’s mindboggling.”

6. Consider the vast size of the universe as it is discussed in this video in light of Psalm 8. Do you think the vastness of space and the immensity of time diminishes or amplifies the cosmic significance of human beings? Why?

Wiseman notes that the universe is still expanding and also that “We don’t really know...how big the universe is.” In her comments during the interview for this video, Wiseman said, “The universe is full of stuff we call dark matter, and we don’t know what it is. That the universe is actually expanding at a faster and faster rate. We don’t know exactly why.” In a similar way, Consolmagno said, “It’s marvelous to realize that a lot of the things that we thought we understood are not so well understood.”

7. Consider the role of “the unknown” in both theology and science. Do you think there will always be things that are unknown or even unknowable? What do you find more interesting or exciting--what we *do* know from science, or what we don’t (or possibly can’t) know?
8. What role does faith play when confronted with the unknown? Do you think that faith in science is different than faith in religion? Why or why not?

These astronomers discuss how there might be life outside our solar system. Charbonneau says, “At this point, astronomers have found about 5,000 planets orbiting many different stars throughout the galaxy.” Discussing clues scientists could look for that might indicate life in his comments during the interview for this video, Consolmagno says, “We do know that there are plenty of planets, and there are planets that are the right distance from their stars where water could be liquid, and so, life as we know it could be flourishing.”

9. Do you think the discovery of life on other planets would have any significant theological implications? If so, what would they be? If not, why not?

FURTHER RESOURCES & SUGGESTED READINGS

- Video: Jenifer Wiseman, “Habitable Exoplanets: The Implications for Human Significance”
<http://downloads.sms.cam.ac.uk/1280913/1280917.m4v>
- Video: David Wilkinson, “The Search for Extra-Terrestrial Intelligence”
<http://downloads.sms.cam.ac.uk/1252000/1252004.m4v>

On scientific cosmology as it relates to theological concepts of creation:

- Guy Consolmagno, *The Heavens Proclaim: Astronomy and the Vatican* (Vatican City State, 2009).
- Owen Gingerich, *God’s Universe* (Harvard University Press, 2006).
- Alister McGrath, *A Fine-Tuned Universe: The Quest for God in Science and Theology* (WJK Press, 2009).
- Nancey Murphy and George Ellis, *On The Moral Nature of the Universe: Theology, Cosmology, and Ethics* (Fortress, 1996).
- Robert John Russell, *Cosmology from Alpha to Omega: The Creative Mutual Interaction of Theology and Science* (Fortress, 2008).

- Mark William Worthing, *God, Creation, and Contemporary Physics* (Fortress Press, 1996).

On the theological significance of exoplanets and the possibility of extraterrestrial life:

- Jacques Arnould, "Does Extraterrestrial Intelligent Life Threaten Religion and Philosophy?" *Theology and Science* 6:4 (2008).
- Albert A. Harrison and Douglas A. Vakoch, eds. *Extraterrestrial Altruism: Evolution and Ethics in the Cosmos* (Springer, 2013).
- Guy Consolmagno, SJ, and Paul Mueller, SJ, *Would You Baptize an Extraterrestrial?: And Other Questions from the Astronomers' In-box at the Vatican Observatory* (Crown, 2014).
- Guy Consolmagno, SJ, *Intelligent Life in the Universe?: Catholic Belief and the Search for Extraterrestrial Intelligent Life* (Catholic Truth Society, 2005).
- Andreas Losch & Andreas Krebs, "Implications for the Discovery of Extraterrestrial Life: A Theological Approach," *Theology and Science* 13:2 (2015).
- Ted Peters, Robert John Russell, and Joshua Moritz, eds. *Astrotheology* (Wipf and Stock, 2017).
- Ted Peters, "Astrotheology and the ETI Myth," *Theology and Science* 7:1 (February 2009).
- David Wilkinson, *Science, Religion, and the Search for Extraterrestrial Intelligence* (Oxford Univ. Press, 2013).

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