

DISCUSSION GUIDE

Facing Infinity: Black Holes and Our Place on Earth

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If you have any questions or comments about this discussion guide, which has been prepared by the author, please feel free to email info@jonasenander.com.

Prologue: The Ring of Light at the Edge of the Darkness

1. Why do you think the author starts with a journey into a black hole?
2. In what ways does the prologue hint at the relationship between human observers and the cosmos?
3. How do you respond to the idea of confronting the edge of knowledge in the form of the darkness of black holes?

Part I – Amid Stars, War, and Darkness

Chapter 1: The Priest Who Wanted to Weigh the Stars

1. Who was John Michell? Why did he choose to abandon his academic career?
2. How does the figure of a priest in eighteenth-century England help us think about the intersection between religion, science, and the Enlightenment?
3. What is the idea behind “dark stars”?
4. How can you detect these dark stars if they are invisible?
5. Why was Michell so reluctant to share his idea about “dark stars”? Was it justified?

Chapter 2: The Dark Heart of the Milky Way

1. What evidence do astronomers have that a supermassive black hole exists at the center of our galaxy?
2. How did you react to Andrea Ghez’s statement, “I don’t think there’s any stage of my career where I haven’t heard the obnoxious thing ‘you’re only getting to the next step because you’re a girl or because you’re female’”?
3. In what way does our awareness of a black hole at the center of a galaxy affect our human sense of place?
4. Why was the working relationship between Johannes Kepler and Tycho Brahe so fraught?
5. Toward the end of the journey to Maunakea the author reflects on his observation of the Milky Way. What is your experience of the Milky Way?

Chapter 3: The Astronomer by the "Mountain of Death"

1. Who is the astronomer referred to in the chapter title, and what is the "Mountain of Death"? Why is this dramatic term used?
2. What does the chapter reveal about the link between military activities and scientific work?
3. What role does light play for Einstein?
4. What is the main insight Einstein had while working at the Patent Office concerning the nature of time and space?
5. How did this chapter inform your view of the conditions under which science happens?

Chapter 4: Einstein and the Blind Beetle

1. What was Einstein's happiest thought?
2. The author spends two chapters on Einstein's life and work. How does Einstein come across as a person?
3. Why do you think that the pioneers of non-Euclidean geometry had such a hard time?
4. Try to summarize Einstein's main idea about the relationship between gravity, space, and time.
5. What does the metaphor of the Blind Beetle signify?

Chapter 5: Beyond the Event Horizon

1. What is an event horizon, and why is it such an important boundary in physics?
2. How does the author use the concept of "beyond the event horizon" to ask broader philosophical or existential questions?
3. What does the chapter suggest about what we can and can't know about black holes?
4. What is a singularity? Does it also represent a kind of boundary of knowledge?
5. Why do you think that Einstein had a hard time accepting the consequences of his own theory?

Part II – Black Holes in the Depth of Space

Chapter 6: Dying Stars and Spacetime Vortices

1. How does the life cycle of a massive star lead to the formation of a black hole? What are the two other possible end stages of a star?
2. How did Robert Oppenheimer contribute to our understanding of black hole research? What do you make of the fact that, just like Karl Schwarzschild in chapter 3, Robert Oppenheimer was employed by the military?
3. What did Jocelyn Bell Burnell discover, and why do you think that she was not awarded a Nobel Prize?
4. What were the adverse conditions that Roy Kerr had to struggle against before he could study how black holes rotate?
5. If you're outside the event horizon of a black hole, but inside its ergosphere, what will happen to you?

Chapter 7: A Cosmic Symphony

1. What is the “cosmic symphony”—gravitational waves, black hole mergers, or something else?
2. How did music inform the life of Rainer Weiss?
3. How can LIGO detect gravitational waves? What information do they carry?
4. What do you think you would see if you were close to (and survived) the collision of two neutron stars?
5. Why did the pioneering scientists behind LIGO quote Machiavelli in one of their reports? Does the quote make sense?

Chapter 8: The Shadow Hunters

1. What is meant by “shadow” in the context of black hole imaging?
2. What challenges were faced by the scientists who wanted to capture the black hole shadow?
3. The Event Horizon Telescope is a big collaboration with many members. Why do you think the author chose to portray Sara Issaoun as one of the main characters in this chapter?
4. Do you think it is correct to call the image of the black hole shadow a photograph?
5. What role do you think the images of M87* and Sagittarius A* play as cultural artifacts?

Chapter 9: The Origin of Giants

1. What are supermassive black holes and how do they differ from stellar mass black holes?
2. Why is it so surprising for scientists including Marta Volonteri that black holes became so big so early in the history of the universe?
3. What are quasars?
4. Both Marta Volonteri and Priyamvada Natarajan had to move around a lot in their academic careers. Do you think this is the normal state of affairs for scientists today?
5. What’s so special about the object UHZ-1?

Part III – Black Holes and Our Place on Earth

Chapter 10: Pōwehi and the Right to the Land

1. How does this chapter connect astronomy with colonial history and Indigenous protests?
2. What responsibilities do scientists have when building observatories on Indigenous land or remote sites?
3. What does Pōwehi mean? Do you think it is a suitable name for a black hole?
4. How did the protests at Maunakea change Jessica Dempsey’s view on the ethics of astronomy?
5. Search online for news about the Thirty Meter Telescope. What is the current status of both the construction and the opposition against it?

Chapter 11: Black Holes and Climate Change

1. What is the International Celestial Reference Frame, and how can it be used to study the Earth?
2. How do the lives and ideas of Karl Schwarzschild and Alfred Wegener intersect both scientifically and biographically?
3. Why do you think Einstein supported a geological model that rejected the idea of continental drift?
4. What does the author mean when he writes, “What’s the point of all this knowledge and technology if we can’t look after our world, our only home in the universe?” Do you agree?
5. How did you react to the idea that the study of black holes can help us understand climate change and the Earth?

Chapter 12: Black Holes Are Our Fathers

1. What is the argument behind black holes being our “fathers”? How does this metaphor work?
2. Search online for more images of black hole jets, being mindful of the difference between the real astronomical images and the many artistic illustrations. How do these images show how black holes can impact the cosmos?
3. How did you react to Aurora Simionescu’s statement that “It’s entirely possible that some of the atoms in your body come from another galaxy”?
4. How did you react to Aurora Simionescu’s statement that “Everything is connected. In a way, I think that’s more beautiful than scientific”?
5. What are blanets? Would you like to live on one?

Chapter 13: Hawking’s Last Journey

1. What are Stephen Hawking’s contributions to black hole physics and our understanding of the universe?
2. Why do black holes explode? Has this been measured?
3. What personal qualities of Hawking’s stand out in this chapter?
4. How did you react to the fact that the search for exploding black holes led to the invention of Wi-Fi?
5. Do you think Hawking’s recording will reach and enter a black hole one day?

Chapter 14: Are We Living in a Black Hole?

1. Why do some scientists think we could be living inside a black hole?
2. What is a worm hole?
3. The author tries to connect the ideas of worm holes and the universe as a black hole to the Mountain of Death. Do you think the link works?
4. Why does the author choose the word “duality” to describe black holes?
5. What is your lasting impression of the ideas put forward in the book, after finishing it?