



Participant Discussion Guide for *Cosmos: A SpaceTime Odyssey*

Episode 4: "A Sky Full of Ghosts"

The creators of *Cosmos: A SpaceTime Odyssey* state that their aim is to promote scientific literacy. Episode 4, "A Sky Full of Ghosts," discusses the speed of light, distant stars, and black holes. *Cosmos* host Neil deGrasse Tyson discusses the implications of the speed of light for space exploration and our earth-bound view of the stars. Unfortunately Tyson uses the topic as a platform to level a direct attack on all who accept the young age of the universe as presented in God's Word. His discussion of black holes crosses over from observable science that promotes scientific literacy to phantasmic speculations, finally suggesting that the mystery of how the big bang could ever have happened in the first place lurks beyond our reach in these hot gravitational light traps. In this discussion guide we focus on the observational science that relates to the speed of light and black holes.

1. Who is the 18th century father of modern stellar astronomy? In addition to mapping much of the Milky Way, he was the first person to discover a planet since ancient times. (Do you know that planet's name?) He also catalogued hundreds of double stars and figured out how they moved. What do we call these double stars, and how do they move?

2. How fast does light travel? Can anything travel faster than light?

3. Because things in space are far apart, scientists find it most convenient to describe vast distances in terms of how many years we calculate light would take to travel that distance. Based on this, how far away are Proxima Centauri, the Pleiades Cluster, and the Crab Nebula? What is Proxima Centauri?

4. If you were to see something happening on the sun's surface—though you must *never* look directly at the sun because doing so can permanently damage your eyes—how many minutes ago would that event have taken place? Some people say the telescope is a sort of time machine. Why? And why is this not a very accurate analogy?

5. What is really happening during our “sunrise”? What would be different about sunrise if earth had no atmosphere?

6. How fast does the earth spin? Why don't you feel the earth spinning?

7. What is a black hole? Can we see them? Are black holes real?

8. Where are black holes located?

9. What is an “accretion disc”? What is a black hole’s “event horizon”? What are the “jets” shooting above and below the plane of a black hole?

10. Do black holes go around space gobbling up things in their paths?

Reaching Beyond

11. What do black holes have to do with the evolutionary big bang model of the universe's origins?

12. What famous physicist is credited with explaining how time, space, light, motion, and gravity are related to each other? Because of this relationship, he noted that it is impossible to measure the speed of light in the same way we measure speeds and distances closer to home. Explain this limitation.