

Answer these questions on angel at Lessons > Homework > Homework 8

1. (3 pts.) Your parents ask, "How do astronomers know that the Big Bang did happen?" Write a simple answer for your parents, who, let's assume, are not scientists.

Answer #1: Hubble's Law describes the motion of galaxies: The speed of a galaxy is proportional to its distance. Here is an analogy: A galaxy moving at 25mph is 25miles away, and one moving at 50mph is 50miles away. At the same instant (an hour ago), both galaxies were very close to us. Therefore Hubble's Law shows that at one instant, all of the matter in the universe was very close together. That instant is the Big Bang.

Answer #2: Astronomers discovered radiation that looks the same in every direction. Furthermore, the radiation has the property that it was emitted by something very dense. (For parents who have taken Ast207, that means the emissivity of the source is 1.) What is dense and the same in every direction? Only the Big Bang has both properties.

2. Simplicio reasons, "The universe is expanding. Hoag's object, being part of the universe, is expanding too. Therefore Hoag's object is steadily moving away from us, and Hoag's object is getting bigger."

- a. (3 pts.) Modify Simplicio's statement so that it is correct.

"The universe is expanding. That means Hoag's object is steadily moving away from us. Held together by gravity, Hoag's object and the solar system are not expanding. The earth is not moving away from the sun, and, and Hoag's object is not getting bigger."

- b. (3 pts.) What is the root cause of Simplicio's misconception?

The universe expanding does not mean everything in the universe is expanding. The distance between two objects expands only if no force has overcome the initial motion caused by the Big Bang.

- c. (0 pts.) What is the big idea behind this question?

(1) Everything was set in motion because of the Big Bang. (2) For some regions where the amount of matter is greater, the force of gravity between matter has reversed the motion.

3. (3 pts.) Simplicio thinks, "Penzias and Wilson probably detected the radiation from lots of dust in the plane of the Milky Way Galaxy. The radiation is not from the Big Bang." What evidence did Penzias & Wilson have that refutes Simplicio's statement?

The radiation is isotropic. If the source were the dust in the plane of the Milky Way, it would be stronger in the direction of the plane and weaker in other directions

4. (3 pts.) Simplicio thinks, "Penzias and Wilson probably detected the radiation from the evergreen trees nearby. Their radio antenna will receive signals even when not pointed directly at the trees, just as my satellite dish gets a signal even when not pointed directly at the satellite. The radiation is not from the Big Bang." What evidence did Penzias & Wilson have that refutes Simplicio's statement?

The radiation is free of seasonal variations. If the radiation were from trees, it would be more intense in the summer when the trees are warmer.