



Review Final Exam

(new material only)



Key questions

- Why are neutron star/neutron star or black hole/neutron star mergers a less dangerous type of GRB?
- Which extinction event may have been caused by a GRB? What were some of the effects?
- GRB mitigation?
- The speed of what is a measured constant regardless of your movement?
- How is time/length/mass affected when you observe someone moving with respect to you? Why is it relative?
- How does your local time/length/mass change when you move at high speeds?



Key questions

- Given that Einstein's theory of general relativity is a better theory of gravity than Newton's, when something falls off a building, why does it fall? What is gravity in this case?
- How does a massive object affect space-time?
- How does a massive object affect time and light?
- What is a black hole in Einstein's GR theory?
- Black holes are simple. What three properties do they have?
- What is a black hole's event horizon? A Schwarzschild radius? How do they change with mass?



Key questions

- A probe/human falls into a black hole. Describe what happens to it.
- How can we detect a black hole? What about a non-accreting black hole entering our Solar System?
- What is Hawking radiation?
- What's in the center of our Galaxy?
- What is more likely to enter our Solar System, a star or a compact object (i.e. black hole, white dwarf, or neutron star)?
- What are possible effects of a black hole entering the Solar System?



Key questions

- What are the effects of a black hole colliding with the Earth?
- What are micro-black holes?
- Why don't we think that the LHC will make them? Even if they do, why is it not expected to be a problem?
- What is the Milky Way?
- What type of galaxy is it?
- Where is the Sun in the Milky Way?
- What are globular clusters and what role did they have in understanding the Milky Way?



Key questions

- What are the four Copernican revolutions? Hint, the 4th is finding ET (We are not alone in the Universe.)
- What are the four components or structures of the Milky Way? Where is the Sun?
- How do we know that the Milky Way has spiral arms?
- How do stars rotate in the disk of the Milky Way?
- If you have three stars at different locations in the disk, will they travel different distances in the same time?



Key questions

- What is a rotation curve of the Milky Way? And why is it flat? What does that mean?
- What did the “spiral nebulae” turn out to be?
- What are the three types of galaxies?
- What is a spiral arm made out of?
- What might happen if the Solar System enters one?
- Are galaxies usually alone? What is the local group?
- What happens when two galaxies collide?



Key questions

- What might happen when Milkomeda is formed? What might happen to the Solar System?
- What is Olber's paradox?
- How are galaxies moving? What does it mean? What is Hubble's Law?
- Is Brooklyn expanding?
- What are some misconceptions of the Big Bang?
- What was the Universe like early on?
- Where was the Big Bang?



Key questions

- What is the CMB? Where does it come from?
- What caused the small perturbations in the CMB? Why do I call them the seeds of galaxies?
- What makes up a proton?
- What is anti-matter? Why are we matter?
- What is Big Bang Nucleosynthesis?
- What was the Era of Recombination?
- When were the first stars born?
- What are the three big pieces of evidence of the Big Bang?



Key questions

- What is the most likely fate of the Universe?
- What is a closed, open, or flat Universe?
- We are likely flat, but don't weigh enough, so what do we invoke?
- Why does the fate of the Universe depend on its properties?
- What is the Big Rip?
- What is the Big Crunch?
- What is the Big Chill?



Key questions

- If the Universe keeps expanding, what happens to our view of other galaxies?
- What is left after 100 trillion years?
- How big does our supermassive black hole get? Does it eat everything?
- What is proton decay?
- What happens to all black holes with enough time?
- What is the idea of branes creating another Big Bang?



Key questions

- What is a quasar?
- How were they discovered?
- What powers a quasar?
- Are there any nearby quasars right now?
- What if Andromeda's BH feeds?
- What happens during the creation of Milkomeda? Any quasars?
- We can estimate the number of intelligent life in the Universe how?
- We can estimate the number of intelligent life in the Galaxy how?



Key questions

- What does the Drake Equation tell us?
- Does any evidence of life exist in the Solar System, except for Earth?
- Why don't we know about life on the early Earth?
- What are Extremophiles?
- Why is life on Earth ubiquitous?
- What is Panspermia?
- Why is alien bacteria or virus unlikely to be seriously dangerous to humans?



Key questions

- What are some problems with interstellar travel?
- What is an optimistic/pessimistic time estimate for an advanced civilization to colonize the Galaxy?
- What is the Fermi Paradox?
- What is arguably the simplest way for a civilization to explore the Universe? Hint, armchair explorers.