

Study Questions for Black Holes Test #2

- **Exotic Objects**

- What are gamma ray bursts? What physical mechanism is thought to give rise to short duration bursts? Long duration bursts?
- What is a hypernova and how is it related to the formation of a black hole?
- What is a quasar? How are quasars, galaxies, and supermassive black holes related to one another? Where are supermassive black holes most likely to be found?
- What are the different possible sources of dark matter and why do we believe that it exists? What observational evidence is there supporting its existence?

- **Quantum Mechanics and Black Holes**

- What does it mean to say that energy is quantized? When are the effects of quantum mechanics most important and when can they safely be neglected?
- What are photons? What two things do they transport? How are they related to electromagnetic waves?
- What is wave-particle duality? To what types of physical phenomena or objects does it apply?
- What is the uncertainty principle? What are some of the different physical properties that are connected by uncertainty relations?
- What is the Pauli exclusion principle? How is it related to the degeneracy pressure supporting white dwarfs and neutron stars? Why does this pressure 'soften' when the white dwarf approaches the Chandrasekhar limit?
- What are the important lessons learned from the double-slit experiment? From the photoelectric effect?
- What is quantum tunneling and how is it related to black hole evaporation?

- To what process does someone outside the black hole attribute its evaporation?
- **Gravitational Waves**
 - What is the source of all gravitational waves? Why are they so difficult to detect? How fast do they travel?
 - What is the connection between gravitational waves and the “Black Holes Have No Hair” theorem?
 - What are the two main approaches to trying to detect gravitational waves? How does each work? What are the pros and cons of each?
- **The Holographic Principle**
 - What is entropy and how is it related to information?
 - What is the second law of thermodynamics and how does it govern the behavior of entropy in the universe?
 - What is the holographic principle and how does it connect entropy and information with the surface area of a black hole?