Mists of Time

1. What is the 'Cosmological Principle'?

2. Bright quasars are only seen in distant parts of the universe, not the nearby universe. Does this violate the Cosmological Principle? Does it violate the 'Perfect' Cosmological Principle?

The universe has changes in several significant ways since early in his history. In particular, according to the Big Bang theory (in which the universe began in an extremely hot and dense state of mostly hydrogen and helium), it has become...

- Cooler and less dense.
- More 'lumpy' (distributed into local concentrations like galaxies and clusters)
- Slower-moving for a period, before recently becoming faster-moving again.
- Increasingly 'polluted' with heavier elements.

3. Explain qualitatively how observations of distant galaxies are able to test each of the predictions of the Big Bang theory listed above.

4. According to the Big Bang theory, what is the greatest distance we can observe, even in principle?

In practice, however, we cannot see out to the distance in part 4. In its very early history, the universe was *opaque* to light – the density and temperature were so high that light could travel only a very short distance before being scattered in a new direction (like fog.) This 'fog' eventually lifted as the universe cooled, vanishing when the universe cooled below 3000 K (about 15 million years after the Big Bang.) As the 'fog' disappeared, photons trapped it could then escape into space.

5. Can we still see this 'fog'? At what distance and direction? What is it called?

6. What happened to the 'fog' that presumably once existed in our vicinity? What about the photons it released as it lifted – where are they now?

7. If we take a spectrum of the 'fog', what do we see?