Summary of Lecture 9

Key points include:

1. The innermost four of the planets in our Solar System (Mercury, Venus, Earth, Mars in increasing order of their distance from the Sun) have enough similarities to Earth that they are called the *terrestrial* planets.
2. These characteristics include being (relative to the other official planets Jupiter, Saturn, Uranus, and Neptune) small, rocky, dense, and with much less fractional mass in their atmospheres.
3. Earth is the most massive of these planets. More massive things take longer to cool (think about a pie right out of the oven; which takes longer to cool, the whole pie or a slice of the pie?). Thus the Earth stayed hotter (and indeed molten) longer than the other terrestrial planets. This gave it time to *differentiate*, which is to say that the denser parts of the Earth (the iron and nickel) had some time to sink to the center. The core of the Earth is therefore denser than the outer parts (the crust on the very outside, the mantle between the crust and the core).
4. Venus is fairly close to the same size as Earth (Venus has $\approx 4/5$ of Earth's mass). Mars is significantly smaller (about 1/9 of Earth's mass) and Mercury is smaller still (about 1/18 of Earth's mass). Although the Moon is not technically a planet, it also has terrestrial planet characteristics, and is about 1/80 of Earth's mass. The lighter terrestrial planets cool off faster and therefore solidify faster than the more massive terrestrial planets.
5. As a result, whereas Earth is geologically active (earthquakes, volcanoes), the Moon and Mercury are geologically "dead". Thus surface features such as craters are destroyed relatively quickly on the Earth compared with its ≈ 4.6 Gyr (Gyr=billion year) lifetime, whereas ancient craters are still visible on the Moon and Mercury.
6. Motion of the still-molten core of the Earth helps sustain our magnetic field (and we're happy about that because the Earth's magnetic field protects us from high-energy charged particles from the Sun!).