**29:52 Exploration of the Solar System**
**Class Notes for March 3, 2008**
**Origin of the Moon**

Last time, we saw that the craters on the Moon were mainly created during an "age of bombardment", 4.4 - 3.8 Gyr ago. If these impacts occurred on the Moon, why didn't they produce craters on the Earth, which is nearby?

The answer is that they *did* occur, but the evidence of them has been mainly wiped out by the effects of volcanism, glaciers, erosion, etc. Nonetheless, a large number of craters have been identified on Earth. In most cases, the crater is below the surface of the Earth. A website devoted to them is at http://www.unb.ca/passc/ImpactDatabase/

Note, in particular, the crater at Manson, Iowa, which was produced about 74 million years ago.

The lesson to be learned for the remainder of our studies of the solar system is that if we see a heavily cratered surface of a planet or moon, it means that the surface of that object has been changed very little in the past 3 billion years or more. On the other hand, if there are few craters or none, it indicates that some process, such as wind or water erosion, volcanism, etc, have obliterated the craters.

## The Origin of the Moon

The main problem in understanding the Moon is understanding how such a large moon (relative to its planet) came into being. In addition, the chemical composition of the Moon is in most ways very similar to that of the Earth, but with some significant differences.

The leading theory for the origin of the Moon at the present time is the *giant Impact Theory*. According to this theory, very early in the history of the solar system, the early Earth was struck by a large object in nearly the same oribt. The explosion blew off much of the outer mantle of the Earth, which later came together to form the Moon. Check the cartoon illustration of this process in the textbook.

## Mercury and Venus

Let's now begin discussing other planets in the solar system. We will follow the traditional approach by discussing the planets in order of distance from the Sun. We deal with Mercury and Venus.

A comparison of Mercury and Venus with the Earth, Moon, and Mars, is given in Table 10.1. Look at it.

The characteristics (vital statistics) of Mercury and Venus are given in Tables 10.2 and 10.3. Look at those, too.

A remarkable feature of *Mercury* is that it is not in *synchronous rotation*, as was once believed (and as I was taught when I first studied astronomy), but instead in a "2/3" resonance. The rotation period of Mercury (59 days) is 2/3 of a revolution period (88 days), so Mercury rotates 3 times in the time it takes to complete 2 orbits. We will talk about this further next time.

The orbital period of *Venus* is 0.615 years, or 224 days. Amazingly, the rotation period of Venus is 243 days (not one day like the Earth). The rotation is also *retrograde*, meaning that it rotates in the opposite sense to its revolution.

A comparison of the physical properties of Mercury and Venus relative to the Earth and the Moon is effectively shown in Figure 10.1. Note that Venus is almost exactly the same size as the Earth.