

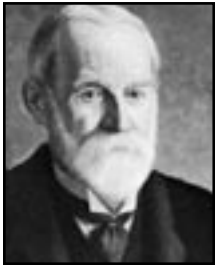
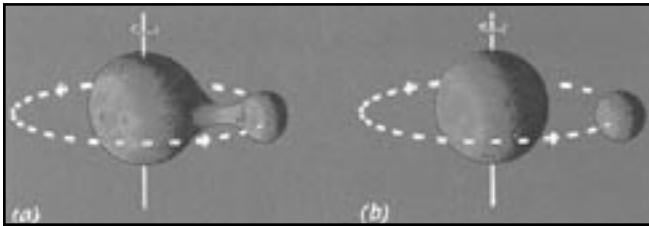


OUR NEAREST NEIGHBOR, VI

By Walt Robinson

There have been many theories concerning how the moon came to be. Fission, co-creation, capture and impact are old theories, which have been used for pretty much the extent of the 20th century. Three of them have flaws. Fission, co-creation and capture have pieces of the puzzle missing or somehow cannot be explained by physics.

In the fission theory, we have a spinning, semi-molten Earth split into two bodies. This theory was developed by George



Darwin (left), son of Charles Darwin the famous scientist who wrote *Origin of Species*. Since the earth would be rapidly spinning, it stands to reason that the more solid materials would coalesce toward the center of the body and the lighter materials would float to the top.

This would make the fission theory

favorable, since the Moon has no iron core and is made of lighter materials. Where this theory fails, however, is the fact that during the 1970s when lunar rocks were brought back to earth, they were found to differ chemically from the crustal material of Earth. Also, it would have taken a great deal of angular momentum to break off a chunk of the Earth's material. That angular momentum would have drastically changed the rotational rate of the earth-moon system today, for which we do not see evidence.

In the co-creation theory, the Moon and Earth formed together out of a nebulous cloud during the early stages of the solar system. This theory was discounted since both the density and composition of the Moon is very different.

In the capture theory, the Moon formed somewhere else in the solar system and was captured by the Earth. Again the problem requires a very unlikely set of interactions between a three-body encounter (the earth-sun-moon system). The Moon is a large enough body that the Sun's gravitational forces would have overtaken any capture by the Earth. Also, if the Earth did possess enough gravitational force to capture such a body, that

body would have more likely been torn apart, than captured.

During the Apollo missions, there was a search by the Apollo 17 crew for what became known as the "Genesis Rock," a chunk of the original material that formed the Moon. Out of the 840 pounds of rock brought back to Earth, no "Genesis Rock" was found. It was decided that during the Moon's early history, there was enough bombardment of material that there was utter destruction of all the original crustal material.

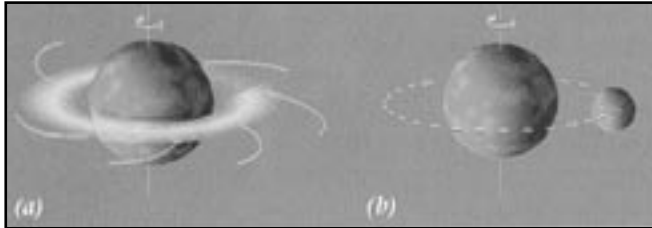
In 1984, William K. Hartmann concluded that during the early formation of the Earth, it received nearly 25 times the amount of impacts compared to the Moon and that one of these gigantic impacts was responsible for the formation of the Moon. Although the impactor theory was not all that new, it took on a



look of most-probable cause of the formation of the Moon. The theory was greatly studied through the 1980s and 1990s.

Enter H.J. Melosh who was skeptical of Hartmann's theory of a giant impactor. He went to the military to use computer simulations at the Sandia National Laboratory and began inputting various variables such as size and speed into the supercomputer to generate models of what would be produced with different scenarios. Those models ascertained that a body, large enough, and with the correct speed and angle of entry, could produce a moon such as we have today. Robin Canus of the University of Colorado at Boulder has done further studies and most astronomers now believe that this theory correctly shows how our Moon was formed. The theory shows that a body close to half the size of earth, travelling at the rate of 11km per second, and grazing the Earth at an angle of around six degrees, would remove enough of the mantle of Earth to send it into orbit as a ring outside the Roche limit and that this

ring of material would finally condense into a solid body. (If the ring formed inside the Roche limit, the material would have



eventually rained back down onto Earth as will eventually happen with Saturn's rings).

So you may ask — what if we had no Moon? Well, we probably would not have to worry about that, since we would not be here. The Earth, like all the other planets, is tilted as it orbits the Sun. The Earth's tilt is approximately 23.5 degrees. It takes us about 23,000 years to “make the circle” in what is known as precession. Right now because of our tilt, we are pointed in a north-south direction towards Polaris. In approximately 13,000 years, Vega will be our North Star. The moon's gravitational pull on the Earth keeps this 23.5-degree tilt in check. It stabilizes precession. If there were no Moon, this slight wobble would go out of control. Hence, the tilt could go from 23.5 to 30 or 50 or 90 degrees. The climate on Earth would change drastically. Polar ice caps would melt; desert areas would become tropical; tropical would become frozen wastelands. Life, as we know it, could not survive the dramatic climate changes. Weather patterns would be very different without the Moon.

There would be no tides. Aquatic life as we know it would be nonexistent. It is known that coral spawn only in November during the full-moon tide, sea turtles come ashore during only full- and new-moon tides to lay their eggs and other forms of



aquatic life depend on the tides for their very existence. Without the tides, these creatures would probably not be in the



aquatic make up of things. Our oceans would be very different without the Moon.

The Moon also has shielded Earth from many impacts. Just as Jupiter has been called the solar system's vacuum cleaner, taking many hits due to its gravitational attraction, the Moon has

taken many hits that could have targeted Earth. Our planet would be a very different place. We could have a different atmosphere (or no atmosphere at all!), different crustal make up or a planet devoid of life.

So, next time you plan that observing session only to find you have a Moon that interferes, extend your observing time and take some time to study and learn the lunar surface features. I would bet that most of you can find at least three dozen deep-sky objects, but you can't name and locate eight of the major lunar Maria!



Next month I'll write on eclipses. Not so much of the mechanics, but rather some of the more unknown facts and notable lunar eclipses that have occurred over the millennia.

Until next time, enjoy the Moon and be grateful it is our closest neighbor!



Walt Robinson has been a member of the Astronomical Society of Kansas City since 1987. His present duties include Webmaster for the society's Web site. He has presented many programs at the public nights at Powell Observatory and in Bonner Springs, Kan. where he lives.

Walt also runs the “Robinson Lunar Observatory” to spur interest in the moon among amateur astronomers. His recent “lunar light ray” program brought many amateurs together from across the United States and abroad to study and observe these events. An article written in the Astronomical League's Reflector explained the program, and as a result recruited many more interested amateurs into studying the moon.