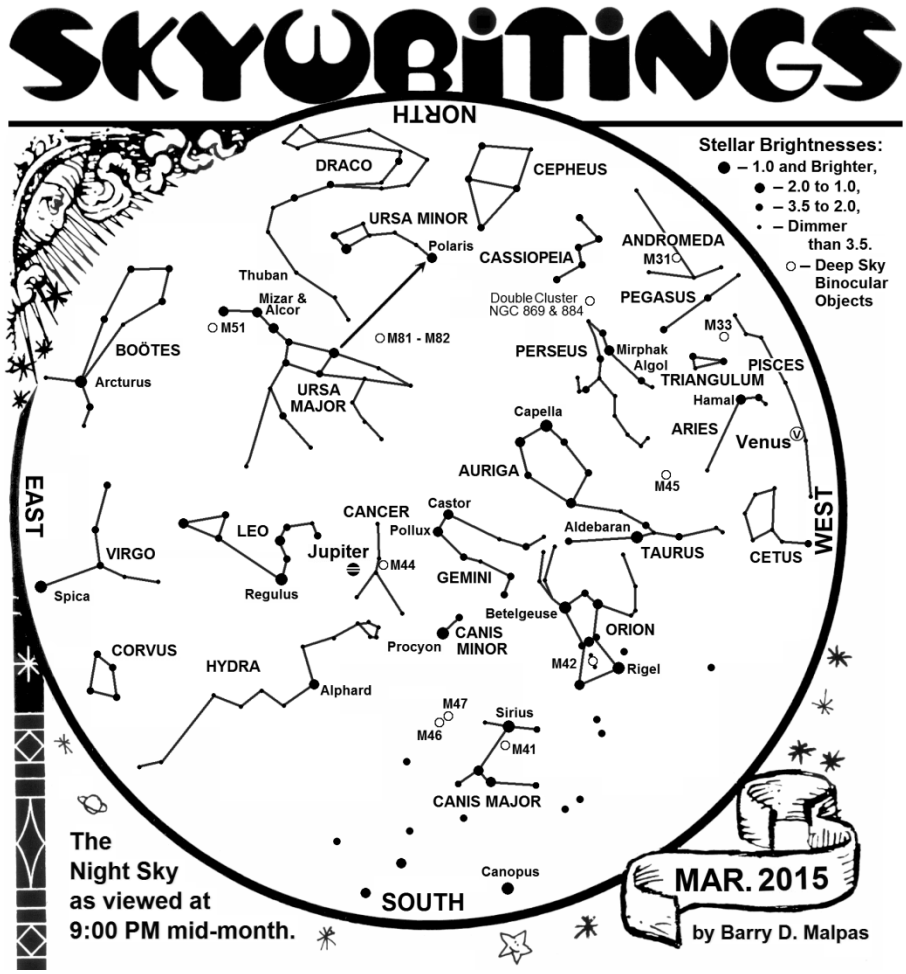
Origins of Our Earth-Moon System

By Barry D. Malpas – Special to the Williams-Grand Canyon News – 2015 March



Earth's nearest neighbor is just over a quarter of a million miles from us and has been the study of modern poets and astronomers, as well as ancient humans over the eons. It has evoked respect, wonderment, fear and curiosity, and appears in every early religion and culture due to its prominence and seasonal aspects. Humans have used its cycles to help gauge when to plant and when to harvest. In fact the 29.5 day lunar orbit is the reason our calendar has a dozen "moon-ths".

The two bodies are actually rather unique in the solar system since the size of the Moon is fairly large in comparison to its parent body. So, how could such an Earth-Moon arrangement have come about? Astronomers have suggested many theories over the centuries. The three most popular have been the following:

Co-Accretion Theory: Both Earth and Moon coalesced at about the same time, from basically the same material in the debris disk that existed around the Sun, forming our nearly double planet system.

Capture Theory: The Moon formed independently elsewhere in the Solar System and was captured by the Earth's gravity as it passed near the Earth.

Impact Theory: After Earth was partially formed it was struck a "glancing" blow from a Mars sized object, throwing material out into space which later coalesced to become the Moon.

When trying to prove, or disprove any Earth-Moon origin theory, astronomers must take into consideration a variety of known physical, geological, and chemical characteristics, both terrestrial and lunar. However, there is one very prominent physical difference between the two bodies. The density of the Earth is almost twice that of the Moon. That is, the Earth is made up of mostly metals, like Iron, while the Moon consists primarily of rocky material.

During the accretion period of the creation of planetary bodies, as material coalesces together due to the force of gravity, heavier material "sinks" to the center of a planet while lighter material tends to "float" to the surface. This is what produces the dense central heavy metal cores of planets with the less dense rocky material forming in the outer crust and mantle.

In the first two theories one would expect to find the densities of Earth and Moon to be similar since they would have formed out of basically the same material that surrounded the primordial Sun. For instance, the terrestrial planets Mercury, Venus and Mars each have densities not unlike that of Earth. However, the impact produced

by a glancing blow from a Mars sized object would have torn off much of the outer, and lighter, material from both planets. This reason alone suggests the Impact Theory as being the most plausible choice. This theory is also supported by the chemical analysis of lunar rocks.

Shooting the Moon

Due to the advent of digital cameras having a high megapixel resolution and fast image sensitivity (high ISO), anyone can take very good photographs of the Moon using only a pair of binoculars mounted on a tripod. This technique can even be done using a cell phone camera.

Set up your tripod and binoculars when the Moon is around first quarter (when the shadows of craters reveal their greatest detail.) Focus the binoculars on the Moon. Then hand-hold your camera lens right up to one of the eyepieces. Your camera will self-adjust for focus. If your camera has a telephoto capability you can also play with that feature to better match the optics and fill the frame, but take the entire Moon at once. You will be amazed at the detailed results you will get.