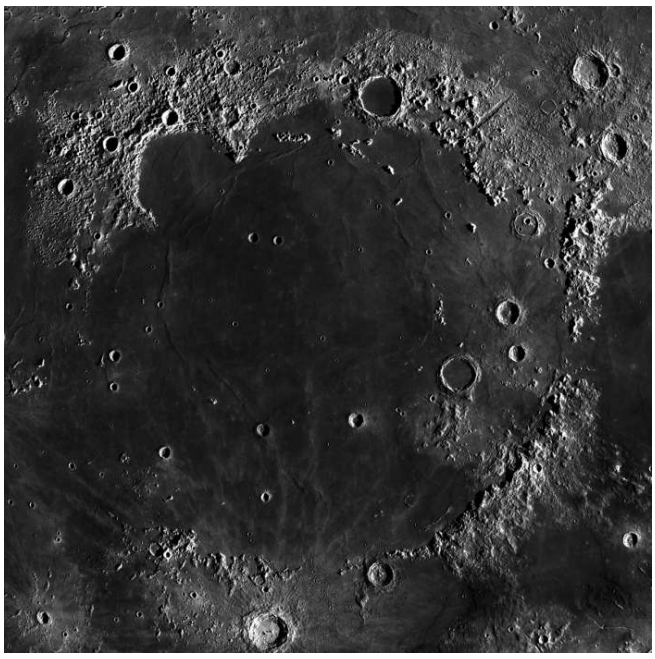
ORIGIN OF MARE IMBRIUM BASIN ON THE MOON

The Mare Imbrium – Latin for or Sea of Showers or Sea Rains – on the Moon.

Brown University astronomer **Peter Schultz** announced today (July 20, 2016) that the object that slammed into the moon 3.8 billion years ago to create the great, dark lava plain we call Mare Imbrium was a protoplanet sized object. That is, it was big – about twice as big and 10 times more massive than previous estimates – about 250 km in diameter. Schultz bases his estimate on hypervelocity impact experiments performed using the Vertical Gun Range at the NASA Ames Research Center, and on computer modeling. Schultz is the professor of Earth, environmental and planetary sciences at Brown University. He said in a statement:

> *We show that Imbrium was likely formed by an absolutely enormous object, large enough to be classified as a protoplanet. This is the first estimate for the Imbrium impactor's size that is based largely on the geological features we see on* the moon.



The Mare Imbrium basin on the moon– the Man in the Moon's right eye – might have been made by a protoplanet-sized impact, 3.8 billion years ago.

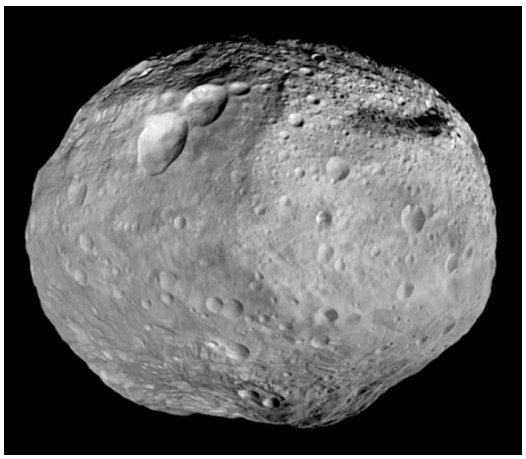
In theories of how solar systems are born, protoplanets are formed from smaller chunks of debris in the disks around young stars; protoplanets gradually coalesce to make the planets we see today.

Schultz said previous estimates of the size of Mare Imbrium were based solely on computer models and yielded a size estimate of only about 80 km in diameter. He also said that his new findings, which are published in the journal Nature, help to explain some of the puzzling geological features that surround Mare Imbrium.

His work suggests that – given the sizes of other impact basins in the Moon, Mars and Mercury – the early solar system must have been well stocked with protoplanet-sized objects, which he calls "the lost giants."

The Imbrium Basin measures about 1,200 km across. Grooves and gashes surround it, large enough to be seen with small telescopes, created by rocks blasted out of the crater when it was formed. Schultz suggest that these features, known as the Imbrium Sculpture, radiate out from the centre of the basin like spokes on a wheel Most of the spokes have been explained by other scientists, but some remained mysterious. Schultz used hypervelocity impact experiments with the Vertical Gun Range at the NASA Ames Research Center, which uses a 4.3 metre cannon to fire small projectiles at up to 26,000 km/hr.

With these experiments, Schultz was able to show that those grooves were likely formed by chunks of the impactor that sheared off on initial contact with the surface. The grooves created by those chunks are what let Schultz estimate the size of the impactor. **The key point is that the grooves made by these chunks aren't radial to the crater. They come from the region of first contact.** We see the same thing in other experiments on the Moon – grooves pointing up-range, rather than at the crater.



Asteroid Vesta could be one surviving example

Combining these new estimates with the fact that there are even larger impact basins on the moon and other planets, Schultz concludes that protoplanet-sized asteroids may have been common in the early solar system. He suggests that the large basins we see on the Moon and elsewhere in the Solar System are the record of those lost giants. AK, with EarthSky Notes