

Offered Title: Origin of Our Moon

Our Moon, The Moon, has been up there in the sky for longer than humans have been recording it on cave walls, on canvas, on film, on digital sensors. But, it appears, the Moon has not been there all the time. Was there was a time when our Earth had no Moon? Where'd it come from?

Before the late 1970s, the prevailing theory of our Moon's formation was it developed along with the Earth, in the accreting rocks, dust, and gas from our newly formed Sun. This theory assumed there was a separate source of material for the Moon and Earth and this material began revolving around an emerging Earth. If they formed together, then the Earth pretty much always had a moon.

Well, that theory came into question in a 1975 paper by William K. Hartmann and Donald R. Davis, published in the journal *Icarus*. Their paper extended research on planetesimals done by Soviet scientist V. S. Safronov. This paper started a new avenue of investigation by suggested a body, we call *Theia* and nearly as large as Mars, slammed into the young Earth, ripping a huge chunk of crust and mantle away. Why did they take such a radical departure from previous thinking? Because the Moon has very little iron in its core and it should have as much as Earth if it formed from the same basic material. Our Moon is made up of the same stuff as Earth's crust and mantle. This is evidence of a big wreck, but not big enough to dig up much iron from Earth's early core. Is it proof? No, but other evidence lends credence. For example, the Moon and Earth's crust/mantle have the same oxygen isotope ratios. That helps.

That also causes a conflict. If something crashed into Earth the resulting debris should be a mix, not exactly the same as Earth's. So, a modification of the theory has been proposed. Two bodies collided several times, the debris eventually coalescing into the Earth and Moon.

This means the Earth had no moon for a little bit, maybe a few hundred million years. The collisions would have been spectacular to see, OK, from a space ship, at a distance.

Other theories have come and gone.

Maybe the forming Earth spun so fast a bunch of material flew off and formed the Moon. This is consistent with the Moon's composition but falls apart when Earthly and Lunar angular momentums are examined. The energies required would result in a different Earth – Moon configuration.

What if the Moon formed somewhere else in the solar system, then captured by the Earth? Lunar oxygen isotopes match Earth's, but as of yet, no other solar system body.

How the Moon formed is not nailed down.

What's in the Sky?

July 31: Mars is closest to Earth and brilliant in the southeast after sunset.

August 1...: Mars, Saturn, Jupiter, and Venus grace the evening sky from east to west.