

Why are the full Moon and the Sun
the same apparent size?

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with assistance from
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Click these links for good photos of total solar eclipses:

www.jonah.dk/Astronomy/solar_eclipse_1_white.jpg
www.jonah.dk/Astronomy/solar_eclipse_2_white_2024.jpg
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www.jonah.dk/Astronomy/solar_eclipse_4_red_not_full.jpg

I've unsuccessfully tried to find out why the Sun and full Moon, when seen from the Earth, are the same apparent size. Here's how far I got.

At a first glance, it seems that science has ignored any possibility of a purpose or reason for this strange situation arising. But behind a "how", there's a larger context, something approaching a "why".

Webpages such as the following one attempt to answer this question, but not to my satisfaction -

<https://physics.stackexchange.com/questions/24912/can-the-apparent-equal-size-of-sun-and-moon-be-explained-or-is-this-a-coincidence>

Background scientific factors and findings:

The Sun's diameter is about 400 times larger than the Moon's, but the Sun is also about 400 times farther away than the Moon, so they look the same size to us. But the mathematical probability of these numbers being the same by random chance is thereby only 1 out of 400.

According to present theories, mainly based on analyses of lunar rock samples as compared to the Earth's matching inner components, about 4.4 billion years ago and about 100 million years after the Earth's formation, a smaller planet ("Theia") smashed into the Earth. The Moon coalesced from magma, dust, and debris ejected into space from that impact.

As seen from outside our North pole, the direction of spin and and revolution of both the Earth and Moon all go the same way, counter-clockwise.

When the Moon was only about 15,000 miles away, a day and night on Earth (its rotation period) took only 6 hours.

Geological evidence shows that 3 billion years ago, the Earth was covered by water, without continental separation at its surface.

The moon's gravity generates tides by pulling hardest on the side of Earth facing it. This attraction causes the Earth's malleable liquid oceans to bulge, and the Earth's center of gravity shifts along with the tides.

The Earth's stronger gravity tidally locks the Moon's spin in place, so that the same side of the Moon always faces the Earth.

But the Earth rotates much faster than the Moon orbiting it, so the watery tidal bulge travels ahead of the moon's relative position.

This displaced mass gravitationally tugs the Moon forward, giving it energy, and so the Moon's orbit has been widening or moving away from us - which in turn slows down the Earth's rotation period.

2½ billion years ago, when the Moon's orbit had reached 200,000 miles distance, the Earth rotated every 17 hours. Now it's 238,000 miles away, and the Earth rotates every 24 hours. It's still moving very slowly away.

The present pull of the Moon's gravity on Earth's oceans is about twice that of the Sun's pull. The variations in the directions of their combined, reinforcing, or opposing pulling causes the daily and 28-day high and low tidal changes along the Earth's locations.

The Moon's angle toward the Sun and revolving Earth, causes its perceived shapes during its growing 14-day cycle, its shrinking reverse twin, and at its full and darkened extremes.

The Anthropic thesis:

The religious anthropic presumption is that something in Nature has been created in order to benefit mankind's existence. In this case this planet's evolution of life, culminating in human superiority.

The line of argument here is that the quick turn-over tidal flows make a predictable ebb-and-flow water system for already existing aquatic life, and these churning currents encourage the life-forms' speedy manoeuvring, feeding, reproductive, etc.

interactions. The two-tides-per-day system further refines this dramatic flow, as do the major changes of light and temperature during the alternating days and nights.

The seasons' gradual temperature and overall weather changes are on the other hand advantageous to a gentler flow which encourages steady life-cycles and gradual evolution.

Living next to the beach as I do, I notice that tides are indeed very stimulating and helpful in the systematically fluctuating life-cycles of the water plants and animals, plus for their predators (thereby stimulating fast genetic mutations), and for the amphibious species.

Some of these aquatic-forms will try and be able to escape or spread onto emerging land, and then evolve further there.

In other words, the anthropic solution is that the Moon's life-cycle evolved as it did in order to make ideal conditions for biological life's evolution here, as a pre-condition for the culminating human take-over from this assumed hierarchy's assumed peak position.

The Animistic hypothesis:

Animism holds that all things in Nature have a living spirit, and that these spirits can be contacted.

I think that the Gaia theory by chemist James Lovelock convincingly demonstrates that within its top layers, this planet's many inorganic and organic systems interact so precisely together, in a coordinated and self-regulating way which maintains conditions favorable for life, that the total combination acts as a single living entity. I likewise personally assume that the Sun and all the parts of its solar system are an intelligently interacting system.

Here's a thought: Perhaps intelligences within stars, surrounded by materials for exo-planets, aid in forming the astronomical developments of their coalescing dependent planets with their moons, in order to favour conditions for the development of lesser intelligences among their formed planets.

If that was the case, you would find relevant moons-to-mother-planet ratios for the other planets in our solar system too. Other planets will have their own tidal movements of their elements. Their moons' combined ratios would be best for possible gaseous, liquid, crystalline, etc. life-forms evolving there, which we have not as yet developed the tools to discover and document.

But neither do these general, animistic influences and adaptations specifically explain why, from our viewpoint, our Sun's and Moon's sizes and distances were earlier so apparently similar and are presently almost perfectly congruent. So I'm nearly "back to start".

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Mickey's comment:

I'm afraid it will take a lot more digging to get reasonably close to the explanation of the apparent similar size of the Moon and Sun when viewed from Earth.

"Time" is probably a major part of the answer because likely in the far past, the sizes and behaviors of the Sun, Moon and Earth weren't the same as now, and won't be in the far future. We happen to be alive at a time when they appear the same.

As for plant and animal evolution, if the Earth had continued to be covered with water, few if any organisms would have evolved to be strictly territorial. If any did, they wouldn't have survived, although we might find fossil traces of some that appeared to go in that direction...lungs, legs, hair. Or if oceanic debris had coalesced into floating islands, something adapted to that might have arose. A lot like what would happen to humans if life reverted to the days of living in temporary spaces like yurts, hotels or airbnb's instead of houses and apartment buildings. That's a long story.

Why would Nature's fluctuations promote or be necessary for steadiness in life-cycles? Freshwater life and perhaps salt-water life may not require tides at all. So a question is, where did the idea come from that aquatic life needed tides?

Is cognition necessary for evolution?

Evolution occurs because it genetically can occur, and to the survivors, did occur.

The Earth is only minimally, literally and superficially a combination of inorganic and organic systems; below the surface, the Earth is exclusively inorganic. In that way, "Gaia" is a fashionista, feel-good theory to persuade people to stop polluting. It is not a cosmic theory.

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(my rejoining remark)

Most animal biomass lives in water. Land-based living is not a prerequisite for animal evolution. Tails in water give much more maneuverability than legs on land, and breathing through gills is effective. For many species, territorial environments under water are prevalent.

As an exception, the mammals returning from land to water (whales, sea turtles, etc.), have had the cognitive advantage of having had many experiences from two very different environments. Regarding homo sapiens' vanity, there is much documentation by John Lilly and others for the superiority – according to the man-made definitions of a complex developed language, social and ethical behavioural patterns, comparative neo-cortex brain size, etc. - of dolphins over human beings.

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Mickey's comment:

Despite the apparent coincidence (or intention) of the Moon disk size being sized to cover the Sun's appearance, it's not like that with the Earth's shadow on the Moon during lunar eclipses. The Earth's shadow is much larger in diameter. What would you say about that, from an anthropic and/or animistic point of view?

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Click these links for good photos of total lunar eclipses:

https://airandspace.si.edu/sites/default/files/styles/body_large/public/images/events/WEB11716-2010_640_0.jpg?itok=c0C9B2MD

https://images.telescope.com/get/ap1870_8282007.jpg

https://www.skyandtelescope.com/wp-content/uploads/2015-09-28_56096c7454e69_1eclipse092715.jpg

https://nineplanets.org/wp-content/uploads/2020/11/0415Eclipse_Hallas.jpg

Background scientific factors and findings:

Moon's early magnetic field shared with Earth

The movement of liquid iron and nickel deep inside the Earth, still flowing because of the heat left over from Earth's formation, generates the magnetic fields that make up the magnetosphere, a protective bubble surrounding Earth and its life-forms.

The Earth's mantle regularly deforms elastically, due to tidal effects caused by the Moon. This effect could continuously stimulate the motion of the liquid iron and nickel alloy making up the Earth's outer core, thereby maintaining the Earth's magnetic field.

The iron and nickel, or for that matter the oxygen in water and air, had to have come from hotter, previously exploded stars, nor from our Sun.

Retrieved rocks from the Moon, show that it used to also have a magnetic field, which shielded both itself and the Earth in their early years, while earthling microbes were just beginning to develop.

Bacteria have lived on Earth for about 3.5 billion years. Some kinds of bacterial spores can feed on and be transported through outer space in meteors and asteroids, and turn inorganic materials into food for organic life. Some can lie dormant under extreme conditions for at least 100 million years, and then start metabolising again when exposed to nutrients or water.

The Earth and its Moon both had magnetic fields connected in the polar regions of each object, which helped protect their atmospheres from streams of damaging solar particles from the volatile young Sun.

Billions of years ago, their magnetospheres were also connected together as a larger system, and importantly for the evolution of the Earth, the high-energy solar wind particles could not completely penetrate the coupled, strengthened magnetic field and strip away the atmosphere.

The Moon, as a neighboring shield, may have thus helped our planet to retain its atmosphere and eventually go on to develop habitable conditions and life.

The recent search for exoplanets with life, now includes looking for such attendant moons, which strengthen the planet's magnetic field.

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(my remarks:)

Intelligent hierarchy hypothesis:

There's an obvious hierarchy.

The Sun-to-Moon present ratio of 400:1 implies that the more powerful Sun has mainly determined the resonating geometrical similarity of the Moon's size and distance from it. By forming the Moon's allotted size out of the debris material encircling the Earth after the collision. The lack of simple geometrical ratios between the Moon and Earth, obvious during a lunar eclipse, underlines the Moon's

primary subordination to the Sun, not the Earth, concerning its size.

The Earth's stronger gravity keeps the Moon around, and the combined Earth-Moon gravity system controls the Moon's progressive distance from the Earth.

But the Moon is definitely subordinate to the Earth. The Moon turns very nearly equally to the Earth's own rotation (which changes through time), and thereby keeps the same face pointing towards us.

The Moon is made out of ejected material from the Earth, plus dispersed leftovers from the planet which hit the Earth. Being of the same materials and cruising so close together, the Moon and Earth would be amenable to a mutual attraction on several levels, to another kind of resonance.

About the pace of evolution of life-forms. Shots in the dark...

The Moon's light is our weak sunlight at night. Getting continual sunlight in its various wavelengths would seem to be essential to most local, larger life-forms, which if facing the darkness half their lives, might be much less nourished and have to hibernate more often. The Moon's set up of our circulating tides takes extra care of more sunlight-deprived, water-based life-forms.

Even if the Earth faced only the light of the other planets all night, that's still reflected sunlight, combining with the elements in their systems. Living under farther off star-light alone, might be too distant and weak to nourish local, larger species. Bacteria and other small creatures would make it.

Organic and Non-organic intelligence:

The main question is, does the intelligent practical use of physics and chemical reactions, among other laws of nature, happen on purpose, since it's so statistically improbable that the inter-balancing conditions in nature just turn out right by random chance? (Back to the Moon-Sun 400 to 1 unlikelihood.)

With this intelligent series of choices being either set in motion by inborn intelligence within the involved bodies – and we have created no material tools to discover that ability (although some specialists do have subjective, non-material tools) – as in: Do astronomical bodies themselves intelligently coordinate their reactions, like the spontaneous choices or well-studied patterns in a dance? Or have these solutions and reactions previously been planned by an external creator or aware programmer, to fit the situations which might turn up – as in: Has the Sun

itself intelligently formed its solar system?

But these animistic possibilities come to much the same thing, for if the Sun has a realm of intelligence with a greater overview, why shouldn't the Earth have intelligence on a smaller scale, then the Moon, and so on, in a Russian nesting-dolls system, down to sub-atomic particles and beyond?

Are there other forms of intelligence and consciousness at several stations between chance and purposefully done actions? For example, instinct ("It's just their instinct"), which is just earlier conscious choices and concentrated efforts become unconscious habits which pop up quicker than conscious deliberation, for here-and-now survival. Higher intuition is lightning-speed perception through more finely developed biological senses. Lower intuition from the solar plexus ("my gut feeling") mixes emotional needs into what's sensed.

We humans have the anthropic presumption's prejudice that the action of our bicameral brain (mostly working on the principle of only on-off, and highly influenced by the chemical input from our often irrational hormones, rather than using a more fluid scale including the overview of higher intuition, received revelation, empathetic overview, etc.) is the objective definition of consciousness or intelligence, and that all those unlike us are mentally inferior. (This arrogant sort of thinking has led us to our recent shortening proximity to collective global suicide.)

Perhaps the Sun's collective consciousness in turn assumes that anything with as limited a sensory system as ours can only reach an automatic consciousness with a very limited scope? But it passes on its powerful energy in all directions, so maybe its attitude toward us is more generous than that?

Maybe one needs a conscious view way beyond the modes of our normal physical brain to find out why the Sun-Moon-Earth have set up the incredible overlapping of the Full Moon's and Sun's shapes at the Earth's distance.

Another starting point: What functions are temporarily eliminated during a full Solar eclipse?

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