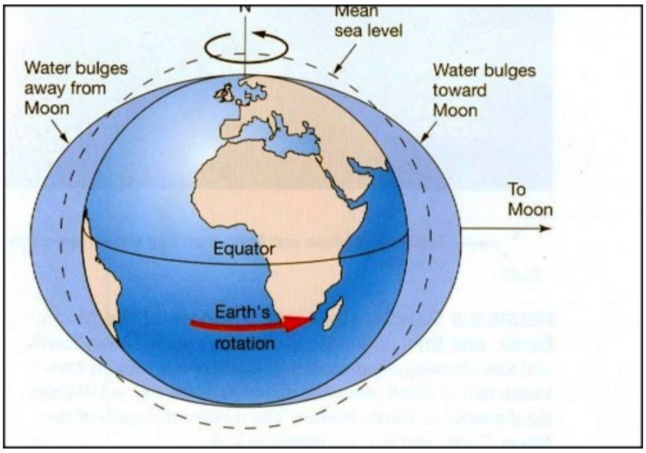
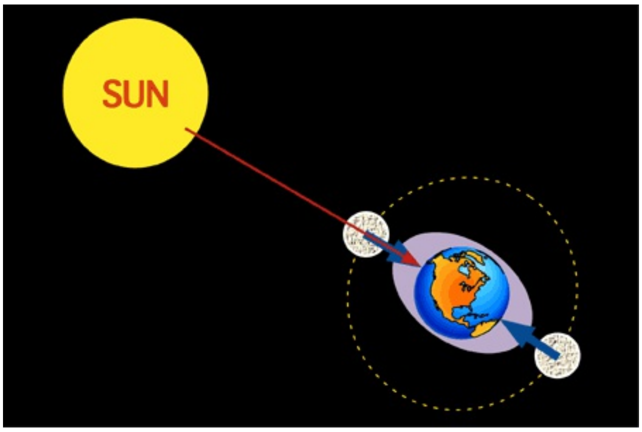
SUPER-MOON AND OCEAN TIDES

Expect higher-than-usual tides a day or two after the February 19, 2019, and the supermoon.

In most places, but not everywhere, there are two high tides and two low tides a day. The difference in height between high and low tides varies, as the Moon waxes and wanes from new to full and back to new again. The Moon and Sun are primarily responsible for the rising and falling of ocean tides. However, for any particular spot on Earth's surface, the height of the tides and their fluctuation in time also depend on the shape of your specific beach and the the angle of the seabed leading up to your beach, plus your larger coastline and the prevailing ocean currents and winds.
All of that said – in the day or two following the February 19 supermoon, which happens to be 2019's biggest supermoon (the full Moon closest to perigee this year) – you can expect higher-than-usual tides.

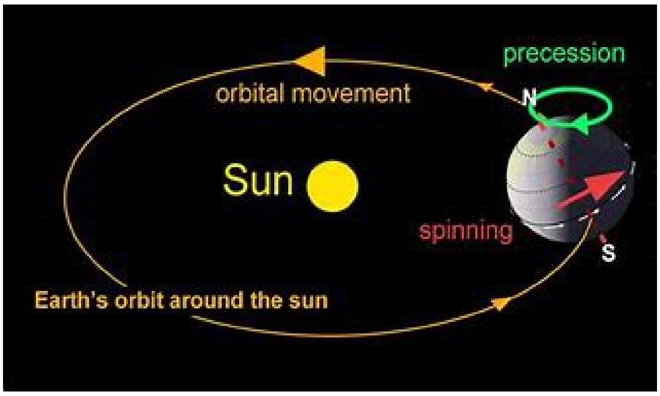


Around each new moon and full moon – when the Sun, Earth, and Moon are located more or less on a line in space – the range between high and low tides is greatest. These are called spring tides. Here is some background. What are spring tides? Around each new Moon and full Moon, the Sun, Earth, and Moon arrange themselves more or less along a line in space. Then the pull on the tides increases, because the gravity of the Sun reinforces the Moon's gravity. In fact, the height of the average solar tide is about 50 percent of the average lunar tide.
Thus, at new Moon or full Moon, the tide's range is at its maximum. Spring tides are not named for the season. This is spring in the sense of jump, burst forth, rise.
So spring tides bring the most extreme high and low tides every month, and they always happen – every month – around full and new Moon. But since, in recent years, these close new or full moons have come to be called supermoons, it's also likely some are already calling them supermoon tides, and we've also heard the term king tides.
Why are the tides at their strongest around supermoons? It's simply because the Moon is at its closest to Earth, and thus the Earth's oceans are feeling the pull of the Moon's gravity most powerfully. Should you expect these extra-high tides on the exact day of a supermoon? Probably not. The highest tides tend to follow the supermoon (or any full moon) by a day or two.
Do the most extreme high tides always occur at supermoons? Not necessarily. It's when a spring tide coincides with a time of heavy winds and rain – flooding due to a weather extreme – that the most extreme flooding occurs.



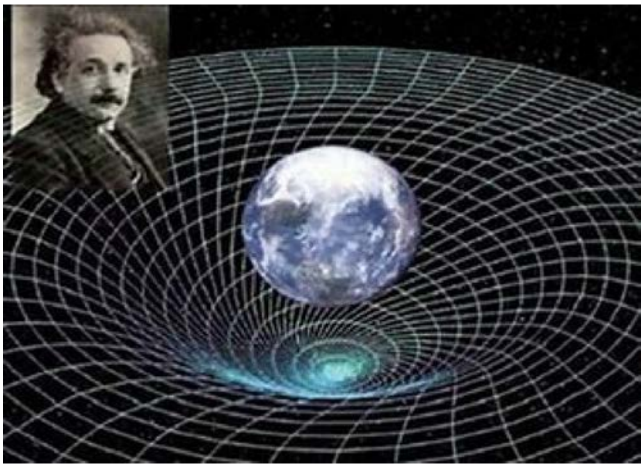
The Son and the Moon acting on the Earth together

What part does the Sun play, in 2019? Not only the Moon, but also the Sun plays a role in Earth's tides. You might see that – when Earth is closest to the Sun, as it is every early January – the pull on Earth's tides by the Sun is strongest. We reached Earth's closest point to the sun for 2019 on January 3, at 5:20 UTC. Astronomers call this special point in our orbit perihelion, from the Greek roots peri meaning near and helios meaning Sun.



It’s February now, and we’re getting slightly farther from the Sun each day. Still, we’re closer to the Sun now than we will be in July (when Earth reaches aphelion, its farthest point).

Around each first quarter Moon and last quarter Moon – when the Sun and Moon are at a right angle to Earth – the range between high and low tides is least. These are the neap tides. Neap tides occur halfway between each new and full Moon – at the first quarter and last quarter moon phase – when the Sun and Moon are at right angles as seen from Earth.
Earth has two tidal bulges, one on the side of Earth nearest the Moon (where the Moon’s gravity pulls hardest), and the other on the side of Earth farthest from the Moon (where the Moon’s gravity pulls least).
Why are there two high tides and two low tides each day? If you picture the part of Earth closest to the Moon, it’s easy to see that the ocean is drawn toward the Moon. That’s because gravity depends in part on how close two objects are. But then why – on the opposite side of Earth – is there another tidal bulge, in the direction opposite the Moon? It seems counterintuitive, until you realize that this second bulge happens at the part of Earth where the Moon’s gravity is pulling the least.
Earth spins once every 24 hours. So a given location on Earth will pass “through” both bulges of water each day. Of course, the bulges don’t stay fixed in time. They move at the slow rate of about 13.1 degrees per day – the same rate as the monthly motion of the Moon relative to the stars. Other factors, including the shape of coastlines, etc., also influence the time of the tides, which is why people who live near coastlines like to have a good tide almanac.



After working with Gravity for close to 400 years it comes as a surprise to us that we still don’t know what it actually is. Newton publicized his Theory of Universal Gravitation in the 1680s. It basically set forth the idea that gravity was a predictable force that acts on all matter in the universe, and is a function of both mass and distance. The theory states that each particle of matter attracts every other particle with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.
Einstein then, 100 years ago, found out that small discrepancies could only be explained by assuming Gravity to be an interaction between Mass and the Space-Time around it. Through Gravity Mass actually curves the space around itself, and it affects time. The Tides on Earth as explained above, are a visible sign of Gravity at work. In a rotating body of mass, like the Moon in its orbit around Earth, Gravity causes stresses in the structure of the body trying to balance the differences between near and far side around the centre of the Moon, which on Earth causes the visible tides. These stresses use up rotational energy and eventually cause rotation of a body to stop completely. That is why today the Moon always shows the same face towards the Earth, over time it became gravitationally locked to us. The Earth still rotates in its orbit around the Sun, giving us day and night, because it is so much larger than the Moon. But even there the slowing down effect is measurable.

So, while Gravity works extremely well in the Solar System just around us, why does it seem to fail when applied to large collections of stars and Galaxies? There, there does not seem to be enough matter for Gravity to hold it all together. Dark Matter had to be invented to make up the difference there. So, what is Dark Matter? More questions. What are we missing?
For me, gravity is a property of space, that it is competing with matter for the space occupied. It is trying to eliminate the invasive matter (Mass) that is using the space. Or at least contain it to the smallest area possible. The force is equivalent to the density of matter as compared to empty space.

AK, with EarthSky and Wikipedia Notes