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It is surrounded by a thin disk of dust, gas and little bits called planetesimals that range in size from grains of sand and large rocks to objects the size of mountains. Astronomers are pretty sure the disk formed from material left over when the star was born 20 million years ago. Every star is born from a cloud of gas and dust that moves through space surrounded by other similar clouds. The force of gravity causes these clouds to tug on one another as they pass, which makes them slowly rotate. Even when one of these clouds collapses to form a star, it continues to rotate. The star forms, spinning at the center of a flat pancake of rotating gas and dust called a protoplanetary disk. All of it — the star, the gas, the dust — spins in the same direction. Astronomers think that our solar system looked a lot like Beta Pictoris in its early years. We think that inside the disk, the gas and dust can stick together in a process called accretion. As a baby planet starts to grow, it gets heavier, and its gravity attracts more and more little pieces. When the baby planet gets massive enough, the force of gravity begins crushing it, making it denser. Because of the force of gravity, the planet spins faster, like an ice skater drawing in her arms to spin. Rising pressure in the core then causes the core to melt. Denser materials sink toward the core, and lighter materials float to the planet's surface. We end up with a planet with an iron core surrounded by rock, and maybe water and ice on the outer edges. That's what we see in our solar system. If you're the kind of person who gets a lot done, you're grateful for every second of the 86,400 seconds that make up a day. On July 9, however, as well as on July 22, and August 5, you won't get your full complement of seconds. On these days the Earth will be measurably—and, so far, unaccountably— accelerating its rotation, shaving from 1.3 to 1.5 milliseconds off of the usual 24 hours the typical day gets. A millisecond, or one thousandth of a second, is admittedly not much—an eyeblink takes about 100 milliseconds. But with atomic clocks tracking the Earth's rotational speed so closely that once every year and a half or so, the International Earth Rotation and Reference Systems Service (yes, there is such a thing) has to add a leap second to the year to account for any increase in the planet's speed, every millisecond counts. So what's behind the sudden speed-up and what effect could it have?The shortest day in historyAround the world, there are 450 atomic clocks in operation, tracking the time with an accuracy that sees them gaining or losing only about 1 second every 100 million years. The clocks exist for more than just tidy temporal bookkeeping. Everything from weather satellites to GPS satellites to telecommunications to nuclear missiles and other weapons of war rely on precise timing to operate properly. So when both astronomers and the operators of the clocks notice that the atomic ticks are falling out of step with the rotation of the Earth, people take notice.The shortest day ever recorded since atomic clocks went into operation in the 1950s occurred last year, on July 5, according to Date and Time, when the Earth shaved off 1.66 milliseconds. Three years earlier, on June 30, 2022, things moved similarly quickly, when the day came in 1.59 milliseconds under the 24-hour wire. But with three short days predicted over the next few weeks by astronomers and clock watchers, this summer is something even more rare.What makes Earth spin faster?There are a number of reasons the Earth may be changing its speed this way. But it's not clear yet just which explanation is responsible this time.The likeliest cause is the position of the moon. Lunar distance is an always-changing thing, with the moon tracing an elliptical orbit around the Earth. At its closest approach—or perigee—the moon is only 224,000 miles distant. At its furthest—or apogee—that gap widens to 251,655 miles. On the three speedy days this summer, the moon will be at or near apogee—which is a puzzle, since lunar gravity is such that the Earth tends to slow down, not speed up, when the moon is farther away. The moon's orbit is not only elliptical, however, but cockeyed too, angled anywhere from 18° to 28° relative to the Earth's equator. The sharper that angle is the faster the Earth orbits, with lunar gravity in this case speeding things up, countering the braking effect that lunar apogee usually applies. On the three days in question this summer, the moon will be close to its 28° peak.The moon is not the only thing that can shorten earthly days. Earthquakes can too, redistributing subterranean mass and causing the planet to accelerate or to slow down in the same way a figure skater can change the speed of her spin when she tucks in or extends her arms. In 2005, an earthquake in Indonesia shifted the Earth's polar mass about one inch toward the east, decreasing the length of a day by 2.68 microseconds—or millionths of a second. No significant earthquake has occurred recently, however, ruling temblors out as the cause of the current speed up.Climate change—again and seemingly always—may play a role too. Last year, two NASA-funded studies found that since 2000, melting glaciers have caused the axis of the planet—or the centerpoint of its spin—to shift by about 30 ft., changing the speed of rotation. The catch is, in this case the change causes the planet to decelerate, not speed up—by about 1.33 milliseconds per century. If warming continues at its present pace, it is projected to increase the length of our days by 2.62 milliseconds by the end of the century.Other factors, including rising ocean levels and the warming—and thus swelling—of the atmosphere can make a difference too, slightly increasing planetary circumference. Even the springtime blossoming of trees can play a role. "In northern summer, the trees get leaves," geophysicist Richard Holme of the University of Liverpool told Live Science. "This means that mass is moved from the ground to above the ground—further away from the Earth's spin axis." In all of these cases too, however, the effect is to slow the Earth, not speed it up.So that brings scientists back to lunar gravity as the cause of the current acceleration—and that's a reason not to fret the slightly shorter days. Earth and the moon have been doing their dance for the better part of 4.5 billion years, and it's always been a stable one. Here's betting they've got a few billion more years yet in their. Earth spins because of the way it was formed. Our Solar System formed about 4.6 billion years ago when a huge cloud of gas and dust started to collapse under its own gravity. As the cloud collapsed, it started to spin. Some of the material within this cloud gathered into swirling eddies and eventually formed into planets. As the planets formed, they kept this spinning motion. This is similar to what you see when skaters pull in their arms and spin faster. As material gathered in more closely to form a planet, like Earth, the material spun faster. The Earth keeps on spinning because there are no forces acting to stop it. Page 2 The Earth is made out of many things. Deep inside Earth, near its center, lies Earth's core which is mostly made up of nickel and iron. Above the core is Earth's mantle, which is made up of rock containing silicon, iron, magnesium, aluminum, oxygen and other minerals. The rocky surface layer of Earth, called the crust, is made up of mostly oxygen, silicon, aluminum, iron, calcium, sodium, potassium and magnesium. Earth's surface is mainly covered with liquid water and its atmosphere is mainly nitrogen and oxygen, with smaller amounts of carbon dioxide, water vapor and other gases. Page 3 Earth's circumference (the distance all the way around the equator) is 24,901 miles (40,075 kilometers). Its diameter (the distance from one side to the other through Earth's center) is 7,926 miles (about 12,756 kilometers). Earth is slightly smaller when measured between the North and South Poles which gives a diameter of 7,907 miles (12,725 kilometers). Earth bulges out a bit more around the equator than around the poles because of its rotation (spin). Continue reading NARRATOR: Earth experiences two different motions, rotation and revolution. Earth spins on its axis, and it takes one day to do so. In one day Earth makes one rotation on its axis. Earth also travels on an elliptical orbit around the Sun. And it takes one year to make a complete trip. In one year Earth makes one revolution around the Sun. This story was updated at 9:40 a.m. E.D.T. on Monday, Sept. 10 Every day, the Earth spins once around its axis, making sunrises and sunsets a daily feature of life on the planet. It has done so since it formed 4.6 billion years ago, and it will continue to do so until the world ends — likely when the sun swells into a red giant star and swallows the planet. But why does it rotate at all?The Earth formed out of a disk of gas and dust that swirled around the newborn sun. In this spinning disk, bits of dust and rock stuck together to form the Earth, according to Space.com, a sister site of Live Science. As it grew, space rocks continued colliding with the nascent planet, exerting forces that sent it spinning, explained Smadar Naoz, an astrophysicist at the University of California, Los Angeles. Because all the debris in the early solar system was rotating around the sun in roughly the same direction, the collisions also spun the Earth — and most everything else in the solar system — in that direction. [Photo Timeline How the Earth Formed] You may like But why was the solar system spinning in the first place? The sun, and the solar system, formed when a cloud of dust and gas collapsed due to its own weight. Most of the gas condensed to become the sun, while the remaining material went into the surrounding, planet-forming disk. Before it collapsed, the gas molecules and dust particles were moving all over the place, but at a certain point, some gas and dust happened to shift a bit more in one particular direction, setting its spin in motion. When the gas cloud then collapsed, the cloud's rotation sped up — just as figure skaters spin faster when they tuck their arms and legs in.Because there isn't much in space to slow things down, once something starts rotating, it usually keeps going. The rotating baby solar system in this case had lots of what's called angular momentum, a quantity that describes the object's tendency to keep spinning. As a result, all the planets likely spun in the same direction when the solar system formed.Today, however, some planets have put their own spin on their motion. Venus rotates in the opposite direction as Earth, and Uranus' spin axis is inclined 90 degrees. Scientists aren't sure how these planets got this way, but they have some ideas. For Venus, maybe a collision caused its rotation to flip. Or maybe it began rotating just like the other planets. Over time, the sun's gravitational tug on Venus' thick clouds, combined with friction between the planet's core and mantle, caused the spin to flip. A 2001 study published in Nature suggested that gravitational interactions with the sun and other planets might have caused Venus' spin to slow down and reverse.In the case of Uranus, scientists have suggested that collisions — one huge impact with a big rock or maybe a one-two punch with two different objects — knocked it off kilter, Scientific American reported.Get the world's most fascinating discoveries delivered straight to your inbox.Despite these kinds of disturbances, everything in space rotates in one direction or another. "Rotating is a fundamental behavior of objects in the universe," Naoz said.Asteroids rotate. Stars rotate. Galaxies rotate (it takes 230 million years for the solar system to complete one circuit around the Milky Way, according to NASA). Some of the fastest things in the universe are dense, whirling objects called pulsars, which are the corpses of massive stars. Some pulsars, which have a diameter about the size of a city, can spin hundreds of times per second. The fastest one, announced in Science in 2006 and dubbed Terzan 5ad, rotates 716 times per second.Black holes can be even faster. One, called GRS 1915+105, may be spinning anywhere between 920 and 1,150 times per second, a 2006 study in the Astrophysical Journal found.But things slow down, too. When the sun formed, it spun around its axis every four days, she said. Its magnetic field interacts with the solar wind to slow its spin, Naoz said.Even Earth's rotation decelerates. Gravity from the moon pulls on Earth in a way that ever so slightly slows it down. A 2016 analysis in the journal Proceedings of the Royal Society A of ancient eclipses showed that Earth's rotation slowed by 1.78 milliseconds over a century.Still, you don't have to worry about Earth or the sun stopping. "It's only going to stop it," Naoz said. "The Earth would continue to spin even if you would stop it." Originally published on Live Science.Editor's Note: This story was updated to remove an incorrect calculation. Earth's rotation did not slow down by 6 hours over the last 2,740 years. From the November 2019 issue Betty Lou Bose York, Pennsylvania By Astronomy Staff | Published: November 8, 2019 | Last updated on May 18, 2023 Planets inherit spin from the rotating cloud of material they form from. Objects keep spinning unless something slows them down. Friction usually slows spinning objects on Earth, but space is different. Earth's spin is gradually slowing due to the Moon and Sun's gravity. The planets in our solar system formed from the solar nebula of gas and dust that surrounded our infant Sun. The material in this nebula was spinning; as the planets formed from this material, they, too, were spinning. Objects in motion will stay in motion unless an outside force acts on them. In most everyday applications on Earth, friction counteracts motion by slowing things down, so energy must be added to keep an object moving (or spinning). Our planet doesn't slow down much simply because there is almost nothing stopping it from continuing to spin. But there are factors slowing it down, as well as speeding it up. The collision that formed the Moon added rotational energy to the planet, making Earth's day only about five hours long. Over time, tides raised on Earth by gravitational interactions with the Moon and, to a much lesser extent, the Sun, have slowed our planet's rotation to the 24-hour day we now experience. Current measurements show the effects of the Sun and Moon are slowing Earth's rotation at a rate of about 2 milliseconds every 100 years. Alison Klesman Associate Editor [embed] In a classic episode of this video series, I did the calculations for how fast the Earth is spinning. We know the Earth is rotating, but why? Why is it spinning? Why is everything in the Solar System spinning? And why is it mostly all spinning in the same direction? It can't be a coincidence. Look down on the Earth from above, and you'd see that it's turning in a counter-clockwise direction. Same with the Sun, Mars and most of the planets. 4.54 billion years ago, our Solar System formed within a cloud of hydrogen not unlike the Orion Nebula, or the Eagle Nebula, with its awesome pillars of creation. Then, it took some kick, like from the shockwave from a nearby supernova, and this set a region of the cold gas falling inward through its mutual gravity. As it collapsed, the cloud began to spin. Why? It's the conservation of angular momentum. Think about the individual atoms in the cloud of hydrogen. Each particle has its own momentum as it drifts through the void. As these atoms glom onto one another with gravity, they need to average out their momentum. It might be possible to average out perfectly to zero, but it's really really unlikely. Which means, there will be some left over. Like a figure skater pulling in her arms to spin more rapidly, the collapsing proto-Solar System with its averaged out particle momentum began to spin faster and faster. This is the conservation of angular momentum. As the Solar System spun more rapidly, it flattened out into a disk with a bulge in the middle. We see this same structure throughout the Universe: the shape of galaxies, around rapidly spinning black holes, and we even see it in pizza restaurants. The Sun formed from the bulge at the center of this disk, and the planets formed further out. They inherited their rotation from the overall movement of the Solar System itself. Over the course of a few hundred million years, all of the material in the Solar System gathered together into planets, asteroids, moons and comets. Then the powerful radiation and solar winds from the young Sun cleared out everything that was left over. Without any unbalanced forces acting on them, the inertia of the Sun and the planets have kept them spinning for billions of years. And they'll continue to do so until they collide with some other object, billions or even trillions of years in the future. So are you still wondering, why does the Earth spin? The Earth spins because it formed in the accretion disk of a cloud of hydrogen that collapsed down from mutual gravity and needed to conserve its angular momentum. It continues to spin because of inertia. The reason it's all the same direction is because they all formed together in the same Solar Nebula, billions of years ago. iStockphoto We spend our lives on a spinning globe—it takes only 24 hours to notice that, as night follows day and the cycle repeats. But what causes Earth to rotate on its axis? The answer starts with the forces that formed our solar system. A fledgling star gathers a disk of dust and gas around itself, says Kevin Luhman, an assistant professor of astronomy at Penn State. As things coalesce, the star's gravitational orbit sets that dust and gas to spinning. "Any clump that forms within that disk is going to naturally have some sort of rotation," Luhman says. As the clump collapses on itself it starts spinning faster and faster because of something called conservation of angular momentum. Figure skaters exploit this law when they bring their arms closer to their bodies to speed up their rate of spin, Luhman explains. Since gravity pulls inward from all directions equally, the emerging clump, if massive enough, will eventually become a round planet. Inertia then keeps the planet spinning on its axis unless something occurs to disturb it. "The Earth keeps spinning because it was born spinning," Luhman says. Different planets have different rates of rotation. Mercury, closest to the Sun, is slowed by the Sun's gravity, Luhman notes, making but a single rotation in the time it takes to orbit the Sun 58 times. Other factors affecting rotational speed include the rapidity of a planet's initial formation (faster collapse means more angular momentum conserved) and impacts from meteorites, which can slow down a planet or knock it off stride. Earth's rotation, he adds, is also affected by the tidal pull of the Moon. Because of the Moon, the spin of the Earth is slowing down at a rate of about 1 millisecond per year. The Earth spun around at a faster clip in the past, enough so that during the time of the dinosaurs a day was about 22 hours long. In addition to slowing the Earth's rotation, the Moon's tidal pull is causing the Moon to slowly recede from the Earth, at a rate of about 1 millimeter per year. In the distant past, the Moon was closer. "It would have appeared much larger in our sky than it does now," Luhman says. Millions of years from now, he adds, the cycle of a day on Earth will likely stretch to 25 or 26 hours. We'll have to wait a little longer for the true death of the sun. Kevin Luhman, Ph.D., is assistant professor of astronomy and astrophysics in the Eberly College of Science. He can be reached at kluhman@astro.psu.edu. The Chandler wobble is the change in the spin of Earth on its axis. photo/ideostock / Getty Images The Chandler wobble is the change in the spin of Earth on its axis. Think of the wobble you see in a toy top when it first starts spinning or slows down. This "poles" do not spin in a perfectly straight line. The displacement of the Chandler wobble is measurable -- Imagine a gigantic ballpoint pen poked through the center of the earth, entering at the South Pole and exiting at the North Pole. Imagine the pen is drawing on a scratch pad-equipped space station directly over the North Pole. After a day (one full rotation of the earth on its axis) the ballpoint pen draws a circular path, and not a dot, because of the "wobble" in the earth's rotation on its axis. (A Doodletop, a toy drawing tool that is a pen attached to a top, draws the same sort of path.) Over 14 months the pen draws a spiral path similar to this drawing. The American astronomer Seth Carlo Chandler discovered the wobble in the late 1800s. The exact cause of the wobble in Earth's polar motion has stumped scientists with few agreeing on the actual cause, other than the fact that the Earth is not a perfect sphere. There are theories about the cause of the Chandler wobble, and you can decide which one makes the most sense. Some of the most recent conjectures include the constant winds over the oceans pushing varying amounts of water on the earth at one time or even the effects of a major earthquake. This article talks about one of the most recent theories, which attributes most of the wobble to pressure changes in the ocean. The chandler wobble doesn't really have any effect on most people. The people who live with it on a daily basis are astronomers using earth-based telescopes and people using various navigation systems. With telescopes, the wobble affects the ability to point at a star accurately. The Chandler wobble also affects celestial navigation, since the latitude does change over a period of 14 months. Global Positioning Systems, (GPS), can overcome the effect of the wobble on navigation. Navigators' star charts, however, still have to be updated to show the new reference point for the geographic North and South Poles. The magnetic North Pole, used by a compass, is not affected. Here are some interesting links: Ever feel like there's just not enough time in the day? Turns out, you might be onto something. Earth is rotating faster than it has in the last half-century, resulting in our days being ever-so-slightly shorter than we're used to. And while it's an infinitesimally small difference, it's become a big headache for physicists, computer programmers and even stockbrokers. Why Earth rotates Our solar system formed about 4.5 billion years ago, when a dense cloud of interstellar dust and gas collapsed in on itself and began to spin. There are vestiges of this original movement in our planet's current rotation, thanks to angular momentum — essentially, "the tendency of the body that's rotating, to carry on rotating until something actively tries to stop it," explains Peter Whibberley, a senior research scientist at the UK's National Physical Laboratory. Thanks to that angular momentum, our planet has been spinning for billions of years and we experience night and day. But it hasn't always spun at the same rate. Hundreds of millions of years ago, Earth made about 420 rotations in the time it took to orbit the Sun. You can see evidence of how each year was jam-packed with extra days by examining the growth lines found in fossil corals. Although days have gradually grown longer over time (in part because of how the moon pulls at Earth's oceans, which slows its spin down a bit), during humanity's watch, we've been holding steady at about 24 hours for a full rotation — which translates to about 365 rotations per trip 'round the Sun. As scientists have improved at observing Earth's rotation and keeping track of time, however, they've realized that we experience little fluctuations in how long it takes to make a full rotation. A new way to track time In the 1950s, scientists developed atomic clocks that keep time based on how electrons in cesium atoms fall from a higher-energy state back to their normal ones. Since atomic clocks' periods are generated by this unchanging atomic behavior, they don't get thrown off by external changes like temperature shifts the way that traditional clocks can. Over the years, though, scientists spotted a problem: The unimpeachably steady atomic clocks were shifting slightly from the time that the rest of the world kept. "As time goes on, there is a gradual divergence between the time of atomic clocks and the time measured by astronomy, that is, by the position of Earth or the moon and stars," says Judah Levine, a physicist in the time and frequency division of the National Institute of Standards and Technology. Basically, a year as recorded by atomic clocks was a bit faster than that same year calculated from Earth's movement. "In order to keep that divergence from getting too big, in 1972, the decision was made to periodically add leap seconds to atomic clocks," Levine says. Leap seconds work a little like the leap days that we tack on to the end of February every four years to make up for the fact that it really takes around 365.25 days for Earth to orbit the Sun. But unlike leap years, which come steadily every four years, leap seconds are unpredictable. The International Earth Rotation and Reference Systems Service keeps tabs on how quickly the planet spins by sending laser beams to satellites to measure their movement, along with other techniques. When the time plotted by Earth's movement approaches one second out of sync with the time measured by atomic clocks, scientists around the world coordinate to stop atomic clocks for exactly one second, at 11:59:59 pm on June 30 or December 31, to allow astronomical clocks to catch up. Voila — a leap second. Unexpected change Since the first leap second was added in 1972, scientists have added leap seconds every few years. They're added irregularly because Earth's rotation is erratic, with intermittent periods of speeding up and slowing down that interrupt the planet's millions-of-years-long gradual slowdown. "The rotation rate of Earth is a complicated business. It has to do with exchange of angular momentum between Earth and the atmosphere and the effects of the ocean and the effect of the moon," Levine says. "You're not able to predict really well what's going to happen very far in the future." But in the past decade or so, Earth's rotational slowdown has ... well, slowed down. There hasn't been a leap second added since 2016, and our planet is currently spinning faster than it has in half a century. Scientists aren't sure why. "This lack of the need for leap seconds was not predicted," Levine says. "The assumption was, in fact, that Earth would continue to slow down and leap seconds would continue to be needed. And so this effect, this result, is very surprising." The trouble with leap seconds Depending on how much Earth's rotations speed up and how long that trend continues, scientists might have to take action. "There is some concern at the moment that if Earth's rotation rate increases further that we might need to have what's called a negative leap second," Whibberley says. "In other words, instead of inserting an extra second to allow Earth to catch up, we have to take out a second from the atomic timescale to bring it back into state with Earth." But a negative leap second would present scientists with a whole new set of challenges. "There's never been a negative leap second before and the concern is that software that would have to handle that has never been tested operationally before," Whibberley adds. Whether a regular leap second or a negative leap second is called for, in fact, these tiny changes can be a massive headache for industries ranging from telecommunications to navigation systems. That's because leap seconds meddle with time in a way that computers aren't prepared to handle. "The primary backbone of the internet is that time is continuous," Levine says. When there's not a steady, continuous feed of information, things fall apart. Repeating a second or skipping over it trips up the whole system and can cause gaps in what's supposed to be a steady stream of data. Leap seconds also present a challenge for the financial industry, where each transaction must have its own unique time stamp — a potential problem when that 23:59:59 second repeats itself. Some companies have sought out their own solutions to leap seconds, like the Google smear. Instead of stopping the clock to let Earth catch up with atomic time, Google makes each second a tiny bit longer on a leap second day. "That's a way of doing it," Levine says, "but that doesn't agree with the international standard for how time is defined." Time as a tool In the grand scheme of things, though, we're talking about very tiny amounts of time — just one second every couple of years. You've lived through plenty of leap seconds and probably weren't even aware of them. And if we view time as a tool to measure things we want to keep track of in our natural world, like the transition from one day to the next, then there's an argument to be made for following the time set by the movement of Earth rather than the electrons in an atomic clock — no matter how precise they might be. Levine says he thinks that leap seconds might not be worth the trouble they cause: "My private opinion is that the cure is worse than the disease." If we stopped adjusting our clocks to account for leap seconds, it could take a century to get even a minute off from the "true" time recorded by atomic clocks. Still, he concedes that while it's true that time is just a construct, a decidedly human attempt to make sense of our experiences in a big, weird universe, "it's also true that you can be very sure that at 12 o'clock noon, the Sun is overhead. And so you, although you don't think about it often, do have a link to astronomical time." Leap seconds are just a tiny, nearly invisible way of keeping that link alive. France is a country, which has produced many notable people in the world. One of them is Emile Waldteufel. October 31st 2018 | Figures Facts about Emile Durkheim make you learn more about the famous French sociologist. He was born on April 15, October 30th 2018 | Figures Facts about Emiliano Zapata tell the readers about a prominent figure in the Mexican Revolution. He was born on October 29th 2018 | Figures Many types of precious gemstones are available in the world. Most of them are sold in expensive price. They October 27th 2018 | Fashion Facts about Emancipation Proclamation tell the readers about the presidential proclamation, which changed the life of the slaved African October 26th 2018 | History Facts about Email Etiquette make you know more about the right ways to send emails to the colleagues in October 25th 2018 | Technology Let us talk Facts about email. 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You do not have to comply with the license for elements of the material in the public domain or where your use is permitted by an applicable exception or limitation . No warranties are given. The license may not give you all of the permissions necessary for your intended use. For example, other rights such as publicity, privacy, or moral rights may limit how you use the material. Have you ever wondered why the Earth keeps on spinning? Earth spins constantly like a spinning top without slowing or needing recharging. This daily rotation gives us reliable patterns like sunrises and sunsets, allowing life to thrive across shifting light and darkness. But what set this vital motion in place to start with? Modern astronomy gives clues into the origins of Earth's spin by looking back billions of years. Leading theories aim to explain how clouds of cosmic matter fused into the churning, rotating globe we inhabit today. Looking at Earth's formation and developmental history points more specifically to the events behind why does Earth spin. In this article, we will explore fascinating models proposing how inherited forces initially spun the Proto-Earth into being and why this millennial rotation persists smoothly against all odds. What key physics principles maintain the reliable rotation rate ever onward? Discover how our planet continues spinning smoothly despite wobbles and periodic changes in speed. Along the way, grasp the basics of angular momentum and gravity crucial for exoplanetary spin dynamics in worlds beyond our own. Source: purpledshub.com Why does Earth spin? Earth spins because, during its formation 4.5 billion years ago, it began as a rotating mass of gas and dust. As gravity pulled these materials together, the spinning motion intensified, giving rise to Earth. The persistence of this rotation is due to the absence of significant resistance in the vacuum of space. Earth's continuous spin brings about day and night cycles, shaping climate and influencing weather patterns crucial to the planet's functioning. Earth rotates fully every 24 hours, taking just under one full day to spin around its axis. This 24-hour cycle of rotation is known as Earth's rotational period, the time it takes to complete one full turn. Delving into why does Earth spin on its tilted axis reveals important planetary physics at play. Earth spins around an imaginary pole called its rotational axis. This rotational axis remains tilted at about 23.5 degrees off-perpendicular to its orbital plane around the Sun. This consistent tilt as Earth orbits causes familiar seasonal changes by altering how direct sunlight strikes regions over a full year. This reliable spin gives rhythm to Earth's natural systems. The precise 24-hour rotating cycle helps set human constructs like the measurement of time. Biological cycles like sleep patterns also conform to Earth's continual, unceasing spin. The tilt as Earth rotates introduces reliable phenomena fundamental for life, like repeating sunrises, sunsets, days, and nights within fixed hour ranges across latitudes over the seasons. This establishes circadian rhythms for Earth's flora and fauna. The difference in solar heating between the equator, tropics, and poles creates temperature variations between air masses around the globe. These temperature distinctions generate pressure gradients that drive wind and precipitation patterns. So Earth's spherical shape combined with its rotation exposes areas unevenly to solar radiation and this differential powers weather systems transporting heat and moisture between climate zones across latitudes. The earliest version of our Solar System was a slowly spinning cloud of gas and dust. It is thought denser clumps began contracting under gravity, increasing their rate of spin. One clump formed into the spinning early Earth. Thus, the planet may have inherited initial rotations from the primordial nebula. This law says a body conserving its original angular momentum must spin faster if contracting in size. The Earth was largely molten early on from impacts and radioactive decay. It would have compacted over time, increasing spin like a figure skater drawing arms inward during a pirouette. Earth's spin provides stability for life, seasons, days, and nights as we know it. Contemplating what happens if Earth stops spinning highlights the disastrous consequences if rotation ceased after billions of years of momentum. Such an abrupt halt seems only possible through cosmic calamity on massive scales. The gravity of large objects like the Sun and Moon may tug at planet shapes, very slightly transferring rotational motions. Earth was still hot when the giant impact forming our Moon occurred. The blast debris could have pulled Earth's mass distribution enough to induce faster spinning. Charged particles streaming outward from the young Sun may have imparted subtle rotational push on thinly layered planetary atmospheres. However, simulations find any spin from solar wind drag proves minor for Earth's thick airs compared to the above tidal momentum and primordial spin root causes. Source: hearstapps.com Spins once daily on a tilted axis Earth spins once fully around its axis every 24 hours. This tilted axis stays pointed towards Polaris as our planet orbits the Sun each year. The leading science theory explains Earth's reliable spinning. It states that the conservation of angular momentum from formation has maintained it. This is an absence of alteration by external torques over billions of years. From our viewpoint on Earth, it appears the Sun travels across our sky each day. But in reality, the planet is rotating to reposition itself relative to the Sun fixed in space, giving the impression of sunrise and sunset. Axis always points towards the North Star. Earth's axis alignment stays inclined towards the pole star Polaris as it spins, enabling navigation systems. This tilt also regulates seasons annually as each hemisphere angles towards and away from direct overhead sunlight. The west-to-east axis rotation carries places on the planet's surface from light into shadow each spin, making the familiar pattern of day followed by night. Additionally, the spin sets up an apparent deflection force called the Coriolis effect, causing winds and waters to bend right or left depending on the hemisphere. The Coriolis effect influences winds/waters. The Earth rotates at slightly over 1000 miles per hour or 460 meters per second at the equator, completing a full 360-degree spin every 24 hours. The speed gradually slows down closer to the North and South Poles relative to their tighter circumference circles spinning around the planetary axis. From vantage points in the Northern Hemisphere facing northward, Earth rotates in a leftward or counter-clockwise direction, completing one full turn each day and night cycle. The length of Earth's day does not stay precisely 24 hours but rather varies across decades and centuries between slightly shorter and longer true solar days. This periodic change in spin accounts for slight speed variations. Compared to the orbits of the Moon around it each month, Earth spins over 27 times faster (taking just a single day vs the Moon's 28 days). Relative to the outer planets, Earth's spin compares even quicker. Earth's perpetual rotation traces back to the conservation of angular momentum established early in its molten history. Gradual cooling and tidal forces from the moon-birthing impact likely contributed additional spin too. This momentum remains reliably stable thanks to an absence of external torques in space. Understanding the origins of Earth's axis tilt illuminates the builders of seasonal rhythms and climate variations across the epochs. Comprehending the mechanisms governing planetary spin rates proves pivotal. Understanding what causes and maintains spin applies to more than just Earth. It also aids in characterizing exoplanets being discovered across distant solar systems. We hope analyzing the fundamental astrophysics perpetuating Earth's west-to-east spin has shed insightful light. This explains why our world incessantly rotates on its slightly wobbly axis. This rotation creates the welcoming day and night cycle, enabling life throughout the ages. Learning more about why does Earth spin will further unravel the workings of worlds beyond our Solar System. The best chance to witness the phenomenon is when the moon is full nearest the vernal (spring) and autumnal (fall) equinoxes. That's because the moonrise is closest to due east and sets closest to due west on those dates. When the moon is full at these times of year, it's just about directly opposite the sun in the sky as it sets. So, during these times of year, as you watch the sun setting on one side of the Earth, simply turn around and you might see the full moon rising behind you. They're not technically happening at exactly the same time, but from your vantage point as a mere mortal on Earth, it appears to be so. Plus, you're really witnessing THREE astronomical events: sunset, moonrise and a full moon. The best place to watch this happen — or any nighttime astronomical event — is from a location that has limited light pollution. You can search for an IDA Dark Sky Place — many exist around the world. These include communities, parks and areas that encourage and protect dark light and dark skies. As of January 2022, there were 195 around the world, with several Dark Sky Certified Communities in the United States alone, ranging from Indiana to five in Arizona (Flagstaff, Sedona, Cottonwood, Fountain Hills and Oak Creek Canyon). Utah has one Certified IDA International Dark Sky Community, but, more impressively, it does have the highest concentration of Dark Sky Parks. The tiny island of Niue in the middle of the South Pacific Ocean is even the world's first "Dark Sky Nation." If you can't get to an IDA Dark Sky Place, just try to head outside of the big city to any place that has little light pollution. The best time to see the moonrise and sunset at the same time will vary depending on your location and the time of year, and when the next full moon appears on the calendar. Now That's Interesting Did you know that just like hurricanes, every full moon has a name? You've probably heard of Harvest Moon, Blue Moon or Blood Moon. But what about Worm Moon, Buck Moon or Sturgeon Moon? Monthly moon names originate from Native American culture. Their names and meanings helped tribes keep track of the seasons. Hint: Worm Moon refers to worms appearing as the cold earth thaws. The rotation of earth around its axis is elaborated on Facts about Earth's Rotation. The earth is moving counter-clockwise. The rotation occurred from west to the east. The rotation of earth's axis meets its surface at the Northern Hemisphere, which lies on the Terrestrial North Pole or Geographic North Pole. The point is not the same with the north magnetic pole of earth. It takes 24 hours for earth to complete its rotation. Today, we have longer day. In the past, the day was shorter. A century ago the present day is around 1.7 milliseconds longer. Facts about Earth's Rotation 1: the belief of rotation The rotation of earth was believed by some Pythagorean school members in the ancient Greek period. Hicetas, Heraclides and Ecphantus believed that the rotation of earth occurred. However, they did not realize about the revolution of earth toward the sun. Facts about Earth's Rotation 2: Aryabhata Aryabhata was an Indian astronomer who believed that earth rotated in 499 CE. William Gilbert created treatise on magnetism of earth, which supported the earth's rotation in 1600. Earth's rotation Pictures Facts about Earth's Rotation 3: the rotation theory of earth Even though the earth's rotation has been subject of disputes before the modern science, the theory of earth's rotation had been supported by Newton, Galileo and Kepler. Facts about Earth's Rotation 4: Foucault pendulum Have you ever heard about Foucault pendulum? In 1851, Léon Foucault built this pendulum for the first time. It was considered as the most popular test of earth's rotation. It was located at the top of Panthéon in Paris. The brass sphere of the pendulum is filled with lead. Today, it can be found in many museums. See facts about Earth and its Orbit here. Earth's rotation Image Facts about Earth's Rotation 5: components The nutation and precession are the two primary components found on the movement of earth's rotation axis. Facts about Earth's Rotation 6: the polar motion The term polar motion is used to call the movement of earth toward the crust. Look at facts about earth's interior here. Earth's rotation Facts Facts about Earth's Rotation 7: the causes of polar motion The Chandler wobble and free core nutation are the two causes of polar motion. Facts about Earth's Rotation 8: the precession The external torque produced by Moon, Sun and other astronomical bodies affects the precession. Facts about Earth's Rotation Facts about Earth's Rotation 9: Moon Moon is the only natural satellite of earth, which affects the rotation of earth due to the tidal acceleration. Facts about Earth's Rotation 10: 2004 Indian Ocean earthquake The earth moment of inertia is affected by 2004 Indian Ocean earthquake. The speed of rotation is increased three microseconds. Earth's rotation Do you have any opinion on facts about earth's rotation? tags: Earth's Rotation, Facts about Earth's Rotation What if someone were to tell you that at any given moment, you were traveling at speeds well in excess of the speed of sound? You might think they were crazy, given that - as best as you could tell - you were standing on solid ground, and not in the cockpit of a supersonic jet. Nevertheless, the statement is correct. At any given moment, we are all moving at a speed of about 1,674 kilometers an hour, thanks to the Earth's rotation, By definition, the Earth's rotation is the amount of time that it takes to rotate once on its axis. This is, apparently, accomplished once a day - i.e. every 24 hours. However, there are actually two different kinds of rotation that need to be considered here. For one, there's the amount of time it take for the Earth to turn once on its axis so that it returns to the same orientation compared to the rest of the Universe. Then there's how long it takes for the Earth to turn so that the Sun returns to the same spot in the sky. Solar vs. Sidereal Day: As we all know, it takes exactly 24 hours for the Sun to return to the same spot in the sky, which would seem obvious. 24 hours is what we think of as being a complete day, and the time it takes to transition from day to night and back again. But in truth, it actually takes the Earth 23 hours, 56 minutes, and 4.09 seconds to turn rotate once on its axis compared to the background stars. Why the difference? Well, that would be because the Earth is orbiting around the Sun, completing one orbit in just over 365 days. If you divide 24 hours by 365 days, you'll see that you're left with about 4 minutes per day. In other words, the Earth rotates on its axis, but it's also orbiting around the Sun, so the Sun's position in the sky catches up by 4 minutes each day. [caption id="attachment_11875" align="aligncenter" width="800"] The night sky, showing 6 hours of rotation captured by long-exposure. Credit: Chris Schur [/caption] The amount of time it takes for the Earth to rotate once on its axis is known as a sidereal day which is 23.9344696 hours. Because this type of day-measurement is based on the Earth's position relative to the stars, astronomers use it as a time-keeping system to keep track of where stars will appear in the night sky, mainly so they will know which direction to point their telescopes in. The amount of time it takes for the Sun to return to the same spot in the sky is called a solar day, which is 24 hours. However, this varies through the year, and the accumulated effect produces seasonal deviations of up to 16 minutes from the average. This is caused by two factors, which include the Earth's elliptical orbit around the Sun and it's axial tilt. Orbit and Axial Tilt: As Johannes Kepler stated in his Astronomia Nova (1609), the Earth and Solar planets do not rotate about the Sun in perfect circles. This is known as Kepler's First Law , which states that "the orbit of a planet about the Sun is an ellipse with the Sun's center of mass at one focus". At perihelion (i.e. its closest) it is 147,095,000 km (91,401,000 mi) from the Sun; whereas at aphelion, it is 152,100,000 km (94,500,000 mi). This change in distance means that the Earth's orbital speed increases when it is closest to the Sun. While its speed averages out to about 29.8 km/s (18.5 mps) or 107,000 km/h (66487 mph), it actually ranges by a full km per second during the course of the year - between 30.29 km/s and 29.29 km/s (109,044 - 105,444 km/h; 67,756.8 - 65,519.864 mph). [caption id="attachment_117033" align="aligncenter" width="580"] Earth's axial tilt (or obliquity) and its relation to the rotation axis and plane of orbit as viewed from the Sun during the Northward equinox. Credit: NASA [/caption] At this rate, it takes the Sun the equivalent of 24 hours - i.e. one solar day - to complete a full rotation about the Earth's axis and return to the meridian (a point on the globe that runs from north to south through the poles). Viewed from the vantage point above the north poles of both the Sun and Earth, Earth orbits in a counterclockwise direction about the Sun. This Earth's rotation around the Sun, or the precession of the Sun through the equinoxes, is the reason a year lasts approximately 365.2 days. It is also for this reason that every four years, an extra day is required (a February 29th during every Leap Year). Also, Earth's rotation about the Sun is subject to a slight eccentricity of (0.0167°), which means that it is periodically closer or farther from the Sun at certain times of the year. Earth's axis is also inclined at approximately 23.439° towards the ecliptic. This means that when the Sun crosses the equator at both equinoxes, it's daily shift relative to the background stars is at an angle to the equator. In June and December, when the Sun is farthest from the celestial equator, a given shift along the ecliptic corresponds to a large shift at the equator. So apparent solar days are shorter in March and September than in June or December. In northern temperate latitudes, the Sun rises north of true east during the summer solstice, and sets north of true west, reversing in the winter. The Sun rises south of true east in the summer for the southern temperate zone, and sets south of true west. As stated earlier, the Earth's is spinning rather rapidly. In fact, scientists have determined that Earth's rotational velocity at the equator is 1,674.4 km/h. This means that just by standing on the equator, a person would already be traveling at a speed in excess of the speed of sound in a circle. But much like measuring a day, the Earth's rotation can be measured in one of two different ways. Earth's rotation period relative to the fixed stars is known as a "stellar day", which is 86,164.098903691 seconds of mean solar time (or 23 hours, 56 minutes and 4.0989 seconds). Earth's rotation period relative to the precessing or moving mean vernal equinox, meanwhile, is 23 hours 56 minutes and 4.0905 seconds of mean solar time. Not a major difference, but a difference nonetheless. However, the planet is slowing slightly with the passage of time, due to the tidal effects the Moon has on Earth's rotation. Atomic clocks show that a modern day is longer by about 1.7 milliseconds than a century ago, slowly increasing the rate at which UTC is adjusted by leap seconds. The Earth's rotation also goes from the west towards east, which is why the Sun rises in the east and sets in the west. [caption id="attachment_127109" align="aligncenter" width="500"] Visualization of a sidereal day vs a solar day. Credit: quora.com [/caption] Earth's Formation: Another interesting thing about the Earth's rotation is how it all got started. Basically, the planet's rotation is due to the angular momentum of all the particles that came together to create our planet 4.6 billion years ago. Before that, the Earth, the Sun and the rest of the Solar System were part of a giant molecular cloud of hydrogen, helium, and other heavier elements. As the cloud collapsed down, the momentum of all the particles set the cloud spinning. The current rotation period of the Earth is the result of this initial rotation and other factors, including tidal friction and the hypothetical impact of Theia a collision with a Mars-sized object that is thought to have taken place approx. 4.5 billion years ago and formed the Moon. This rapid rotation is also what gives the Earth it's shape, flattening it out into an oblate spheroid (or what looks like a squished ball). This special shape of our planet means that points along the equator are actually further from the center of the Earth than at the poles. [caption id="attachment_52841" align="aligncenter" width="580"] Artist's impression what the Solar System looked like in the early stages of formation, as a dust cloud circling a star. Credit: JPL/NASA [/caption] History of Study: In ancient times, astronomers naturally believed that the Earth was a fixed body in the cosmos, and that the Sun, the Moon, the planets and stars all rotating around it. By classical antiquity, this became formalized into cosmological systems by philosophers and astronomers like Aristotle and Ptolemy - which later came to be known as the Ptolemaic Model (or Geocentric Model) of the universe. However, there were those during Antiquity that questioned this convention. One point of contention was the fact that the Earth was not only fixed in place, but that it did not rotate. For instance, Aristarchus of Samos (ca. 310 – 230 BCE) published writings on the subject that were cited by his contemporaries (such as Archimedes). According to Archimedes, Aristarchus espoused that the Earth revolved around the Sun and that the universe was many times greater than previously thought. And then there was Seleucis of Seleucia (ca. 190 – 150 BCE), a Hellenistic astronomer who lived in the Near-Eastern Seleucid empire. Seleucus was a proponent of the heliocentric system of Aristarchus, and may have even proven it to be true by accurately computing planetary positions and the revolution of the Earth around the Earth-Moon 'center of mass'. [caption id="attachment_18098" align="aligncenter" width="580"] An illustration of the Ptolemaic geocentric system by Portuguese cosmographer and cartographer Bartolomeu Velho, 1568. Credit: Bibliothèque Nationale, Paris [/caption] The geocentric model of the universe would also be challenged by medieval Islamic and Indian scholars. For instance, In 499 CE, Indian astronomer Aaryabhata published his magnum opus Aryabhatiya , in which he proposed a model where the Earth was spinning on its axis and the periods of the planets were given with respect to the Sun. The 10th-century Iranian astronomer Abu Sa'id al-Sijzi contradicted the Ptolemaic model by asserting that the Earth revolved on its axis, thus explaining the apparent diurnal cycle and the rotation of the stars relative to Earth. At about the same time, Abu Rayhan Biruni 973 – 1048) discussed the possibility of Earth rotating about its own axis and around the Sun – though he considered this a philosophical issue and not a mathematical one. At the Maragha and the Ulugh Beg (aka. Samarkand) Observatory, the Earth's rotation was discussed by several generations of astronomers between the 13th and 15th centuries, and many of the arguments and evidence put forward resembled those used by Copernicus. It was also at this time that Nilakantha Somayaji published the Aryabhatiyabhasya (a commentary on the Aryabhatiya) in which he advocated a partially heliocentric planetary model. This was followed in 1500 by the Tantrasangraha, in which Somayaji incorporated the Earth's rotation on its axis. In the 14th century, aspects of heliocentricism and a moving Earth began to emerge in Europe. For example, French philosopher Bishop Nicole Oresme (ca. 1320-1325 to 1382 CE) discussed the possibility that the Earth rotated on its axis. However, it was Polish astronomer Nicolaus Copernicus who had the greatest impact on modern astronomy when, in 1514, he published his ideas about a heliocentric universe in a short treatise titled Commentariolus ("Little Commentary"). [caption id="attachment_121160" align="aligncenter" width="580"] A comparison of the geocentric and heliocentric models of the universe. Credit: history.ucsb.edu [/caption] Like others before him, Copernicus built on the work of Greek astronomer Atistarchus, as well as paying homage to the Maragha school and several notable philosophers from the Islamic world (see below). Intrinsic to his model was the fact that the Earth, and all the other planets, rolved around the Sun, but also that the Earth revolved on its axis and was orbited by the Moon. In time, and thanks to scientists such as Galileo and Sir Isaac Newton , the motion and revolution of our planet would become an accepted scientific convention. With the advent of the Space Age, the deployment of satellites and atomic clocks, we have not only confirmed that it is in constant motion, but have been able to measure the its orbit and rotation with incredibly accuracy. In short, the world has been spinning since its inception. And, contrary to what some might say, it actually is slowing down, albeit at an incredibly slow rate. But of course, by the time it slows significantly, we will have likely ceased to exist, or slipped its "surly bonds" and become an interplanetary species. We have written many interesting articles about the motions of the Earth here at Universe Today. Here's How Fast Does The Earth Rotate? , Earth's Orbit Around The Sun , How Fast Does The Earth Rotate? , Why Does The Earth Spin? , What Would Happen If The Earth Stopped Spinning? , and What Is The Difference Between the Heliocentric and Geocentric Models Of The Solar System? If you'd like more information on the Earth's rotation, check out NASA's Solar System Exploration Guide on Earth . And here's a link to NASA's Earth Observatory . We've also recorded an episode of Astronomy Cast all about Earth . Listen here, Episode 51: Earth . In this photo of Saturn, snapped by Hubble, you can see the bulge in the ringed planet's middle. NASA/ESA/STScI/University of Leicester It's something we kind of take for granted. Roses are red, and planets are spherical. That's just the way things are, right? After all, building model solar systems would be way more challenging if, instead of using little foam balls, we had to make a bunch of icosahedron-shaped planet models. But have you ever wondered why the planets look like this? Why are they basically spherical and not, say, cylindrical or cube-shaped? We should kick off this discussion by calling a spade a spade. None of the planets in our solar system are perfect spheres, nor for that matter is our sun. All those bodies could more accurately be described as "oblate spheroids." Objects with this shape bulge slightly around the middle. To borrow an analogy from the astronomer Phil Plait, they look like a basketball that someone is sitting on. Put more technically, in a celestial body with an oblate spheroid shape, the polar circumference will be smaller than the equatorial one. So here on Earth, if you were to travel from the North Pole to the South Pole and back, you'd have walked a grand total of 24,812 miles (39,931 kilometers). On the other hand, a complete trip around the equator would be a bit longer. That's because the circumference of Earth's equator is 24,900 miles (40,070 kilometers). As such, when you stand at sea level on the equator, you're farther away from the center of our planet than you would be at either pole. On some other planets, this bulge is even more pronounced. Just look at Jupiter.

Earth is only 0.3 percent wider at the equator than it is from pole to pole. But Jupiter's measurements showcase a much bigger disparity. Indeed, astronomers have found that this plus-sized planet is a full 7 percent wider at its equator than it is between the poles. The oblate spheroid shape is the result of two main factors: gravity and rotation. Troy Carpenter, director of Washington State's Goldendale Observatory, recently discussed the matter with us in an email exchange. "Everything which has mass experiences gravity, and gravity attempts to crush an object inward in all directions," Carpenter explains. That's because all objects experience self-gravity, a force which pulls their atoms toward a common center. As the mass of an object increases, so too does its self-gravitational pull. After it exceeds a certain mass, the pull gets overpowering to the point where the object collapses onto itself and becomes spherical. Little items — like, say, a banana or a lug wrench — can resist this fate because their self-gravity is relatively weak, allowing them to retain non-spheroid shapes. However, in planets, suns and other truly massive bodies, the force is so strong that they can't avoid being distorted into spheroids. "But gravity is not the whole story," says Carpenter. While gravity conspires to render the planets spherical, the speed of their rotations is simultaneously trying to flatten them. The faster a celestial body spins, the more disproportionate its equatorial bulge gets. "This is why there are no perfect spheres in our solar system ... only oblate spheroids," Carpenter tells us. "The sun is almost a perfect sphere, due to its immense gravity and relatively slow rotation rate of 25 days. A significant percentage of stars in the sky rotate much faster and bulge noticeably at their equators." Stars, like Altair pictured here, are subject to midriff bulges, too. NASA/JPL/Caltech/Steve Golden One such star is Altair. Located just 16.8 light-years away from our home planet, it's among the brightest objects in the night sky. Altair is also notable for spinning very, very rapidly and completes a full rotation on its axis every 10.4 earth hours. Accordingly, astronomers estimate that Altair is at least 14 percent wider at the equator than it is from pole to pole. Rotational speed also explains Jupiter's bulge. After all, a day on this gas giant is a brisk 9.9 earth hours long. Other forces act upon the stars and planets as well, altering their shapes. Although Earth is an oblate spheroid, it certainly isn't a perfect one. The gravitational pull of the sun and moon both influence the planet's shape to a degree. For that matter, so do Earth's own plate tectonics. Consequently, the mass of our home world isn't evenly distributed — in fact, it's rather lumpy. Still, it looks a good deal rounder than Jupiter (and Saturn). In turn, the planets in our universe appear way more spherical than some of their moons do. Mars, for instance, has two small satellites, neither of which has the self-gravity to be pulled into an oblate spheroid. Instead, their appearance is often described as potato-shaped. In conclusion, we'll say this much for our home planet: It may not be flawless, but at least the place is fairly well-rounded. Now That's Interesting In DC comics' Superman franchise, the notorious Bizarro character hails from a celestial body called Htrae. Also known as the Bizarro World (go figure), the planet is shaped like a gigantic cube. According to physics professor and comic book fan James Kakalios, a place like Htrae would have to be teeny-tiny in real life. "[The] average distance from the center of the Bizarro planet to one of its faces can be no longer than 300 miles (483 kilometers), if it is to avoid deforming into a sphere," Kakalios writes in his book "The Physics of Superheroes." By comparison, the state of Texas is over 770 miles (1,239 kilometers) long from east to west. At that puny size, Htrae wouldn't have enough gravitational pull to maintain its own atmosphere. [embed] In a classic episode of this video series, I did the calculations for how fast the Earth is spinning. We know the Earth is rotating, but why? Why is it spinning? Why is everything in the Solar System spinning? And why is it mostly all spinning in the same direction? It can't be a coincidence. Look down on the Earth from above, and you'd see that it's turning in a counter-clockwise direction. Same with the Sun, Mars and most of the planets. 4.54 billion years ago, our Solar System formed within a cloud of hydrogen not unlike the Orion Nebula, or the Eagle Nebula, with its awesome pillars of creation. Then, it took some kick, like from the shockwave from a nearby supernova, and this set a region of the cold gas falling inward through its mutual gravity. As it collapsed, the cloud began to spin. But why? It's the conservation of angular momentum. Think about the individual atoms in the cloud of hydrogen. Each particle has its own momentum as it drifts through the void. As these atoms glom onto one another with gravity, they need to average out their momentum. It might be possible to average out perfectly to zero, but it's really really unlikely. Which means, there will be some left over. Like a figure skater pulling in her arms to spin more rapidly, the collapsing proto-Solar System with its averaged out particle momentum began to spin faster and faster. This is the conservation of angular momentum at work. As the Solar System spun more rapidly, it flattened out into a disk with a bulge in the middle. We see this same structure throughout the Universe: the shape of galaxies, around rapidly spinning black holes, and we even see it in pizza restaurants. The Sun formed from the bulge at the center of this disk, and the planets formed further out. They inherited their rotation from the overall movement of the Solar System itself. Over the course of a few hundred million years, all of the material in the Solar System gathered together into planets, asteroids, moons and comets. Then the powerful radiation and solar winds from the young Sun cleared out everything that was left over. Without any unbalanced forces acting on them, the inertia of the Sun and the planets have kept them spinning for billions of years. And they'll continue to do so until they collide with some object, billions or even trillions of years in the future. So are you still wondering, why does the Earth spin? The Earth spins because it formed in the accretion disk of a cloud of hydrogen that collapsed down from mutual gravity and needed to conserve its angular momentum. It continues to spin because of inertia. The reason it's all the same direction is because they all formed together in the same Solar Nebula, billions of years ago.