

BBC WHERE WE'LL FIND THE SOLAR SYSTEM'S WATER

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Sky at Night

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THE CATAclySMIC UNIVERSE

Why astronomers are so fascinated
by things that explode in space

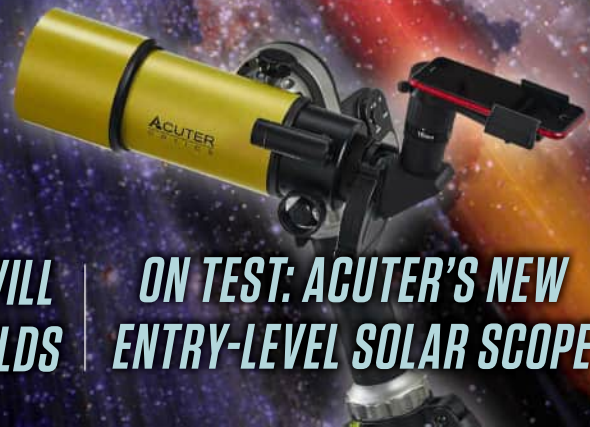
***DARK MATTER: HAVE WE GOT
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Ours may be the Blue Planet, but there's plenty of liquid water sloshing about on other worlds

Where is the Solar System's

WATER?

Hidden under the crusts of icy moons lies multiple planets' worth of liquid water

ILLUSTRATION

Our Solar System is filled with water. Most of it is solid ice, locked away in the frozen bodies of comets, planets, moons and asteroids. But there are several places you can find water in its liquid form. Most obviously, it covers the surface of our own Blue Planet,

but it's estimated there is enough liquid water in the Solar System to fill Earth's oceans 25 to 50 times over. But these oceans lie beneath kilometres of ice on the frozen moons of the outer planets.

Liquid water is one of the most important factors in how worlds grow. It transports minerals and erodes

rock formations, but perhaps its most important role is in allowing life to flourish. Could the liquid water oceans on other worlds provide havens where alien microbes have been able to evolve? We take a look at some of these worlds and the surprising volume of liquid water that lies beneath their surfaces.

At planetary scales, volume is measured in zettalitres. 1 ZL = 1,000 billion billion litres (694 billion billion US gallons)

Enceladus

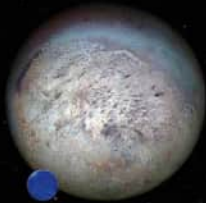


Moon of Saturn

Water volume: 0.01 ZL • 20 per cent of moon's volume

Unlike most icy moons, Enceladus's water isn't completely locked away beneath its icy crust, as plumes of water have been spotted erupting from cracks near the moon's southern pole. The moon's surface is covered with the chemical ingredients of life and these fissures could allow them access to the ocean below.

Triton



Moon of Neptune

Water volume: 0.03 ZL • 0.3 per cent of moon's volume

Triton is one of the most active moons in the outer Solar System, but rather than spewing molten rock, it's cryolava that flows from the moon's volcanoes. This mixture of liquid water, ammonia and other hydrocarbons shapes the moon's surface much like hot lava does on terrestrial planets.

Dione



Moon of Saturn

Water volume: 0.14 ZL • 19 per cent of moon's volume

It was the Cassini orbiter that discovered several of Saturn's moons had subsurface oceans, including the fourth-largest, Dione. Cassini was able to map out Dione's gravitational profile, which suggests the moon has a 160km-deep (100-mile) layer of water around its rocky core.

Pluto



Dwarf planet

Water volume: 1.0 ZL • 15 per cent of dwarf planet's volume

When the New Horizons probe arrived at Pluto in 2015, astronomers were surprised to find the dwarf planet free of craters. This suggested there was an underground ocean – most likely kept warm by radioactive elements and ammonia acting like antifreeze – which occasionally floods the surface, smoothing out Pluto's rough features.



Earth

Home

Water volume: 1.3 ZL

0.12 per cent of planet's volume

Water covers 71 per cent of Earth's surface – the only world we know of where liquid water can pool above ground. Despite this, our planet's body is almost entirely rock, meaning water makes up only 1/1,000th of its volume. As such, several moons actually have more water on them than our Blue Planet.

Europa

Moon of Jupiter

Water volume: 2.6 ZL • 16 per cent of moon's volume

Beneath its 25km-deep (15-mile) icy crust, Europa is thought to have a layer of liquid water around 100km (60 miles) deep. Like Jupiter's other icy moons, it's believed Europa's ocean is kept liquid via tidal heating, where Jupiter's huge gravitational pull flexes and pushes the moon's interior, causing it to heat up and stay molten.

Callisto

Moon of Jupiter

Water volume: 5.3 ZL • 9 per cent of moon's volume

When the Galileo spacecraft passed Callisto in the 1990s, it measured small fluctuations in the moon's magnetic field as it circled Jupiter. These suggested Callisto had a conductive liquid layer – such as salt water – which was conducting electric currents and interfering with the magnetic field. Similar fluctuations were also found around Europa.

Titan

Moon of Saturn

Water volume: 18.6 ZL • 26 per cent of moon's volume

Titan is famously known for its surface lakes of liquid methane, but what's less well known is that it also has a salty ocean located around 50km (30 miles) below the surface. Given the rich abundance of hydrocarbons – the building blocks of life – on the surface, Titan is considered the best place to look for extraterrestrial life.

Ganymede

Moon of Jupiter

Water volume: 35.4 ZL • 46 per cent of moon's volume

Surface features, gravity and magnetic measurements all point towards Ganymede having a liquid water ocean, but what's not certain is what that ocean might look like. Rather than one huge body of water, it's possible the moon has multiple oceans layered one on top of the other, sandwiched between slabs of ice. 🌊