



# GAME OF MOONS

## A TALE OF ICE AND FIRE

**4K**

3 x 50 min.

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4K, 5.1 and Stereo

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**TERRA MATER**  
Factual Studios

Join us on a spectacular rollercoaster ride through our solar system! This three-part series explores alien worlds of extremes right in our celestial neighbourhood, each single one amazing, fascinating, and unique in its own way.

**E**veryone knows the moon—our Moon ... It may come as a surprise, but there are more than 200 of these natural satellites orbiting other planets in the solar system! All these moons are incredibly different regarding their size, but also in terms of their environments. Studying these alien worlds in detail is important. Thanks to the insights scientists are getting through observations, measurements, and conclusions, we all get a better understanding of our world as a whole.

And the better we understand our neighbourhood, the better we get to know our home planet ...

### **CHAPTER 1: BIRTH**

This episode reveals how moons came into existence in the first place.

Our own Moon is the result of a cataclysmic cosmic collision that happened more than four billion years ago. In these early days of the formation of the solar system, a proto planet, approximately the size of Mars, crashed into the young Earth.

The debris that was hurled into space consolidated in an orbit around our planet, and eventually formed the body that we can see today—the Moon.

Most moons, however, have been formed out of the same primordial material that was also the basic building material for the planets themselves. Over aeons, the dust and grains from the very early phase of our solar system condensed into ever bigger objects, the largest being the planets.

The leftover material in the orbits around the planets concentrated ever further as well. Eventually, this led to the formation of solid bodies with a surprising variety of shapes and sizes, colours and compositions.

Yet another way for lonely planets to find a companion in the vast emptiness of space seems quite simple—just hijack one ...

One such example is Triton, the largest moon of the planet Neptune. Scientists suspect that Triton's origin is the Kuiper belt, a vast, icy region at the fringes of the solar system.

Pulled by Neptune's gravity, Triton ended up in the planet's orbit. But while most moons orbit their parent bodies in the same direction the planets themselves are rotating, this is not the

case for Triton. It circles around Neptune in the opposite direction—in a retrograde orbit. But this brings a problem: the laws of physics dictate that in this situation, Triton is being slowed down all the while, this way getting ever closer to Neptune.

Scientists have calculated that in about 100 million years from now, Triton will reach its Roche radius. This is the zone where the gravitational forces of Neptune will become too strong to withstand—and Triton will be ripped apart into pieces ...

### **CHAPTER 2: LIFE**

Our moon is much more than just a nice decoration in the night sky. In fact, without the moon, the chances for life to evolve and survive on Earth would have been much lower. The wild ebb and flow of the early ocean tides were crucial driving forces of evolution. Still today, the tides of the Earth's oceans have a profound effect on countless lifeforms on our planet—including ourselves.

Even more important, the gravitational pull of Earth's quite large companion stabilised our planet's rotational axis and its angle. This way, the Moon ensured the continuity of the annual seasons, of climate and weather patterns over long periods of time, a premise for the evolution of higher lifeforms—right up to us humans.

Yet, there are even more links between life and moons in the solar system.

Jupiter has four large companions, two of which are particularly interesting when it comes to the question of possible extraterrestrial life. Meet Jupiter's deep-frozen ice moons Ganymede and Europa! On both, scientists expect oceans of salty water—yet, under an ice sheet, many kilometers thick.

But how can liquid water exist on these icy worlds, with average temperatures far below minus 100 degrees Celsius?

Again, the reason is gravity: in their orbits, the moons are constantly being kneaded by the never-ending pull of the gravitational forces—mostly from giant Jupiter, but also from the planet's other large moons. This tidal energy is turned into heat—which keeps the water liquid.

At the moment, these exotic bodies of water are the most promising places in our solar system to harbour extraterrestrial lifeforms, according to astrobiologists—at least in the form of microbes.

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Right now, the European Space Agency ESA is preparing an orbiter, designed to study Europa and Ganymede in close detail. If everything goes to plan, JUICE will be launched in 2022.

Meanwhile, NASA is working on Europa Clipper, a probe that will investigate the habitability of Europa. The launch is planned for 2025. This orbiter shall also help selecting a suitable landing site for a potential future Europa Lander mission.

### CHAPTER 3: DEATH

Io is yet another of Jupiter's Galilean moons, and the innermost of its four large satellites.

Therefore, we don't see a deep-frozen ice world, but a hellish and hostile inferno. Io is the most geologically active object in the solar system. No life can exist here, at least no life as we know it.

Huge and violent eruptions of giant volcanoes are occurring frequently, and streams of lava are flowing across Io's surface, ever changing its landscapes and terrain. The cause of all this activity are the massive tidal forces of Jupiter on one side of Io, and Jupiter's three other large moons on the opposite side.

Stuck in between, Io is constantly being kneaded. This 'massage' on a cosmic scale is driving the intense tectonic and volcanic processes on the moon, turning Io into a real hell.

Saturn, the second-largest planet in our solar system has the most prominent rings—most famous for its very prominent rings. The ring particles are made of ice and rock; they range in size from specks of dust up to 10 meters in diameter.

There are different theories about the origin of Saturn's ring system. The cause could be a moon that came too close and therefore was ripped apart by gravity. The second hypothesis is that the rings consist of leftovers from the original nebular material, out of which Saturn itself was formed. However, this spectacular feature won't last forever. Material from the rings is raining down on Saturn. Scientists have calculated that in 100 million years from now, this 'Lord of the Rings' will have lost his characteristic decoration forever.

The ingredients for this otherworldly experience are cutting-edge CGI sequences; original footage, graphics, and stills from NASA and ESA space missions; state-of-the-art filming of models and mock-ups, laboratory settings and experiments; statements of top experts in the fields of planetary science, geology, astrobiology, and possibly a presenter who is our guide on this tour de force through space and time—and beyond your wildest expectations ...

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