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INSIDE KEPLER'S DREAM



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Experience Kepler's Astronomical Dream

This fanciful yet scientifically guided tale is considered the first true work of science fiction. **BY FRED NADIS**

Four centuries ago, Johannes Kepler established three laws of planetary motion that accurately describe how planets in the solar system orbit the Sun. That might be enough for most; however, befitting the Renaissance period in which he lived, Kepler also revised the field of astrology, wrote a treatise on optics, established the field of crystallography with an essay on snowflakes, rhapsodized about universal harmonies, made a volumetric study of barrel shapes used in transporting wine, proposed calendar reforms, and cast horoscopes. But perhaps his most underappreciated accomplishment was writing what some deem the first work of true science fiction.

Kepler's *In Somnium Astronomicum* (*An Astronomical Dream*), which depicts a journey to the Moon, went unpublished in his lifetime but was not exactly an afterthought. He worked on it throughout his career, beginning in his student days in the 1590s, and he had it typeset before his death. While

it's far from his most important accomplishment, *Somnium* does offer a peek into Kepler's wild and wonderful mind.

Origin story

Destined for fame, if never quite for fortune, Kepler was born in 1571 in Weil der Stadt, Germany, into the artisan class. His father, Heinrich, a brutal and destructive man, abandoned the family and became a mercenary soldier. His mother Katharina was an uneducated and allegedly quarrelsome woman who dabbled in herbal healing. His grandfather Sebald, the town mayor, arranged for the sickly youth's education at the University of Tübingen, a Lutheran seminary near Stuttgart.

At Tübingen, he studied theology, philosophy, and mathematics. His teacher, Michael Maestlin, quietly supported the Copernican heliocentric model of the universe. Both Catholic and Protestant authorities rejected Copernicanism as anything more than a model for calculation. Kepler, however, did not doubt its truth. At Tübingen, he proposed a dissertation on the question: "How would the phenomena

Written around the turn of the 17th century, *In Somnium Astronomicum* imagines a strange journey to the Moon and what one might find there. EVGENY OSTROUSHKO/DREAMSTIME.COM

TOP: Johannes Kepler, depicted here in an engraving made centuries after his death, was a true Renaissance man who worked in a variety of fields, including astronomy, astrology, and music. GEORGIOS KOLLIDAS/DREAMSTIME.COM

BELOW LEFT: Kepler's tale accurately takes into account the extreme temperature differences between the portions of the Moon's nearside in sunlight and shadow. His lunar inhabitants have hides designed to protect them, and often take refuge underground. ALAN DYER

BELOW RIGHT: In December 1968, Apollo astronaut Bill Anders snapped the iconic series of Earthrise images, showing Earth rising over the lunar horizon as their spacecraft orbited our satellite. More than 300 years earlier, Kepler described how Earth might appear in the sky to those living on the nearside of the Moon. NASA

occurring in the heavens appear to an observer stationed on the Moon?" A key point was that an observer on the Moon would not sense the Moon's motion. This addressed Copernicus' critics who insisted Earth could not move or those on it would see and feel its disruptive effects. Kepler's advisor, Veit Muller, refused to give this dissertation a public forum, but it later formed the kernel of *Somnium*.

Within a decade of finishing his studies, Kepler



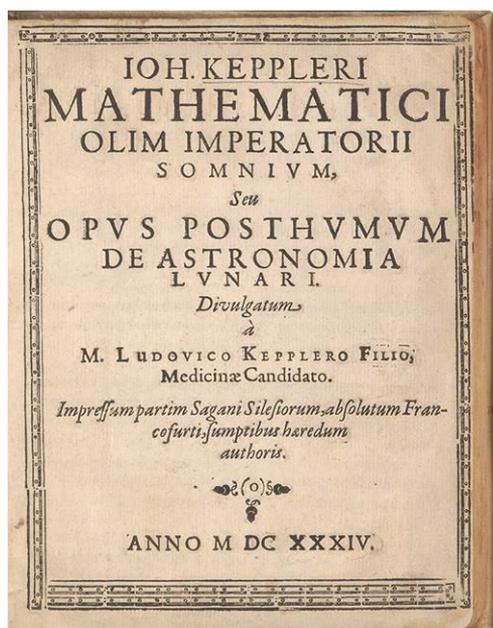
sent the famed astronomer Tycho Brahe a copy of his first book, *Mysterium Cosmographicum* (1597). Brahe wrote to Kepler that he took "unusual pleasure" in the concepts laid out in it, and invited Kepler to visit, then to work with him.

Collaborating with Brahe, however, was frustrating. At Brahe's castle outside Prague, Kepler was an underling, allowed only glimpses of Brahe's superb but carefully guarded astronomical data. It was only with Brahe's death, when Kepler became Brahe's successor as imperial mathematician, that he finally gained full access to Brahe's observations and instruments. This provided the data to scaffold his groundbreaking theoretical work. In 1605, Kepler determined from Brahe's observations his first law — that Mars' orbit was not a circle (as Copernicus believed) but an ellipse. He published this theory, along with his second law, describing a planet's varying speeds in different portions of its orbit, in *Astronomia Nova* in 1609.

The Moon again loomed large for Kepler in 1610 when he received a copy of Galileo Galilei's *Sidereus Nuncius* (or *Starry Messenger*). Relying on the then-novel telescope, Galileo announced his sharpened observations of the Moon's features, and his discovery of four of Jupiter's moons and numerous previously unseen stars. Kepler, delighted, wrote a book-length response. The enormity of the Moon's mountains and valleys that Galileo observed led Kepler to speculate that its inhabitants, if any, were also enormous.

Kepler was astonished that one large crater on the Moon perfectly took the shape of a circle. He could think of no natural ways such a crater could have formed — neither wind nor water erosion could explain this geometric form. He speculated in what he called "playful remarks" that perhaps Moon dwellers had excavated regolith to create circular ramparts that provided recessed areas where they could escape from the sunlight,





moving as necessary. “They have as it were an underground city. ... They place their fields and pastures in the middle.”

Even before reading Galileo’s study, Kepler was turning his dissertation on lunar geography into *Somnium*. Its unnamed narrator, after observing the stars and Moon, falls asleep reading a history of Bohemia. In his dream, he opens another book about a young hero, Duracotus, for whom magic and science are dual sources of knowledge.

Once upon a time

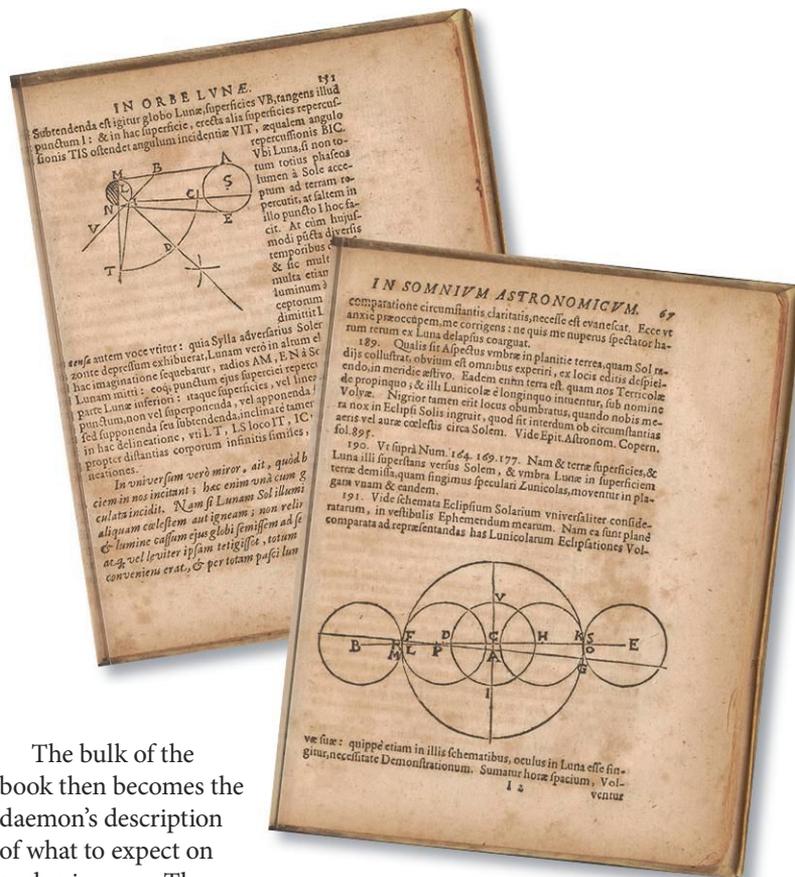
As a child, Duracotus, the son of Fiolxhilde, lives in Thule (modern-day Iceland). His mother packages herbs in goatskin bags that sea captains value as protection on journeys. When Duracotus cuts open a bag to inspect it, a furious Fiolxhilde sends him off with a sea captain who has him deliver a message to Tycho Brahe. The narrator becomes enthralled with astronomy and joins Brahe’s assistants. When he later revisits his mother in Thule, she tells him that she can evoke a spirit or daemon that can transport her to or tutor her about distant lands, including the “island of Levania” (the Moon). He is all in.

Fiolxhilde summons this spirit at a crossroads. When she and Duracotus cover their heads with their cloaks, the spirit speaks to them and explains that not all humans are fit for transport to Levania. The spirits will take “nobody who is lethargic, fat, or tender.” In a jesting reference to witchcraft, the daemon adds, “We especially like dried-up old women, experienced from an early age in riding he-goats at night or forked sticks.”

The bulk of the book then becomes the daemon’s description of what to expect on such a journey. The daemons place damp sponges on travelers’ faces to help them endure the ensuing cold of space and “impeded breathing.” They also administer narcotics to ease travel. With a push from the daemons, the voyagers explode from Earth as if shot by gunpowder. Soon after takeoff, “the bodily mass proceeds toward its destination of its own accord.” The daemons eventually will slow the travelers, so they do not crash land.

The daemon then discusses the motion of the planets as seen from the Moon and describes Levanian flora and fauna. Each lunar day equals two weeks on Earth, and each night another 14 Earth days. The daemon explains that life on the Moon is distinct for the Subvolvans who constantly face Volva (the revolving Earth), and the Privolvans on the Moon’s far hemisphere, which never faces Earth. The daemon reports that for the Subvolvans, Volva remains in place as if “attached to the heavens with a nail” and will present an appearance of alternating light and dark patches — rather like the Moon to us — though 15 times bigger. As Earth rotates, the Subvolvans admire views of its shifting land masses. The planet also will wax and wane in the sky.

Because of their vast size, the Moon dwellers’ lives are brief. Plants typically have a lifespan of only one day (or an earthly month). Most inhabitants resemble massive serpents with thick,

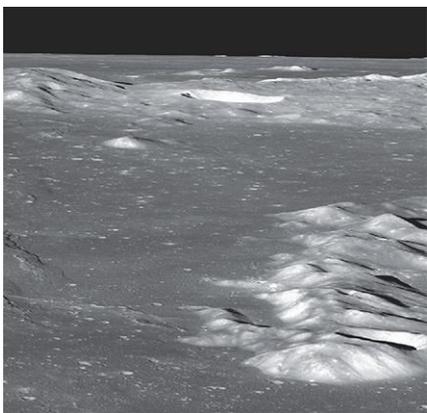


LEFT: The title page of *In Somnium Astronomicum* indicates the book was published posthumously in 1634 by Ludwig Kepler, Johannes Kepler’s son.

LIBRARY OF CONGRESS, RARE BOOK AND SPECIAL COLLECTIONS DIVISION

RIGHT: Within his tale of two humans brought to the Moon by a daemon, Kepler illustrated his scientific ideas on the dynamics of the Earth-Moon system, including lunar phases and eclipses.

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“Kepler thought about what life would be like on the Moon and what kind of life forms it would take, making it the first proper alien tale — he didn’t expect just to find other humanoids in space.”

“spongy and porous” hides to survive extremes of heat and cold. They shed these husks when they become Sun-scorched. They roam in crowds, over mountains and plains, and scatter shells that crack open and “beget living creatures.” Often, for survival, they escape the heat and cold in underground caves and oceans. After a further disquisition on the Levanians’ view of Earth and the heavenly bodies, the dreamer awakes with his bedsheets over his head, resembling Duracotus and Fiolxhilde awaiting their possible journey to Levania.

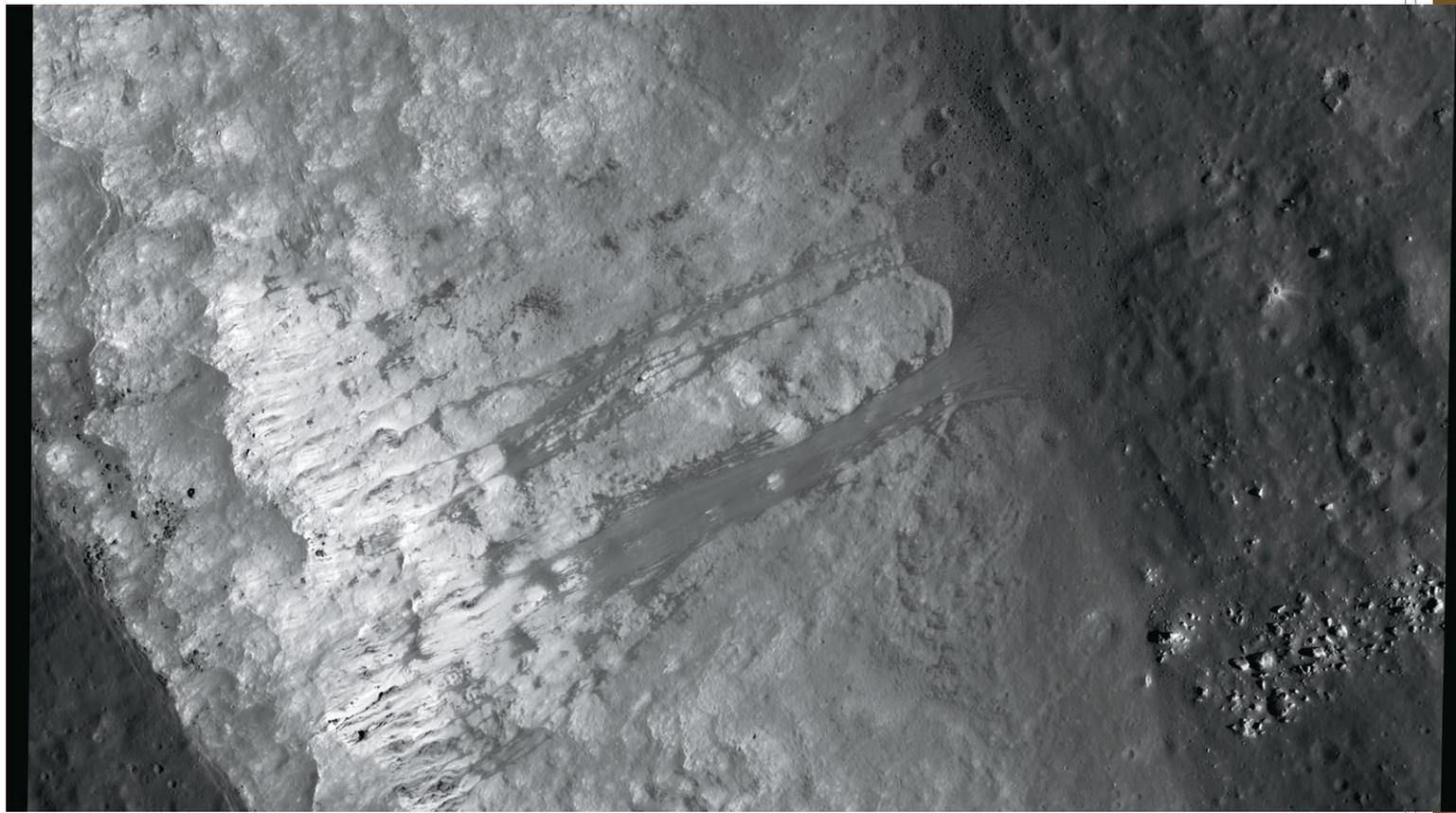
Beyond the book

The story was slender, about 30 pages, but to explain the underlying science, Kepler added 223 lengthy and often entertaining notes. The architect Giovanni de Galliano Pieroni wrote to his friend Galileo that Kepler’s posthumous work was “strange and bizarre.” Adam Roberts, a professor at the University of London and author of *The History of Science Fiction* (Palgrave Macmillan, 2005), proposes that this is just what makes *Somnium* “the

first proper work of science fiction.” He argues that Kepler’s juxtaposition of the “grotesque” with “sober science” embodied the dynamic from which all science fiction emanates.

Roberts notes that while there had been previous fanciful accounts of voyages to the Moon, in all these tales, the “aliens” encountered on other worlds had always been other humans. Kepler recognized that would not do. “Kepler thought about what life would be like on the Moon and what kind of life forms it would take, making it the first proper alien tale — he didn’t expect just to find other humanoids in space.”

While the text was playful, Kepler’s intermixing of magic and autobiography conceivably endangered his mother’s life. The narrator appeared a stand-in for Kepler — he had apprenticed to Brahe, and Kepler’s mother, like Fiolxhilde, concocted herbal potions. When Kepler first learned that his mother was accused of witchcraft in 1615 (but not yet arrested), he was convinced that his enemies had read a version of *Somnium* that he had circulated in 1611. He claimed in his notes at the end of



Somnium that unscrupulous readers began to “chatter” and spread “malicious gossip.”

When first charged, Katharina Kepler sued her accusers for slander, but in 1620, after further accusations, she was imprisoned and threatened with torture. Her prosecutor, Lutherus Einhorn, had successfully condemned eight other women to death by burning. Kepler wrote numerous petitions and traveled long distances to aid her defense. Though he successfully exonerated her in 1621, she never recovered from the trauma, dying a few months later.

Of the connection between *Somnium* and Katharina’s trial, Kepler biographer James Voelkel offers, “I think he felt guilty about the situation. I’m not convinced there was evidence that the manuscript actually had been leaked. But he’d written a book in which his mother figure was a witch and then his own mother was put on trial. He felt some responsibility.”

After the trial, Kepler was eager to publish *Somnium* and set the record straight, but it was not to be. Work, political turmoil, and moves all delayed the project. Finally, in 1630, he arranged for *Somnium* to be typeset and left home on a trip, seeking back interest owed him. While traveling, he fell ill and died. Kepler’s family, in dire financial straits, finally published *Somnium* in 1634, after his death.

Fanciful accounts of Moon voyages became

popular in decades to follow. English author Francis Godwin’s *The Man in the Moone* (1638) depicts a hero harnessing a flock of swans to carry him off the planet — taking advantage of the swans’ yearly migration from Earth to the Moon. In 1657, author Cyrano de Bergerac relied on fireworks to send a traveler to the Moon. Two centuries later, Jules Verne’s Moon-bound voyagers blast off from a great cannon in Florida. In *The First Men in the Moon* (1901), H.G. Wells’ travelers rely on antigravity to float skyward and crash-land on a lunar terrain of monstrous flora similar to that of *Somnium*.

Were Kepler around today, he would relish the advances in lunar geography made since he penned *Somnium*. He might also be amused that 21st-century advocates of Moon settlement hope to make his crater and cave dwellers a reality, with plans for subsurface lunar homes as refuges from heat, cold, and radiation. Underground lava tubes that NASA’s Lunar Reconnaissance Orbiter recently confirmed would be promising habitats for Kepler’s fictional creations. Had he learned of them in his lifetime, he might have even penned a sequel — or more likely, added a long, entertaining endnote. ♪

Fred Nadis is the author of *Star Settlers: The Billionaires, Geniuses, and Crazy Visionaries Out to Conquer the Universe* (Pegasus Books, 2020).

ALL ABOVE: Today, the surface of our satellite has been photographed and mapped in exquisite detail. These images, taken by the Lunar Reconnaissance Orbiter, show just a few of the otherworldly landscapes found on the Moon. From upper left to right: bright ejecta thrown out following an impact, Montes Recti massifs near Mare Imbrium, the slumped walls of Klute Crater, and a landslide down one wall of Kepler Crater (named for Johannes Kepler).

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