



# QUESTIONS



# QUESTIONS

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# QUESTIONS

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# QUESTIONS

How many of you:

- **Read Wikipedia?**
- **Edit Wikipedia?**





# QUESTIONS

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- **Read Wikipedia?**
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- **Use Wikipedia for teaching, research or outreach?**

# QUESTIONS

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- **Use Wikipedia for teaching, research or outreach?**
- **Have looked at your research area's article?**



# QUESTIONS

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**Today's featured article**


 **John C. W. Beckham** (1869–1940) was the [35th Governor of Kentucky](#) and a [United States Senator](#). Descended from a prominent political family, Beckham was chosen as [Democrat William Goebel's](#) running mate in the [gubernatorial election of 1899](#) when the former was not yet of legal age to serve as governor. Goebel lost the election to [Republican William S. Taylor](#), but the [Kentucky General Assembly](#) disputed the election results. During the political wrangling that followed, an unknown assassin shot Goebel. A day later the General Assembly invalidated enough votes to give the election to Goebel, who was sworn into office on his deathbed. Taylor claimed the election had been stolen by the Democratic majority in the General Assembly and a legal fight ensued between him and Beckham over the governorship. Beckham ultimately prevailed and Taylor fled the state. Following his term as governor, Beckham made a bid to become a U.S. Senator, but the seat went to Republican [William O. Bradley](#). Six years later Beckham secured the seat by popular election, but he lost his re-election bid largely because of his pro-temperance views and his opposition to [women's suffrage](#). He died in [Louisville](#) on January 9, 1940. ([more...](#))

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- [Tony Tan Keng Yam](#) is [elected](#) [President of Singapore](#).
- Samples of asteroid [25143 Itokawa](#) retrieved by the [Hayabusa](#) probe confirm that most [meteorites](#) originate from [S-type asteroids](#).
- [Hurricane Irene](#) hits the [Caribbean](#) and [U.S. East Coast](#), causing at least 54 deaths and an estimated [US\\$10.1 billion](#) in damage.

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- 1604** – [Sri Guru Granth Sahib](#), the religious text of [Sikhism](#), was installed at [Harmandir Sahib](#).
- 1902** – The first [science fiction](#) film, titled [A Trip to the Moon](#) and based on [From the Earth to the Moon](#) by [Jules Verne](#), was released in France.
- 1920** – The [Fountain of Time](#) ([detail pictured](#)) opened as a tribute to the 100 years of peace between the United States and Great Britain following the [Treaty of Ghent](#).
- 1939** – [Nazi Germany](#) [invaded](#) Poland at [Wielun](#) and [Westerplatte](#).



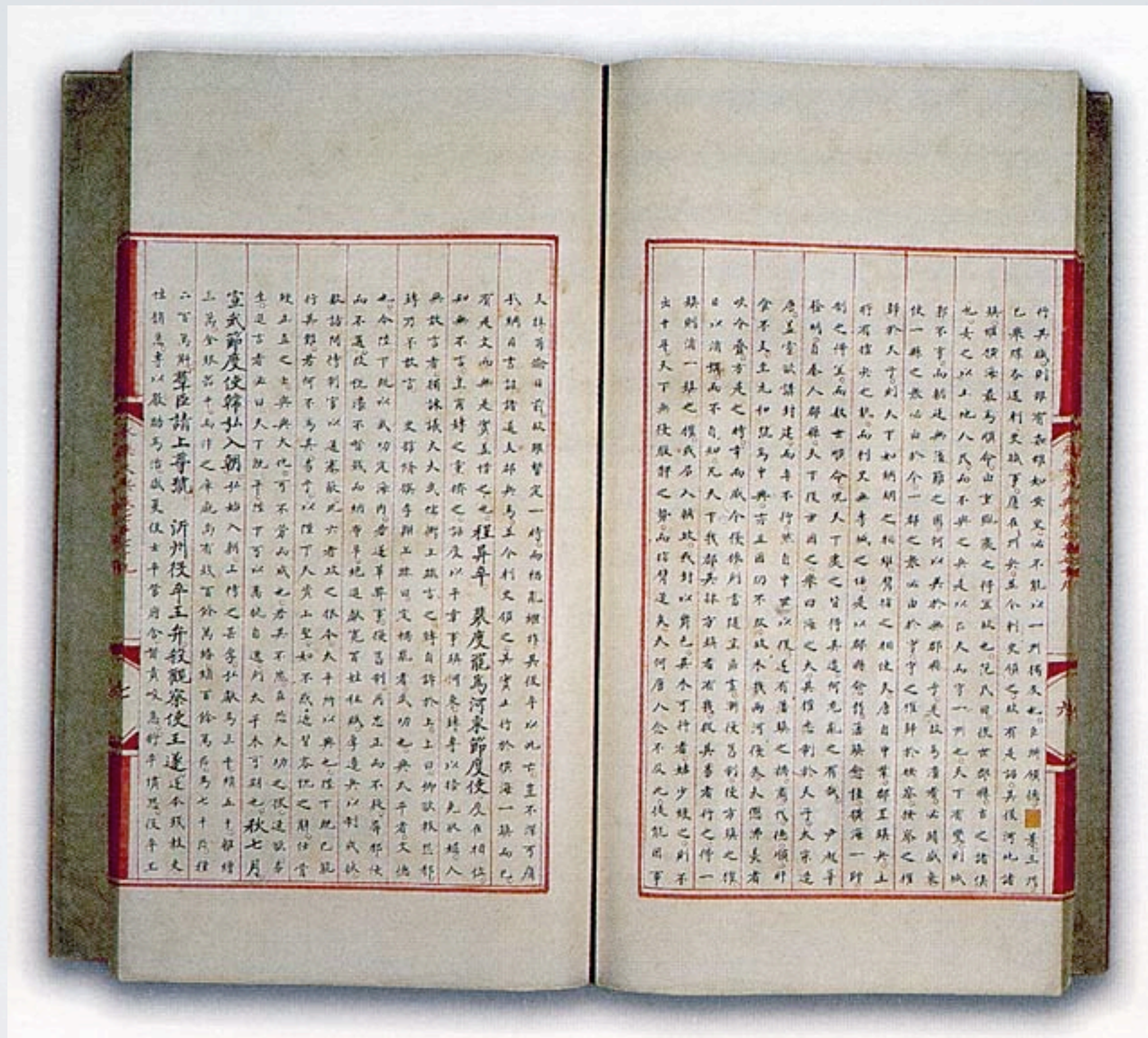
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## Oberon (moon)

From Wikipedia, the free encyclopedia

**Oberon** (<sup>i</sup>/ˈoʊbərən/, <sup>[note 5]</sup> also designated **Uranus IV**, is the outermost major [moon](#) of the planet [Uranus](#). It is the second largest and second most massive of the Uranian moons, and the ninth most massive moon in the [Solar System](#). Discovered by [William Herschel](#) in 1787, Oberon is named after the [mythical king of the fairies](#) who appears as a character in [Shakespeare's](#) *A Midsummer Night's Dream*. Its orbit lies partially outside Uranus's [magnetosphere](#).

It is likely that Oberon formed from the [accretion disk](#) that surrounded Uranus just after the planet's formation. The moon consists of approximately equal amounts of [ice](#) and [rock](#), and is probably differentiated into a rocky [core](#) and an icy [mantle](#). A layer of liquid water may be present at the boundary between the mantle and the core. The surface of Oberon, which is dark and slightly red in color, appears to have been primarily shaped by asteroid and comet impacts. It is covered by numerous [impact craters](#) reaching 210 km in diameter. Oberon possesses a system of [chasmata](#) ([graben](#) or [scarps](#)) formed during crustal extension as a result of the expansion of its interior during its early evolution.

The Uranian system has been studied up close only once: the spacecraft [Voyager 2](#) took several images of Oberon in January 1986, allowing 40% of the moon's surface to be mapped.

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## Discovery and naming

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## Oberon



The best Voyager 2 image of Oberon, obtained on January 24, 1986

### Discovery

**Discovered by** [William Herschel](#)  
**Discovery date** January 11, 1787<sup>[1]</sup>

### Designations

**Alternate name(s)** Uranus IV  
**Adjective** Oberonian<sup>[2]</sup>

### Orbital characteristics

**Semi-major axis** 583 520 km<sup>[3]</sup>  
**Eccentricity** 0.0014<sup>[3]</sup>  
**Orbital period** 13.463 234 d<sup>[3]</sup>



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Slovenščina

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## Discovery and naming

[[edit](#)]

Oberon was discovered by [William Herschel](#) on January 11, 1787; on the same day he discovered Uranus's largest moon, [Titania](#).<sup>[1][10]</sup> He later reported the discoveries of four more satellites,<sup>[11]</sup> although they were subsequently revealed as spurious.<sup>[12]</sup> For nearly fifty years following their discovery, Titania and Oberon would not be observed by any instrument other than William Herschel's,<sup>[13]</sup> although the moon can be seen from [Earth](#) with a present-day high-end amateur telescope.<sup>[9]</sup>

All of the moons of Uranus are named after characters created by [William Shakespeare](#) or [Alexander Pope](#). The name Oberon was derived from [Oberon](#), the King of the Fairies in *[A Midsummer Night's Dream](#)*.<sup>[14]</sup> The names of all four satellites of Uranus then known were suggested by Herschel's son [John](#) in 1852, at the request of [William Lassell](#),<sup>[15]</sup> who had discovered the other two moons, [Ariel](#) and [Umbriel](#), the year before.<sup>[16]</sup> The adjectival form of the name is *Oberonian*, /ˌɒbəˈroʊniən/.<sup>[2]</sup>

Oberon was initially referred to as "the second satellite of Uranus", and in 1848 was given the designation **Uranus II** by William Lassell,<sup>[17]</sup> although he sometimes used William Herschel's numbering (where Titania and Oberon are II and IV).<sup>[18]</sup> In 1851 Lassell eventually numbered all four known satellites in order of their distance from the planet by [Roman numerals](#), and since then Oberon has been designated **Uranus IV**.<sup>[19]</sup>

## Orbit

[[edit](#)]

Oberon orbits Uranus at a distance of about 584,000 km, being the farthest from the planet among its five major moons.<sup>[note 6]</sup> Oberon's orbit has a small [orbital eccentricity](#) and [inclination](#) relative to the [equator](#) of Uranus.<sup>[3]</sup> Its orbital period is around 13.5 days, coincident with its [rotational period](#). In other words, Oberon is a [synchronous satellite](#), [tidally locked](#), with one face always pointing toward the planet.<sup>[6]</sup> Oberon spends a significant part of its orbit outside the Uranian [magnetosphere](#).<sup>[20]</sup> As a result, its surface is directly struck by the [solar wind](#).<sup>[8]</sup> This is important, because the trailing hemispheres of satellites orbiting inside a magnetosphere are struck by the magnetospheric plasma, which co-rotates with the planet.<sup>[20]</sup> This bombardment may lead to the darkening of the trailing hemispheres, which is actually observed for all Uranian moons except Oberon (see below).<sup>[8]</sup>

Because Uranus orbits the Sun almost on its side, and its moons orbit in the planet's equatorial plane, they (including Oberon) are subject to an extreme seasonal cycle. Both northern and southern [poles](#) spend 42 years in a complete darkness, and another 42 years in continuous sunlight, with the sun rising close to the [zenith](#) over one of the poles at each [solstice](#).<sup>[8]</sup> The *Voyager 2* flyby coincided with the southern hemisphere's 1986 summer solstice, when nearly the entire northern hemisphere was unilluminated. Once every 42 years, when Uranus has an [equinox](#) and its equatorial plane intersects the Earth, mutual [occultations](#) of Uranus's moons become possible. One such event, which lasted for about six minutes, was observed on May 4, 2007, when Oberon occulted Umbriel.<sup>[21]</sup>

## Composition and internal structure

[[edit](#)]

Oberon is the second largest and most massive of the Uranian moons after [Titania](#), and the ninth most massive moon in the Solar System.<sup>[note 7]</sup> Oberon's density of 1.63 g/cm<sup>3</sup>,<sup>[5]</sup> which is higher than the typical density of Saturn's satellites, indicates that it consists of roughly equal proportions of [water ice](#) and a dense non-ice component.<sup>[23]</sup> The latter could be made of [rock](#) and [carbonaceous](#) material including heavy [organic compounds](#).<sup>[6]</sup> The presence of water ice is supported by [spectroscopic](#) observations, which have revealed [crystalline](#) water ice on the surface of the moon.<sup>[8]</sup> Water ice [absorption bands](#) are stronger on Oberon's trailing hemisphere than on the leading hemisphere. This is the opposite of what is observed on other Uranian moons, where the leading hemisphere exhibits stronger water ice signatures.<sup>[8]</sup> The cause of this asymmetry is not known, but it may be related to [impact gardening](#) (the creation of soil via impacts) of the surface, which is stronger on the leading hemisphere.<sup>[8]</sup> [Meteorite impacts](#) tend to sputter (knock out) ice from the surface, leaving dark non-ice material behind.<sup>[8]</sup> The dark material itself may have formed as a result of radiation processing of [methane clathrates](#) or radiation darkening of other organic compounds.<sup>[6][24]</sup>

Oberon may be differentiated into a rocky [core](#) surrounded by an icy [mantle](#).<sup>[23]</sup> If this is the case, the radius of the core (480 km) is about 63% of the radius of the moon, and its mass is around 54% of the moon's mass—the proportions are dictated by the moon's composition. The pressure in the center of Oberon is about 0.5 GPa (5 kbar).<sup>[23]</sup> The current state of the icy mantle is unclear. If the ice contains enough ammonia or other [antifreeze](#), Oberon may possess a liquid ocean layer at the core–mantle boundary. The thickness of this ocean, if it exists, is up to 40 km and its temperature is around 180 K.<sup>[23]</sup> However, the internal structure of Oberon depends heavily on its thermal history, which is poorly known at present.

<b>Orbital period</b>	13.463 <span> </span> 234 <span> </span> d <sup>[3]</sup>
<b>Inclination</b>	0.058° (to Uranus's equator) <sup>[3]</sup>
<b>Satellite of</b>	<a href="#">Uranus</a>
<b>Physical characteristics</b>	
<b>Mean radius</b>	761.4 <span> </span> ± <span> </span> 2.6 <span> </span> km (0.1194 Earths) <sup>[4]</sup>
<b>Surface area</b>	7 <span> </span> 285 <span> </span> 000 <span> </span> km <sup>2</sup> <sup>[note 1]</sup>
<b>Volume</b>	1 <span> </span> 849 <span> </span> 000 <span> </span> 000 <span> </span> km <sup>3</sup> <sup>[note 2]</sup>
<b>Mass</b>	3.014 <span> </span> ± <span> </span> 0.075 <span> </span> × <span> </span> 10 <sup>21</sup> <span> </span> kg (5.046 <span> </span> × <span> </span> 10 <sup>−4</sup> <span> </span> Earths) <sup>[5]</sup>
<b>Mean density</b>	1.63 <span> </span> ± <span> </span> 0.05 <span> </span> g/cm <sup>3</sup> <sup>[5]</sup>
<b>Equatorial surface gravity</b>	0.348 <span> </span> m/s <sup>2</sup> <sup>[note 3]</sup>
<b>Escape velocity</b>	0.726 <span> </span> km/s <sup>[note 4]</sup>
<b>Rotation period</b>	presumed <a href="#">synchronous</a> <sup>[6]</sup>
<b>Albedo</b>	0.31 (geometrical), 0.14 (Bond) <sup>[7]</sup>
<b>Temperature</b>	70–80 <span> </span> K <sup>[8]</sup>
<b>Apparent magnitude</b>	14.1 <sup>[9]</sup>
<b>Atmosphere</b>	
<b>Surface pressure</b>	zero



thickness of this ocean, if it exists, is up to 40 km and its temperature is around 100 K. However, the internal structure of Oberon depends heavily on its thermal history, which is poorly known at present.

Surface features and geology

[edit]

Oberon is the second-darkest large moon of Uranus after [Umbriel](#).<sup>[7]</sup> Its surface shows a strong [opposition surge](#): its reflectivity decreases from 31% at a phase angle of 0° ([geometrical albedo](#)) to 22% at an angle of about 1°. Oberon has a low [Bond albedo](#) of about 14%.<sup>[7]</sup> Its surface is generally red in color, except for fresh impact deposits, which are neutral or slightly blue.<sup>[25]</sup> Oberon is, in fact, the reddest among the major Uranian moons. Its trailing and leading hemispheres are asymmetrical: the latter is much redder than the former, because it contains more dark red material.<sup>[24]</sup> The reddening of the surfaces is often a result of [space weathering](#) caused by bombardment of the surface by charged particles and [micrometeorites](#) over the age of the Solar System.<sup>[24]</sup> However, the color asymmetry of Oberon is more likely caused by accretion of a reddish material spiraling in from outer parts of the Uranian system, possibly from [irregular satellites](#), which would occur predominately on the leading hemisphere.<sup>[26]</sup>

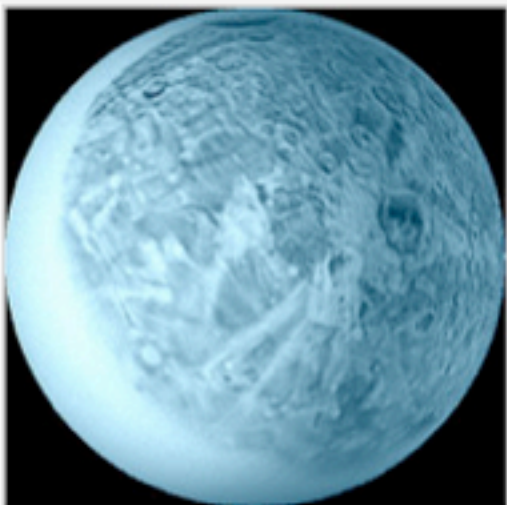
Scientists have recognized two classes of geological feature on Oberon: [craters](#) and [chasmata](#) ('canyons'—deep, elongated, steep-sided depressions<sup>[27]</sup> which would probably be described as [rift valleys](#) or [escarpments](#) if on Earth).<sup>[6]</sup> Oberon's surface is the most heavily cratered of all the Uranian moons, with a crater density approaching saturation—when the formation of new craters is balanced by destruction of old ones. This high number of craters indicates that Oberon has the most ancient surface among Uranus's moons.<sup>[28]</sup> The crater diameters range up to 206 kilometers for the largest known crater,<sup>[28]</sup> [Hamlet](#).<sup>[29]</sup> Many large craters are surrounded by bright impact ejecta ([rays](#)) consisting of relatively fresh ice.<sup>[6]</sup> The largest craters, Hamlet, Othello and Macbeth, have floors made of a very dark material deposited after their formation.<sup>[28]</sup> A peak with a height of about 11 km was observed in some *Voyager* images near the south-eastern limb of Oberon,<sup>[30]</sup> which may be the central peak of a large impact basin with a diameter of about 375 km.<sup>[30]</sup> Oberon's surface is intersected by a system of canyons, which, however, are less widespread than those found on Titania.<sup>[6]</sup> The canyons' sides are probably [scarps](#) produced by [normal faults](#)<sup>[note 8]</sup> which can be either old or fresh: the latter [transect](#) the bright deposits of some large craters, indicating that they formed later.<sup>[31]</sup> The most prominent Oberonian canyon is [Mommur Chasma](#).<sup>[32]</sup>

The geology of Oberon was influenced by two competing forces: [impact crater](#) formation and [endogenic](#) resurfacing.<sup>[31]</sup> The former acted over the moon's entire history and is primarily responsible for its present-day appearance.<sup>[28]</sup> The latter processes were active for a period following the moon's formation. The endogenic processes were mainly [tectonic](#) in nature and led to the formation of the canyons, which are actually giant cracks in the ice crust.<sup>[31]</sup> The canyons obliterated parts of the older surface.<sup>[31]</sup> The cracking of the crust was caused by the expansion of Oberon by about 0.5%,<sup>[31]</sup> which occurred in two phases corresponding to the old and young canyons.

The nature of the dark patches, which mainly occur on the leading hemisphere and inside craters, is not known. Some scientists hypothesized that they are of [cryovolcanic](#) origin (analogs of [lunar maria](#)),<sup>[28]</sup> while others think that the impacts excavated dark material buried beneath the pure ice ([crust](#)).<sup>[25]</sup> In the latter case Oberon should be at least partially differentiated, with the ice crust lying atop the non-differentiated interior.<sup>[25]</sup>

**Named surface features on Oberon**<sup>[33]</sup> (Surface features on Oberon are named for characters and places associated with Shakespeare's works)<sup>[34]</sup>

Feature	Named after	Type	Length (diameter), km	Coordinates
<a href="#">Mommur Chasma</a>	<a href="#">Mommur</a> , <a href="#">French folklore</a>	<a href="#">Chasma</a>	537	<a href="#">16.3°S 323.5°E</a>
Antony	<a href="#">Mark Antony</a>	<a href="#">Crater</a>	47	<a href="#">27.5°S 65.4°E</a>
Caesar	<a href="#">Julius Caesar</a>		76	<a href="#">26.6°S 61.1°E</a>
Coriolanus	<a href="#">Coriolanus</a>		120	<a href="#">11.4°S 345.2°E</a>
Falstaff	<a href="#">Falstaff</a>		124	<a href="#">22.1°S 19.0°E</a>
<a href="#">Hamlet</a>	<a href="#">Hamlet</a>		206	<a href="#">46.1°S 44.4°E</a>
Lear	<a href="#">King Lear</a>		126	<a href="#">5.4°S 31.5°E</a>



A computer-projected false-color image of Oberon. The white region is that which has not yet been photographed by a spacecraft. The large crater with the dark floor (right of center) is [Hamlet](#); the crater Othello is to its lower left, and [Mommur Chasma](#) is at upper left.



Falstaff	<a href="#">Falstaff</a>	Crater	124	<a href="#">22.1°S 19.0°E</a>
<a href="#">Hamlet</a>	<a href="#">Hamlet</a>		206	<a href="#">46.1°S 44.4°E</a>
Lear	<a href="#">King Lear</a>		126	<a href="#">5.4°S 31.5°E</a>
MacBeth	<a href="#">Macbeth</a>		203	<a href="#">58.4°S 112.5°E</a>
Othello	<a href="#">Othello</a>		114	<a href="#">66.0°S 42.9°E</a>
Romeo	<a href="#">Romeo</a>		159	<a href="#">28.7°S 89.4°E</a>

## Origin and evolution

[[edit](#)]

Oberon is thought to have formed from an [accretion disc](#) or subnebula: a disc of gas and dust that either existed around Uranus for some time after its formation or was created by the giant impact that most likely gave Uranus its large [obliquity](#).<sup>[35]</sup> The precise composition of the subnebula is not known; however, the relatively high density of Oberon and other Uranian moons compared to the [moons of Saturn](#) indicates that it may have been relatively water-poor.<sup>[note 9][6]</sup> Significant amounts of [carbon](#) and [nitrogen](#) may have been present in the form of [carbon monoxide](#) and N<sub>2</sub> instead of methane and [ammonia](#).<sup>[35]</sup> The moons that formed in such a subnebula would contain less water ice (with CO and N<sub>2</sub> trapped as clathrate) and more rock, explaining the higher density.<sup>[6]</sup>

Oberon's accretion probably lasted for several thousand years.<sup>[35]</sup> The impacts that accompanied accretion caused heating of the moon's outer layer.<sup>[36]</sup> The maximum temperature of around 230 K was reached at the depth of about 60 km.<sup>[36]</sup> After the end of formation, the subsurface layer cooled, while the interior of Oberon heated due to decay of [radioactive elements](#) present in its rocks.<sup>[6]</sup> The cooling near-surface layer contracted, while the interior expanded. This caused strong [extensional stresses](#) in the moon's crust leading to cracking. The present-day system of canyons may be a result of this process, which lasted for about 200 million years,<sup>[37]</sup> implying that any endogenous activity from this cause ceased billions of years ago.<sup>[6]</sup>

The initial [accretional heating](#) together with continued decay of radioactive elements were probably strong enough to melt the ice<sup>[37]</sup> if some antifreeze like ammonia (in the form of [ammonia hydrate](#)) or some [salt](#) was present.<sup>[23]</sup> Further melting may have led to the separation of ice from rocks and formation of a rocky core surrounded by an icy mantle. A layer of liquid water ('ocean') rich in dissolved ammonia may have formed at the core–mantle boundary.<sup>[23]</sup> The [eutectic temperature](#) of this mixture is 176 K.<sup>[23]</sup> If the temperature dropped below this value the ocean would have frozen by now. Freezing of the water would have led to expansion of the interior, which may have also contributed to the formation of canyon-like [graben](#).<sup>[28]</sup> Still, present knowledge of the evolution of Oberon is very limited.

## Exploration

[[edit](#)]

*Main article:* [Exploration of Uranus](#)

So far the only close-up images of Oberon have been from the [Voyager 2](#) probe, which photographed the moon during its flyby of Uranus in January 1986. Since the closest approach of *Voyager 2* to Oberon was 470,600 km,<sup>[38]</sup> the best images of this moon have spatial resolution of about 6 km.<sup>[28]</sup> The images cover about 40% of the surface, but only 25% of the surface was imaged with a resolution that allows [geological mapping](#).<sup>[28]</sup> At the time of the flyby the southern hemisphere of Oberon was pointed towards the [Sun](#), so the dark northern hemisphere could not be studied.<sup>[6]</sup> No other spacecraft has ever visited the Uranian system, and no mission to this planet is planned in the foreseeable future.

## See also

[[edit](#)]

- [Oberon in fiction](#)

## Notes

[[edit](#)]

- ↑ Surface area derived from the radius *r*: 



4
π

r

2




{\displaystyle 4\pi r^{2}}

.
- ↑ Volume *v* derived from the radius *r*: 



4
π

r

3


/
3.


{\displaystyle 4\pi r^{3}/3.}
- ↑ Surface gravity derived from the mass *m*, the [gravitational constant](#) *G* and the radius *r*: 



G
m

/

r

2




{\displaystyle Gm/r^{2}}

.
- ↑ Escape velocity derived from the mass *m*, the gravitational constant *G* and the radius *r*: 





2
G
m

r




{\displaystyle {\sqrt {2Gm/r}}}

.



3. <sup>a</sup> Surface gravity derived from the mass  $m$ , the [gravitational constant](#)  $G$  and the radius  $r$ :  $Gm/r^2$ .
4. <sup>a</sup> Escape velocity derived from the mass  $m$ , the gravitational constant  $G$  and the radius  $r$ :  $\sqrt{2Gm/r}$ .
5. <sup>a</sup> In US dictionary transcription, US dict: [ō·ber·ōn](#).
6. <sup>a</sup> The five major moons are [Miranda](#), [Ariel](#), [Umbriel](#), [Titania](#) and Oberon.
7. <sup>a</sup> The eight moons more massive than Oberon are [Ganymede](#), [Titan](#), [Callisto](#), [Io](#), Earth's [Moon](#), [Europa](#), [Triton](#), and [Titania](#).<sup>[22]</sup>
8. <sup>a</sup> Some canyons on Oberon are [graben](#).<sup>[28]</sup>
9. <sup>a</sup> For instance, [Tethys](#), a Saturnian moon, has a density of 0.97 g/cm<sup>3</sup>, which means that it contains more than 90% water.<sup>[8]</sup>

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[\[edit\]](#)

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## Rfam

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**Rfam** is a [database](#) containing information about [non-coding RNA](#) (ncRNA) families and other structured RNA elements. It is an [annotated, open access](#) database hosted by the [Wellcome Trust Sanger Institute](#) in collaboration with [Janelia Farm](#).<sup>[1][2][3][4]</sup> Rfam is designed to be similar to the [Pfam](#) database for annotating protein families.

Unlike [proteins](#), ncRNAs often have similar [secondary structure](#) without sharing much similarity in the [primary sequence](#). Rfam divides ncRNAs into families based on evolution from a common ancestor. Producing [multiple sequence alignments](#) (MSA) of these families can provide insight into their structure and function, similar to the case of protein families. These MSAs become more useful with the addition of secondary structure information. Rfam researchers also contribute to [Wikipedia's RNA WikiProject](#).<sup>[5][4]</sup>

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- 2 [Methods](#)
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### Uses of Rfam

The Rfam database can be used for a variety of functions. For each ncRNA family, the interface allows users to: view and download multiple sequence alignments; read annotation; and examine species distribution of family members. There are also links provided to literature references and other RNA databases. Rfam also provides links to Wikipedia so that entries can be created or edited by users.

The interface at the Rfam website allows users to search ncRNAs by keyword, family name, or genome as well as to search by ncRNA sequence or [EMBL accession number](#).<sup>[1]</sup> The database information is also available for download, installation and use using the INFERNAL software package.<sup>[6][7]</sup> The INFERNAL package can also be used with Rfam to annotate sequences (including complete genomes) for homologues to known ncRNAs.

### Methods

In the database, the information of the [secondary structure](#) and the [primary sequence](#), represented by the [MSA](#), is combined in

#### Rfam

Content	
<b>Description</b>	The Rfam database provides alignments, consensus secondary structures and covariance models for RNA families.
<b>Data types captured</b>	RNA families
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4	<a href="#">SULF1</a>	<a href="#">Adenosine A2A receptor</a>
5	<a href="#">Insulin</a>	<a href="#">5-HT1A receptor</a>
6	<a href="#">SFRP1</a>	<a href="#">Reelin</a>
7	<a href="#">5-HT2A receptor</a>	<a href="#">5-HT2A receptor</a>

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