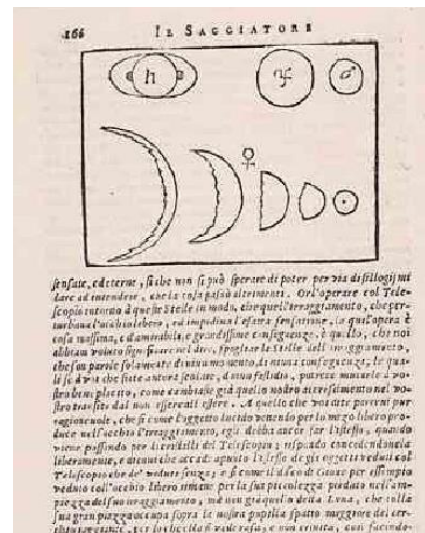


## THE RINGS OF SATURN



These evenings, when it is clear, there is a fairly bright, dull yellow "star" in the southern sky. It is not actually a star; it is the planet Saturn, the sixth planet out from the Sun. When, back in 1610, Galileo pointed his telescope at it, he was rather puzzled as to what he saw. It looked as though the planet was triple, or that it seemed to have "carrying handles" on each side. Then, in 1612 he was puzzled because those features seemed to have vanished. Then, in 1613 they were back. In 1655, Huygens observed Saturn using a rather better telescope, and suggested there was a big ring around the planet. Thanks to close observations made by the Cassini spacecraft, named after Cassini, an astronomer who studied Saturn extensively, we now know the planet is surrounded by a huge number of concentric rings, all arranged in precisely the same plane.



The planet Saturn has a diameter of 120,536 km, and a mass of 93.161 Earths. This is interesting because to be that big, with such a low mass, the average density of the planet is 0.69 grams per cubic centimetre. Our planet's density is 5.513 grams per cubic centimetre, which is consistent with it being a rock ball. Saturn has a density lower than that of water (1 gm/cc). If we had a bucket of water big enough, the planet would float. This indicates that Saturn is a big ball of gas.

The innermost edge of the ring system lies some 15,000 km above the cloud tops and extends outwards another 75,000 km or so. However, although large, the rings are very thin, less than 50 km. There are some very faint, thicker rings orbiting further out. The most widely accepted theory for the formation of the rings is the disintegration of a moon that was orbiting too close to the planet, a victim of tidal forces.

We are familiar with the tides here on Earth. Because the pull of gravity varies strongly with distance (ten times the distance means a 100-fold drop in the pull), the oceans on the side of the Earth facing the Moon are pulled away from the surface of the Earth, making a bump. The Earth is pulled away from the oceans on the opposite side, making another bump. Our planet itself is distorted by the difference in gravitational pulls but is strong enough to tolerate the distortion. However, for a body orbiting closely around a giant planet, things can be much more serious. If it is close enough the difference in the pull on the nearest and furthest parts of the body can become strong enough to overcome the forces holding it together. We currently think that is how Saturn got its rings. A moon orbited too close and was pulled apart by those tidal forces. That far from the Sun, water is a permanently frozen rock mineral, and many bodies out there are made almost totally of ice, as was that unfortunate moon. The rings of Saturn are made of ice particles, ranging from gravel to occasional lumps the size of a house.



One other striking thing about Saturn's rings is they are so bright. The ice is nice and clean, and shiny. However, the rings are located in a very dirty, dusty neighbourhood. The most likely reason for the ring particles to be so clean is that they have not been there long enough to get dirty. That means they cannot be more than about 100 million years

old, which means, in a 4.5-billion-year-old Solar System, they formed very recently. In addition, the ring material is gradually falling into the planet, so the rings won't be there forever.

As Saturn and the Earth orbit the Sun, we get to see the rings from various angles. Sometimes we are right in line with the rings, which makes them very hard to see, perhaps as a thin black line crossing the planet's disc. That is why Galileo didn't see them in 1612. The next time we will be in line is during 2025, so now would be a good time to get out the telescope and have a look.

After sunset, Venus shines low in the southwest. Saturn lies in the south and Jupiter is rising in the northeast. Mars rises about three hours later. The Moon will be Full on the 15th.

Ken Tapping, 10th December, 2024

Ken Tapping is an astronomer with the National Research Council's Dominion Radio Astrophysical Observatory, Penticton, BC, V2A 6J9.