

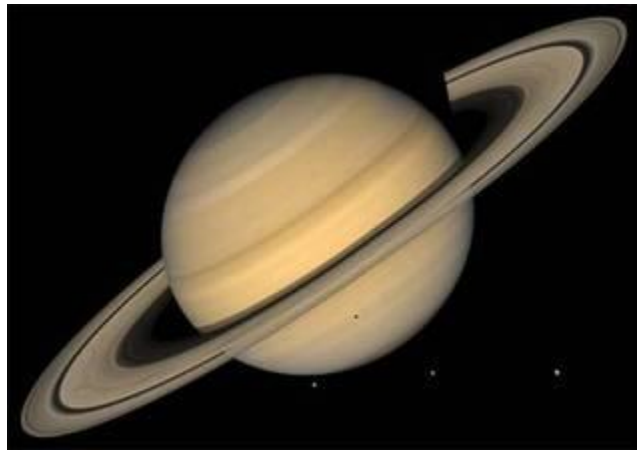
One Good Target

With Some Other Sights Worth Seeing
While You're in the Neighborhood

September

Saturn and its Moons

When Galileo first observed Saturn in 1610, he wondered why the two “moons” on either side of the planet didn’t change position from night to night, like the moons of Jupiter did. He was puzzled again when they disappeared completely in 1612. When they eventually returned, he noted that they looked like handles (Latin *ansae*) attached to the sides of the planet. Although we now know that they aren’t really handles, Galileo’s name stuck, and the rings are sometimes referred to as the *ansae* even today. Finally, in 1654, a 26 year old English astronomer named Christiaan Huygens deduced that Saturn’s “handles” were actually a ring surrounding the planet, and that their changes in shape and occasional disappearances happen because the rings are tilted from our perspective, making them appear to slowly open and close as Saturn makes its 29½ year long journey around the Sun, and to disappear completely when their thin edge lines up with our line of sight.



Credit NASA: www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/ring-a-round-the-saturn.html

The rings are made mostly of water ice along with other ices, in chunks no larger than the size of a mountain. They comprise three distinct sections. The outermost section is called *the A Ring*, followed by the brighter *B Ring* and the gossamer glow of *the C Ring* (also known as *the crepe ring*), which can be detected in 6"+ scopes with some patient effort and high power (300x or so). Between the B Ring and the A Ring is *Cassini's Division*, a nearly-black and mostly-empty band that can be seen in 3"+ scopes. A much more subtle gray band, called *the Encke Gap*, lies near the outer edge of the A Ring, visible at very high power (400x) in 8"+ scopes.

Dark *radial markings*, like spokes on a bicycle wheel, can sometimes be seen crossing the B Ring. These are subtle features, more like smudges than distinct lines, and are usually seen only in 12"+ scopes. A red filter can help make them stand out.

A *three-dimensional effect* can result from the shadow of the planet on the rings and that of the rings on the planet. These shadows are most prominent when the rings are fully open and Saturn is at *quadrature* (when Saturn is directly to one side of the Earth, so the Sun-Earth-Saturn angle is 90°). The shadows disappear at *opposition* (when Saturn is directly opposite from the Earth, with the Sun behind them both), because the Sun then illuminates Saturn from directly above from our perspective. For a similar reason, the rings often appear noticeably brighter for a few days around opposition – a phenomenon known as *the Seeliger effect* – because the individual bits of ice that make up the rings no longer throw small shadows on their companions.

The rings are more than 35,000 miles from outer edge to inner edge, but they're surprisingly thin – only about 100 feet from top to bottom, on average – which is why they seem to disappear from time to time, as they line up with the plane of the ecliptic. The most recent *ring plane crossing* occurred in September 2009, and the next one will happen in March 2025, when our view of Saturn will flip, and we'll be able to see its south pole instead of its north pole. The months surrounding ring plane crossing present unique observing opportunities as the thinner rings expose *tiny inner moons* that can be seen only when the rings get out of the way. In addition, it's often possible to see *bright knots of light* about four-fifths of the way from the edge of the planet to the outer edge of the narrow rings: these "*intensity clumpings*" may represent irregularities in the rings' surfaces or density, or possibly areas where sunlight flows unobstructed through the Cassini Division.

In comparison to the rings, *the disk of Saturn* is often considered to be unspectacular, especially when it is (inevitably but unfairly) compared to its neighbor Jupiter. Although Saturn's face is divided into a series of belts and zones, just like Jupiter's is, Saturn's bands are harder to perceive because there is less color contrast here than on Jupiter. The greater distance from Earth adds to the difficulty, since Saturn's disk appears markedly smaller than Jupiter's in our skies. Still, Saturn's globe is worth observing for its interesting shape: with a polar diameter only 90% as large as its equatorial diameter, Saturn has the largest *equatorial bulge* of any planet in the solar system, with a shape William Herschel aptly described as "*square-shouldered*." Like Jupiter, Saturn spins on its axis at a dizzying rate of speed, completing a rotation every 10.2 hours (at the equator) and spawning some of the solar system's strongest winds at over 1000 mph (1600 km/h). Also like Jupiter, storms sometimes form in Saturn's deep clouds, with a *Great White Spot* making an appearance from time to time.

Saturn has over 140 known moons, but only five of them make good targets for amateur scopes. The brightest, Titan, is easily visible at magnitude 8.3: larger than the planet Mercury and big enough to show a tiny disk (~0.8" wide) when Saturn is near opposition, it's the second-largest moon in the solar system (after Jupiter's moon Ganymede) and the only one with a substantial atmosphere and lakes of liquid hydrocarbons. Titan can wander as far as five ring diameters from the planet's disk, so take a wide view when you're looking for it.

The next three moons – *Rhea* (mag 9.7), *Tethys* (mag 10.2), and *Dione* (mag 10.4) – all remain within two ring diameters of the planet, and can sometimes get lost in its glare.

Iapetus, the most intriguing of Saturn's major moons, is also the most challenging to observe. It's often far removed from the planet (up to 12 ring diameters away), making it easy to mistake for a star. More confoundingly, its leading face is dark while its trailing face is much brighter, so it shines at mag 10.2 when it's on one side of the planet, and dims to mag 11.9 (less than ¼ as bright) on the other side.

Sky & Telescope magazine has an easy-to-use interactive tool that will show you where Titan, Rhea, Tethys, Dione, and Iapetus will be in relation to Saturn's globe at any given date and time – and will also adjust the view to match what you'll see in a refractor or reflector: https://skyandtelescope.org/wp-content/plugins/observing-tools/saturn_moons/saturn.html

Rick Gering / September 2024