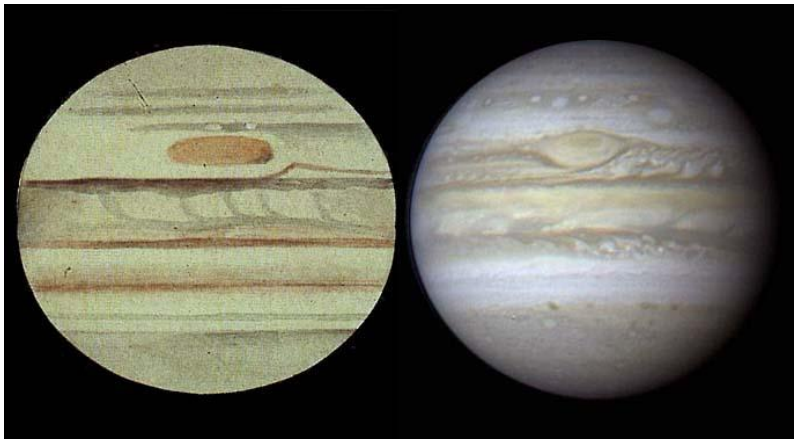
Jupiter's Not-So-Great Red Spot

By: **Kelly Beatty** | April 24, 2014

Astronomers don't know why Jupiter's iconic Great Red Spot has been gradually shrinking since the 1800s — or why the downsizing has accelerated during the past two years.

Thanks to the planet's immensity, seeing Jupiter through a telescope can be very satisfying. Its two main cloud belts appear in most any backyard setup, and with even a modest aperture you can probably glimpse the planet's enduring and enormous Great Red Spot.

Or at least that *used* to be the case. In recent decades the color of this iconic, long-lived storm has waxed and waned, sometimes taking on a hue almost indistinguishable from that of the tawny-white clouds around it. And, redness aside, the Red Spot isn't nearly as "great" as it used to be — it's actually getting smaller. My *S&T* colleague Camille Carlisle wrote about the spot's tightening waistline in 2012, and I offered a report about the downsizing trend a decade ago.

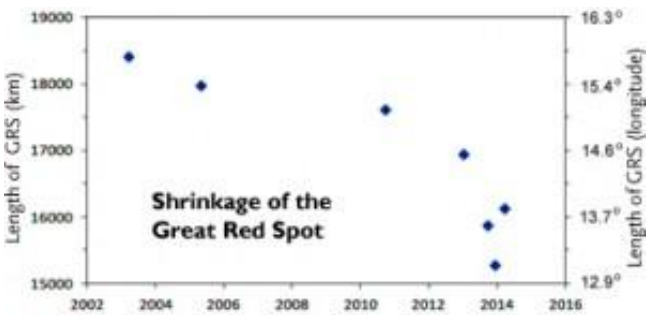


Compare the size (and color) of Jupiter's Great Red Spot as drawn by Thomas Gwyn Elger in November 1881 *(left)* and as imaged by Voyager 1 *(right)* 98 years later. South is up, to match the inverted view in many astronomical telescopes.
NASA (Voyager image)

In fact, astronomers know that the Great Red Spot has been shrinking for more than a century. In the late 1800s the feature was nearly 35° wide in longitude, which corresponds to about 40,000 km (25,000 miles), or roughly three times Earth's diameter. By 1979, when Voyagers 1 and 2 flew past Jupiter at close range, the longitudinal extent had shrunk to 21° (about 25,000 km), though its width from top to bottom remained essentially unchanged at about 12,000 km.

No one has been paying closer attention to this situation than British observer Damien Peach. His exceptionally detailed images have chronicled the spot's obvious shape-shifting for more than a decade.

The spot's contraction continues — but the big surprise, as the graph at right shows, is that the downsizing has accelerated quite a bit during the past two years. Now the iconic vortex is smaller and rounder than ever before. According to John Rogers, who coordinates Jupiter observations for the British Astronomical Association, early this year the Great Red Spot spanned just 13.6° in latitude, a length of only 15,900 km.



Other Changes in the Great Red Spot

Astrophotographer Damien Peach has plotted the Great Red Spot's changing size as measured in his images. Note the abrupt change since 2012.
John Rogers / BAA

That's not the only curiosity. Usually the spot drifts in longitude (relative the planet's interior rotation), but recently the meandering has dropped to just 1.4° per month, Rogers reports, which he terms "unusually slow." And it's taken on a distinctly orange color.

Meanwhile, the spot's rotation rate continues to vary a lot. The Voyagers found a period of 6 to 8 days, corresponding to mean wind velocities around the rim of up to 120 meters per second (270 miles per hour). In 2000, NASA's Galileo orbiter looked on as the GRS raced around at a record-setting 165 m/s (370 mph). This past year observers found a period of just 3.6 days, and the outer winds were clocked at 144 m/s.

The Great Red Spot is a high-pressure feature sandwiched between the dark, turbulent South Equatorial Belt passing westward to its north and a jetstream of the South Temperate Belt sliding eastward to its south. These opposing motions cause the GRS to roll counterclockwise between them like an enormous ball bearing. But it's unclear, despite decades of intensive study, where the spot gets the energy to sustain itself.

The Great Red Spot looked rather circular and had a distinct orange hue on February 15, 2014. Note the small dark spots nearby (arrowed) that might be supplying the huge storm with rotational energy.
Damien Peach

Nor is it clear why the circumstances are changing so rapidly. Rogers suspects the Red Spot might be feeding on a long string of smaller dark spots that have been moving past it since mid-2013. He says the barrage of spots resulted from the collision of a dark segment of the South Tropical Belt with a large, long-lived white oval known as BA.

"These little spots have their own spin," notes Amy Simon-Miller (NASA Goddard Space Flight Center). When they slip past the Great Red Spot, she explains, they often get pulled into the storm's southeast quadrant. "They can either add to the GRS's angular momentum, or subtract from it, depending which way they turn."

Hubble to the Rescue?

Unfortunately, Jupiter is quickly sliding westward in the evening sky, so telescopic observers won't be able to follow the planet for much longer. But Simon-Miller managed to snag some time on the Hubble Space Telescope to check out the situation. Three days ago her team acquired two sets of images, timed 10 hours (one rotation of Jupiter) apart, taken with the Wide Field Camera 3.

It's the first time that Hubble has been turned toward the giant planet since 2012. "Our data look great!" she tells me. The images have a resolution of about 150 km, enough detail to create a map of wind

vectors along and near the spot's outer margin. A fuller analysis is weeks away, but a quick check confirms the faster-than-usual shrinkage that amateurs have been reporting.

Simon-Miller hopes the Hubble images have captured the interaction between the Great Red Spot and the small spots slipping past to its south. That, she says, would be "a major achievement in understanding the energetic feeding of the GRS and constraining the mechanism that governs its long life."

Meanwhile, it's not too late to view Jupiter with your backyard telescope. Don't forget to use our handy Java app to determine the best times to view the Great Red Spot. (Note: free registration on SkyandTelescope.com is required.)