

### Offered Title: "Little" Black Spots On The Sun

Sunspots seem like blemishes on the otherwise perfect complexion of our Sun. Looking at it with various specialty filters reveals the truth. Our Sun is a mess, and sunspots are just part of our closest star's normal character.

In this article's title I put *little* in quotes because sunspots are frequently larger than our Earth!

Sunspots are the result of the Sun's intense and wild magnetic field. If we could see the Sun's magnetic field as lines it would kind of look like hair sprouting in bunches. There would be areas where the lines are concentrated as they shoot out of the surface. Looking at the same view with a visible light solar filter shows these concentrations to be sunspots. Far from quiet splotches, these areas are a maelstrom. Sunspots last from days to months and eventually decay as magnetic fields change.

Internally, the Sun's convective zone of plasma and zones of differential rotation contribute to its twisted magnetic fields. These twisted fields concentrate plasma just below the Sun's surface as they impede its progress. This is a sunspot. Elsewhere on the Sun plasma can escape outward via convection. Bigger sunspots create bigger bottlenecks, holding back more plasma. Sunspots occasionally congregate as a group, a really big bottleneck.

Eventually this bottled up plasma explodes outward and becomes solar prominences, flares, or a coronal mass ejection (CME). Solar prominences and flares are beautiful to see with specialty telescopes and stay within the Sun's gravitational influence. CMEs however are dangerous gigantic clouds of plasma shot from the Sun at escape velocity, and CMEs are thought to originate from sunspot groups. If one is coming our way, it could fry electronics in satellites and on the ground. A big CME will take a regional power grid out of service!

Why are sunspots dark? After all they are hot, up to 4,200 degrees Celsius. Well, the surrounding Sun with unimpeded plasma is around 5,500 degrees Celsius and based on black body luminance theory, brightness differentials are vastly greater than the temperature difference. OK, I believe it though I don't understand it.

Sunspots have two structural features, umbra and penumbra. Umbra is Latin for shadow. The umbra is the darkest part, with magnetic field lines running perpendicular to the Sun's surface. The penumbra surrounds the umbra, is lighter in appearance, and magnetic field lines are inclined, shooting out at different angles.

Sunspots occur in cycles, generally following the 11-year solar maximum/minimum cycles, a manifestation of the Sun's longer term periodic magnetic field changes. At the beginning of solar maximum sunspots appear in mid-latitudes, then appear in the equatorial zone during maximum.

### What's in the Sky?

How about a total lunar eclipse? Yeah, I know, another early riser event, but this one's special. It's a Blue, Blood, and Super Moon all in one. January 31; starts at 5:20 am with totality at 6:51, and sets during totality, just before sunrise.