Spot the Sunspot!

Today, August 12, 2024, this huge sunspot is gracing the front of the solar disk:

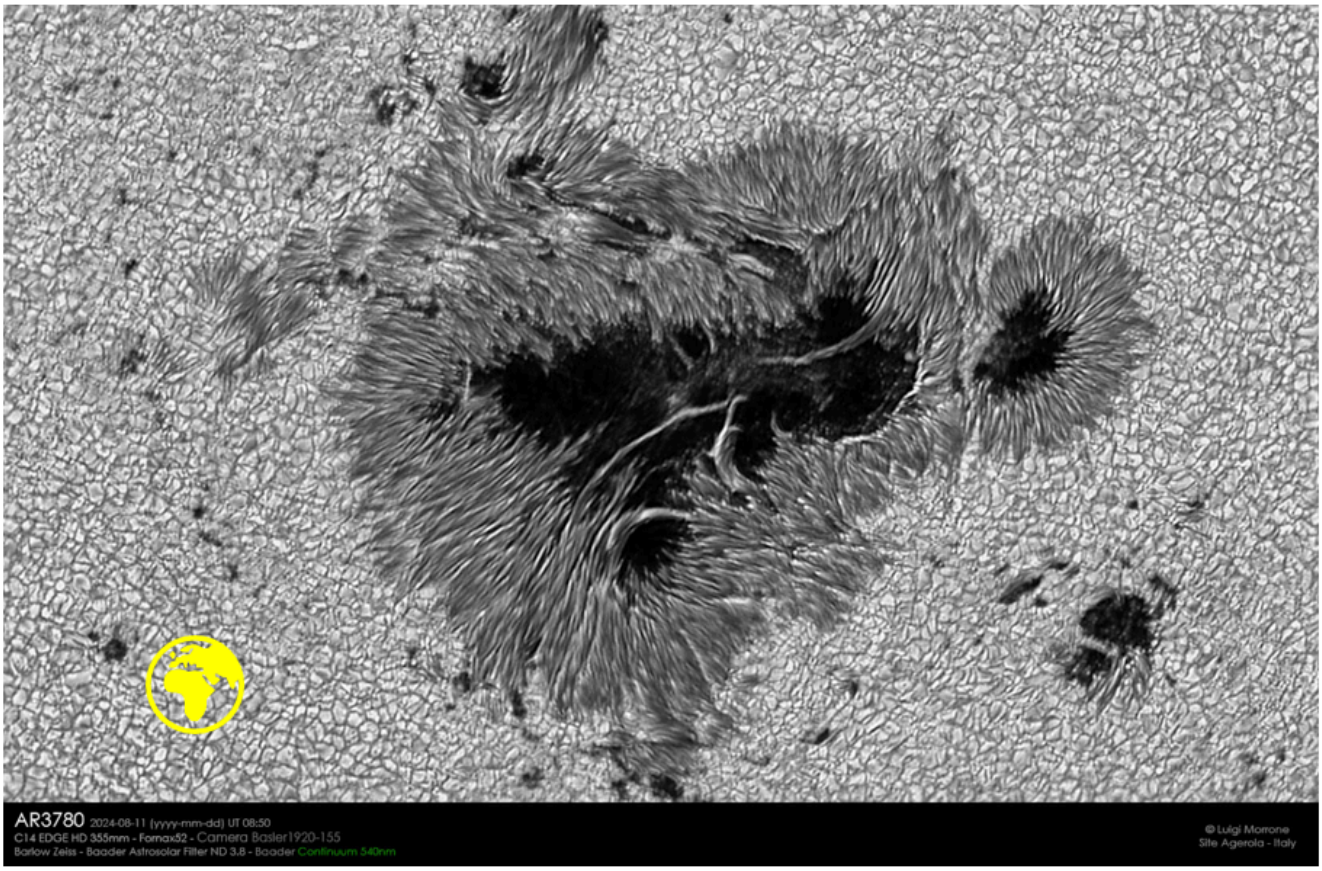
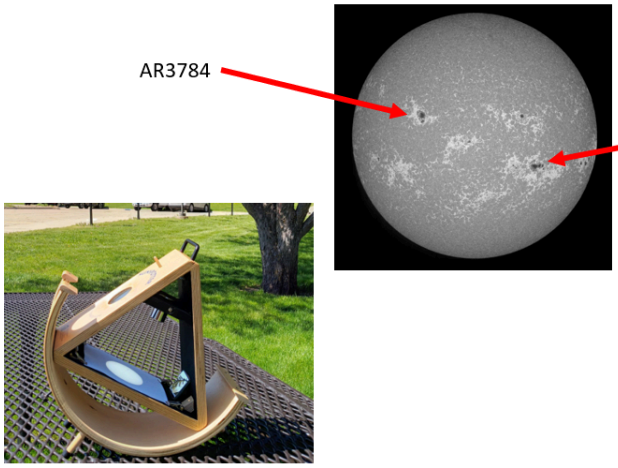


Photo by Luigi Morrone, Aerospace engineer at Leonardo Company, Agerola, Italy via
https://www.facebook.com/photo/?fbid=10232917306585232&set=pcb.10161458431554140

See it with your own eyes, <u>but never your BARE eye!</u>

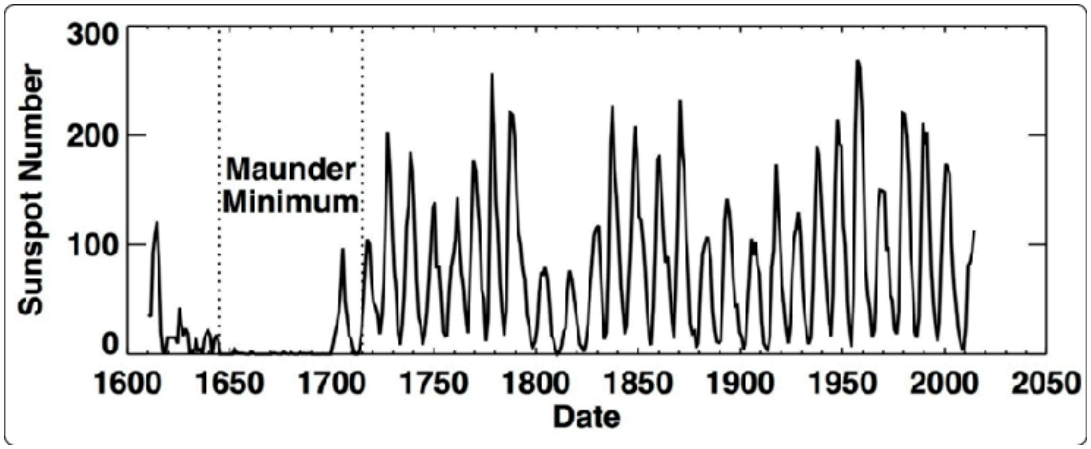


With our sunspotter

With eclipse glasses

What is the solar cycle?

Sunspots are dark features on the surface of the sun, just a little cooler at 3800 K than the surrounding matter at 5800K. The sun undergoes an 11-year cycle. The number of sunspots reaches a maximum every 11 years, about around the same time that the solar magnetic field flips polarity. We are currently approaching a maximum.



[1]

The sun is a plasma: electrons, protons, helium nuclei - all are freely moving charged particles. Moving charges create magnetic fields, but magnetic fields influence how charges move. This complicated interaction between matter flow and magnetic fields is studied by a field called Magneto-Hydrodynamics. Basically, the sun oscillates, reversing its magnetic field every 11 years. One can, perhaps, find some understanding in the following: Not all parts of the sun rotate at the same rate. The plasma at the equator takes only 25 days to travel once around the sun, while matter in the polar region is much slower and needs a little more than 33 days. The different rotation speeds lead to a distortion in time of the sun's magnetic field, as illustrated in the figure below. The distortion becomes stronger and more turbulent, leading to the formation of eddy currents we see as sunspots. A reversal of the magnetic poles is accompanied by an increase in sunspot activity - basically strong magnetic vortexes on the surface of the sun. This increased activity also leads to increased solar flares, coronal mass ejections, protuberances, and fluctuations in solar wind. Some of the ejected matter travels toward earth, interacts with the Earth's own magnetic field, and is observable on Earth as Aurora Borealis or Aurora Australis.

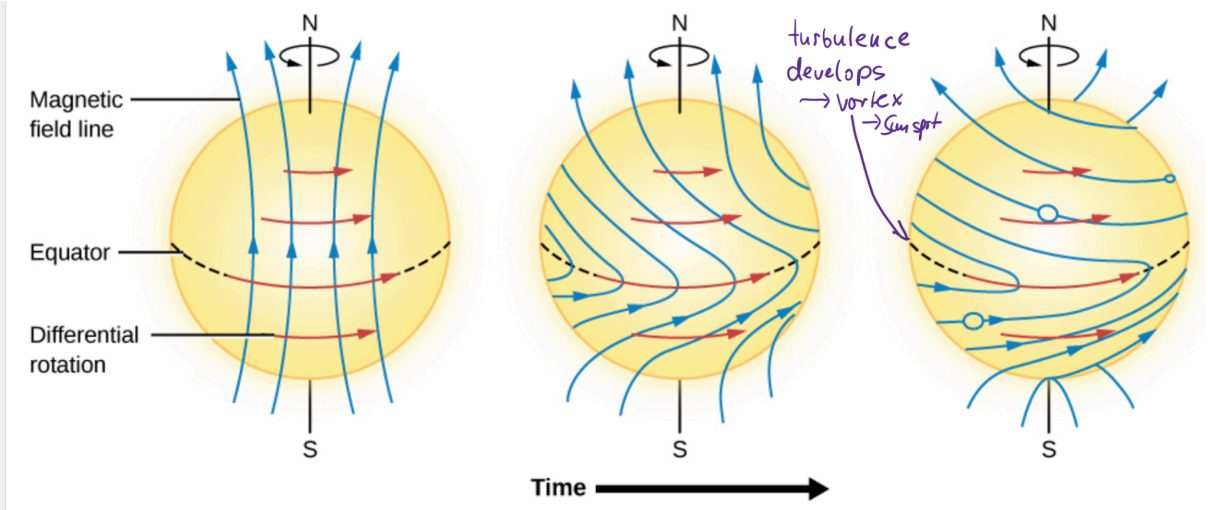


Figure 15.17 Magnetic Field Lines Wind Up. Because the Sun spins faster at the equator than near the poles, the magnetic fields in the Sun tend to wind up as shown, and after a while make loops. This is an idealized diagram; the real situation is much more complex. [2]

If you enjoy this cosmic connection between Earth and Sun, you might find astronomy and physics classes do establish such connections all the time. Hope to see you there.

[1] NC Wickramasinghe, et al (2020) Solar Cycle, Maunder Minimum and Pandemic Influenza. Journal of Infectious Diseases & Case Reports SRC/JIDSCR-143.
[2] https://openstax.org/books/astronomy-2e/pages/15-2-the-solar-cycle