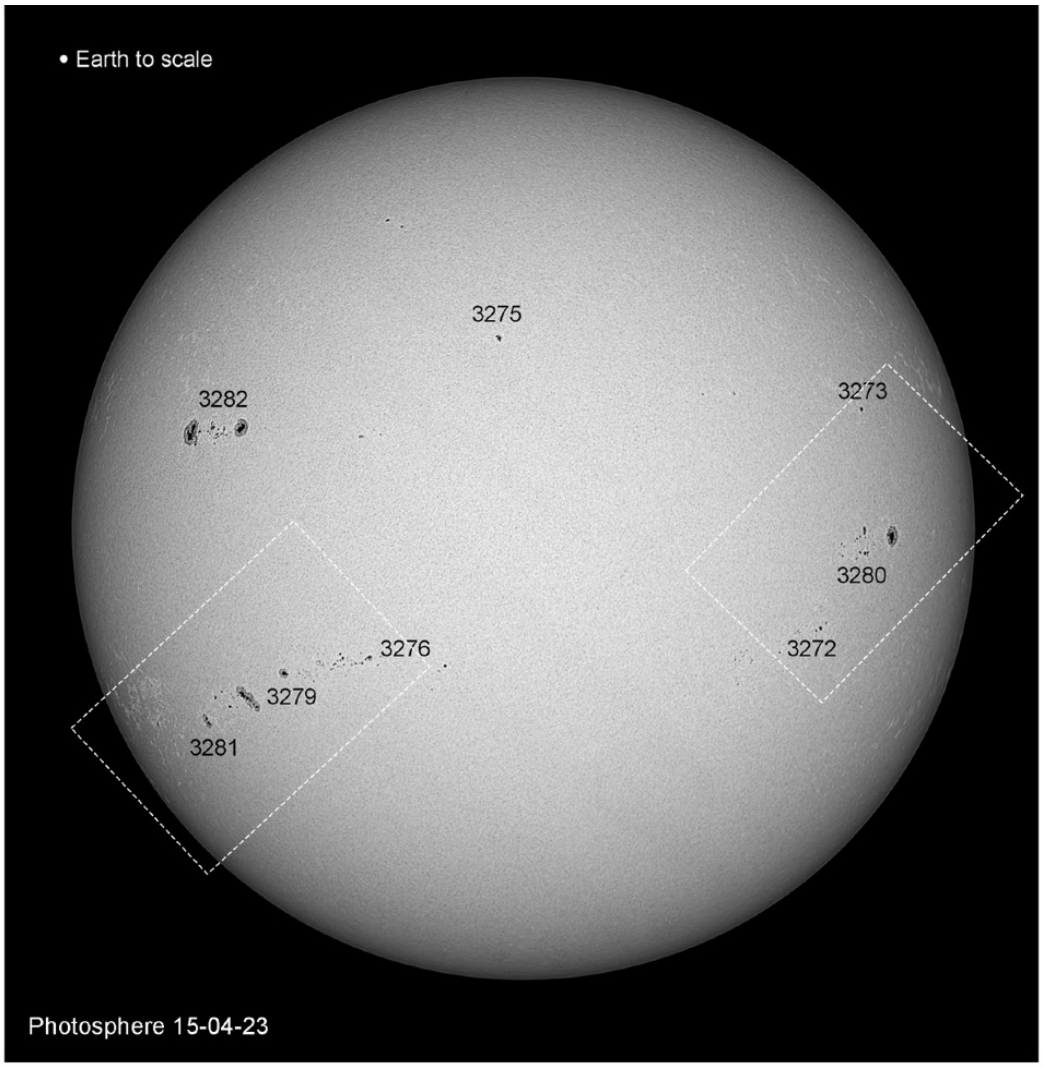
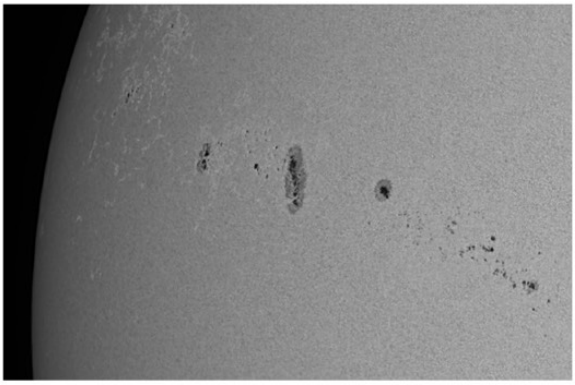
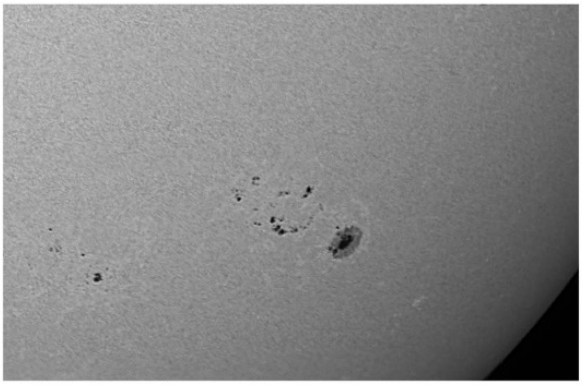
Solar Activity Update April 2023

Solar activity continues to increase as we move into cycle 25. Images from 15 April show nine active regions. Region 3279, 3282, 3280 and 3281 contain 18, 17, 14 and 12 individual sunspots respectively.





AR 3276, 3279 and 3281



AR 3272, 3273 and 3280

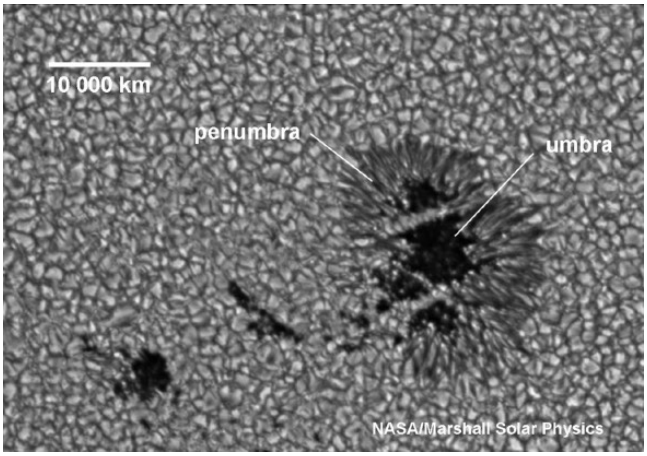
The images above show the photosphere, which is the visible surface of the Sun that we are most familiar with. Since the Sun is a ball of gas, this is not a solid surface but is actually a layer about 100 km thick (very, very, thin compared to the 700,000 km radius of the Sun).

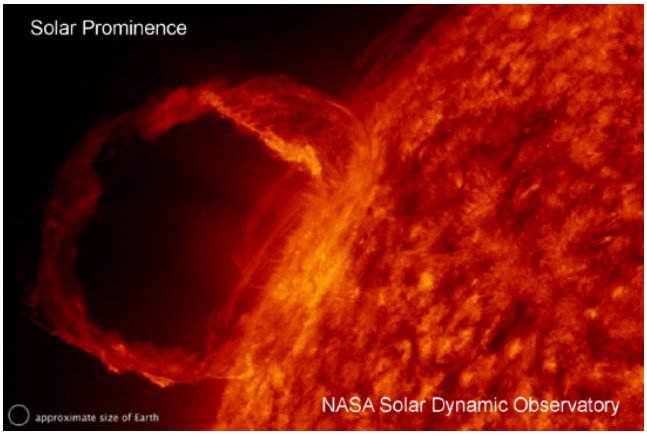
Photons of light are created within the Sun's core through nuclear fusion of hydrogen into helium. It takes the photons about 200,000 years to reach the photosphere from which they escape and then take approximately 8 minutes to reach Earth.

There are a number of features that may be observed on the photosphere. Sunspots appear as dark spots on the surface of the Sun. Temperatures in the dark centres of sunspots drop to about 3700˚C (compared to 5700˚C for the surrounding photosphere). They typically last for several days, although very large ones may live for several weeks. Sunspots are magnetic regions on the Sun with magnetic field strengths thousands of times stronger than the Earth's magnetic field. The field is strongest in the darker parts of the sunspots - the umbra and weaker in the lighter part - the penumbra.

Faculae are bright areas that are usually most easily seen near the limb, or edge, of the solar disk. These are also magnetic areas but the magnetic field is concentrated in much smaller bundles than in sunspots. While the sunspots tend to make the Sun look darker, the faculae make it look brighter. During a sunspot cycle the faculae actually win out over the sunspots and make the Sun appear slightly (about 0.1%) brighter at sunspot maximum that at sunspot minimum.

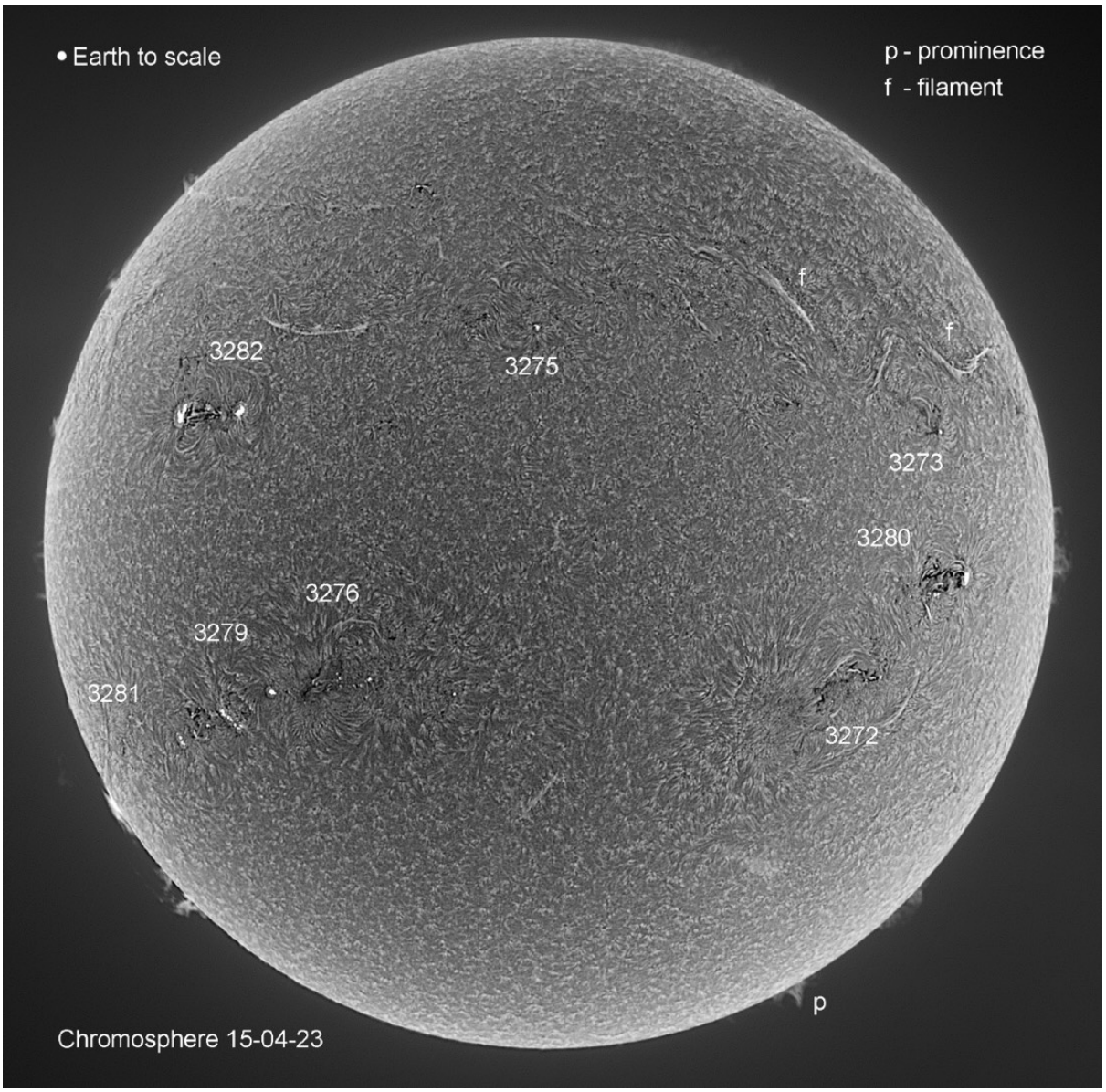
The mottled appearance on the surface shows Granules which are small (about 1000 km across) cellular features that cover the entire Sun except for those areas covered by sunspots. These features are the tops of convection cells where hot fluid rises up from the interior in the bright areas, spreads out across the surface, cools and then sinks inward along the dark lanes. Individual granules last for only about 20 minutes. The granulation pattern is continually evolving as old granules are pushed aside by newly emerging ones. The flow within the granules can reach supersonic speeds of more than 7 km/s (15,000 mph) and produce sonic "booms" and other noise that generates waves on the Sun's surface.



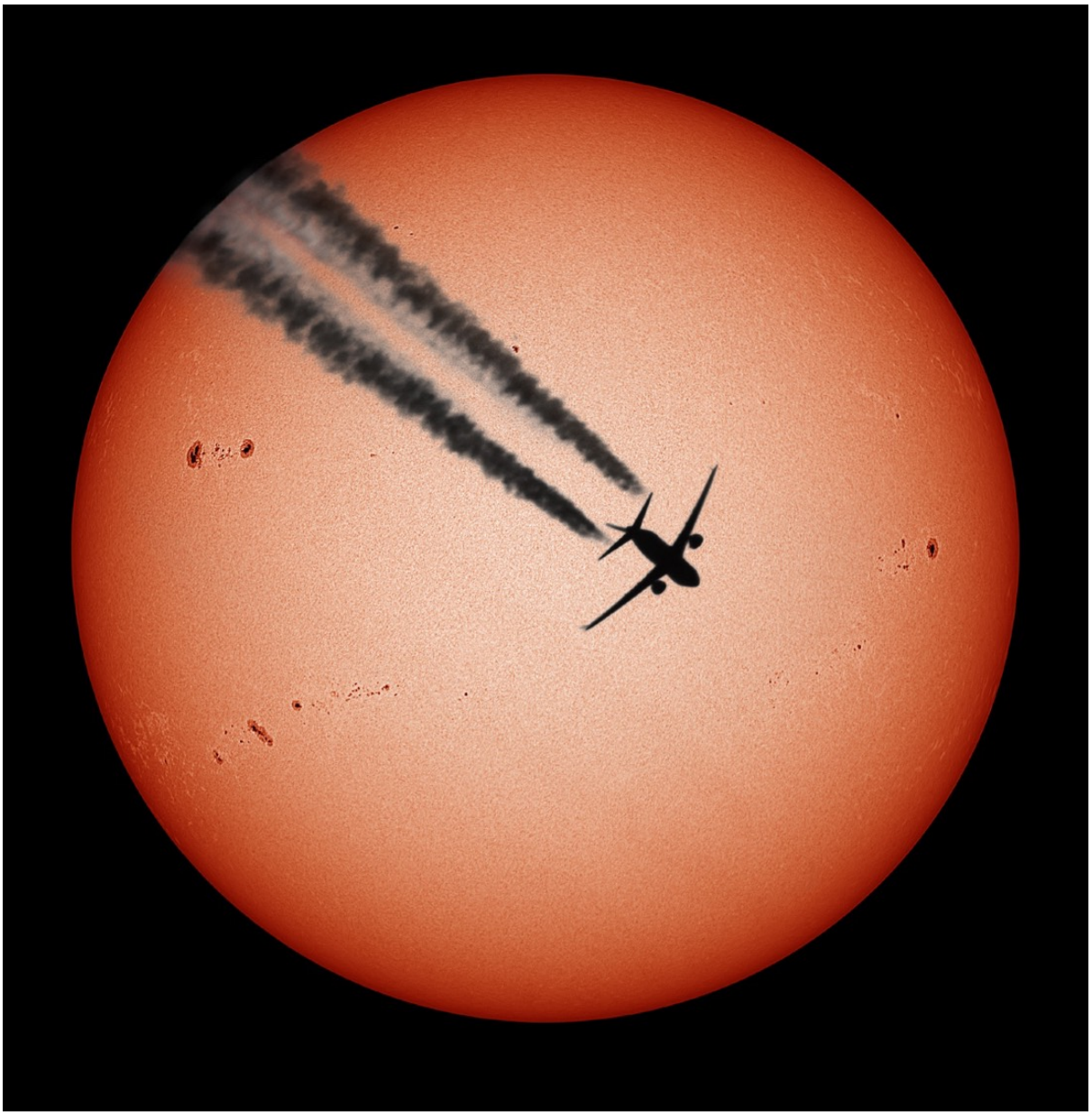


The chromosphere is an irregular layer above the photosphere where the temperature rises from 6000°C to about 20,000°C.

In the image below, which has been inverted, the lighter areas are slightly cooler and the darker areas hotter. Prominences are visible around the solar disk – these are great loops of hydrogen plasma, suspended above the chromosphere, but anchored to it by positive and negatively-charged ends. Sometimes the oppositely charged ends can "snap" together (similar to opposite ends of a pair of magnets attracting each other) and a large burst of plasma is then launched into space and some of it reaches us on Earth, causing electrical storms and the aurora. Filaments are also prominences, but seen face-on when looking at the solar disk. Their length shows just how large solar prominences are, particularly when compared to the diameter of the Earth.



Objects that fly through the air such as birds, insects and very occasionally aircraft can make a cameo appearance in an image. During the imaging of the above, a Ryanair 737 aircraft flying between Gatwick and Gran Canaria very nicely transited the solar disk!



All images unless otherwise noted, were taken by Jean Dean, Astronomy Section. The images of the photosphere were taken with refracting telescopes fitted with a Herschel wedge and ZWO ASI178 planetary camera. The image of the chromosphere was taken with a Ha-solarscope and ASI178 camera.

Please note: Never look directly at the Sun with your naked eyes or optical instruments as permanent eye damage will occur. Viewing and imaging the Sun safely requires specialist equipment.