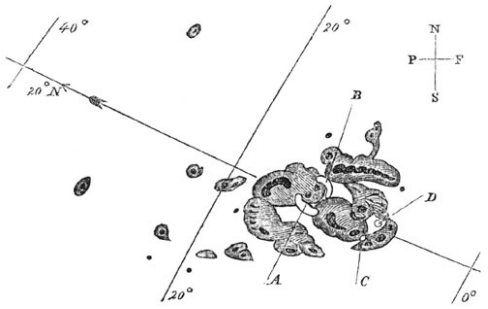
Sun – Part 28 - 1859 Carrington event



Sunspots recorded by Richard Carrington, 1859 Aurora

On 1 September 1859, English astronomer Richard Carrington continued the daytime heliographic measurements of sunspots from his observatory in Surrey, which he had begun in 1857. Sunspot number had been very high ever since 28 August, but, on this particular day, he became one of the first two people to independently make the first observation of a solar flare. The other observer was Richard Hodgson, an amateur astronomer with an observatory in Essex.

What they saw, with the naked eye on a projection of the Sun through a telescope onto a screen, was a 'white light flare' in the Sun's photosphere. When Carrington learned that the nearby Kew Observatory magnetometer had concurrently recorded a crochet, an instantaneous perturbation of Earth's ionosphere, he connected the two, identifying that the flare he had observed was associated with the numerous sunspots he had observed during previous days and the terrestrial effects which had been experienced on Earth.

The flare was associated with a massive coronal mass ejection (CME) which had begun the 150 million km journey from the Sun 18 hours earlier (normally it takes 3-4 days for a CME to reach Earth). It was proposed that this great speed was facilitated by an earlier CME which had 'cleared the way' a few days earlier.

The CME which produced the flare on 1 September 1859 was part of the largest geomagnetic storm ever recorded by ground-based magnetometers. During the 1-2 September storm, aurorae were visible around the world, those in the Northern Hemisphere observed as far south as the Caribbean and sub-Saharan Africa. The auroral light was so bright that it woke miners in the Rocky Mountains, leading them to think it was morning. Others in the southern USA could read the newspaper at night. In the Southern Hemisphere, aurorae were visible as far north as northern Queensland and southern Papua New Guinea. Although no records exist, it is possible that they were even visible to those at high altitude on the equator.

However, the effects of the geomagnetic storm were not all positive. Telegraph systems across Europe and North America failed due to large induced voltage increases, sometimes giving operators electric shocks and setting light to wooden telegraph poles.

Ice core analysis has identified that large-scale events occur approximately once every 500 years. Although there have been more recent massive geomagnetic storms, eg 1882, 1921 and the 1989 event which caused collapse of power grids and blacked out parts of eastern Canada, fortunately, so far, they have not been as powerful or as destructive. Estimates are that if another 1859 event occurred in modern times, the cost to the US alone would be $0.6-2.6 trillion. It is, therefore very fortunate that the trajectory of the 'Carrington-class' solar superstorm of 23 July 2012 missed Earth.

Carrington's observations and records of sunspots and solar activity earned him a lasting legacy. Although he did not discover the 11-year solar cycle, the system of numbering cycles carries his name eg the 2010 maximum was part of Carrington Cycle No 24. Also, his work on sunspots led to increased understanding of solar rotation which has established 'Carrington rotation', the system used to identify individual rotations of the Sun.

Sources: Ridpath, I (Ed) (2012) Oxford dictionary of astronomy 2nd ed rev, www.en.wikipedia.org