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The 20 March 2015 solar eclipse in Europe

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Every year there are two or more solar eclipses on Earth (and also two or more lunar ones). Yet it is a lifetime experience when it happens in the place, area, or country we live in. In a few days, people in Svalbard (Norway) and the Faroe Islands (Denmark) will see a total eclipse while the rest of Europe, northern and eastern Asia, and northern and western Africa will observe a partial occultation of the Sun by the moon (the northern the location the larger and longer the eclipse). The next solar eclipse visible in Europe will be in 2026.

Solar eclipses occur when the Moon in its monthly orbit around the Earth happens to cross in front of the Sun. They happen only at new moon, but do not happen every month because the Moon's orbital plane is tilted by about 5° from the Earth orbital plane around the Sun (called ecliptic because both lunar and solar eclipses happen when the three objects align in it). For a solar eclipse to happen, the new moon phase has to occur when the Moon is precisely crossing the ecliptic (in a lunar eclipse, the Moon makes the cross at the full moon phase).

Although eclipses do not happen every month, they come in groups. The Sun, Moon, and Earth become close enough in alignment, what is called a syzygy, for about 34 days every 6 months or so. There are always two eclipse seasons each year, with two to three eclipses in each of them. In 2015, the first season has eclipses on 20 March (total solar eclipse) and 4 April (total lunar eclipse), and the second season has them in 13 September (partial solar eclipse) and 28 September (total lunar eclipse).

While lunar eclipses can be seen from anywhere on the night side of the Earth and last for a few hours, solar eclipses can only be viewed from a certain relatively small area of the world and last for only a few minutes at any given place, due to the smaller size of the Moon's shadow. In a given place on Earth, a total solar eclipse will be observed in average every four hundred years or so.

The 20 March solar eclipse has some interesting peculiarities. It will happen on the same day than the March equinox and during a so-called supermoon, the Moon will be very close to perigee, therefore the distance between Earth and Moon is the smallest, making the Moon appear slightly larger on the sky (an effect we cannot detect by naked eye though).

And distance happens to be a key factor in eclipses, as seen from Earth. The Sun's distance from Earth is about 400 times the Moon's distance, and the Sun's diameter is about 400 times the Moon's diameter. That is why the Sun and the Moon appear to be approximately the same size on the sky, making possible total or annular eclipses, besides the partial ones.

Due to tidal acceleration, the orbit of the Moon around Earth becomes approximately 2.2 cm more distant each year. In a very distant past, the Moon was too close to Earth to precisely occult the Sun as it does during total eclipses today. In the future, eclipses will be only annular and at some point they will be considered simply transits. No other planet in the Solar System can enjoy a total solar eclipse like we do on Earth.

Many ancient civilizations were able to figure out the cycles behind eclipses and predict them quite accurately, yet these events were then still considered ominous. As we can precisely compute

when eclipses happen, some of them have been used to date historical events. Moreover, Chinese historical records of solar eclipses dating back over 4,000 years have been used to measure changes in the Earth's rate of spin.

Eclipses are still the only natural way to observe the solar corona (otherwise you must resort to a solar coronagraph). Extending millions of kilometers into space, the corona is a plasma that produces about one-millionth as much visible light than the Sun's surface—that is why it is so difficult to observe—yet it is far hotter, reaching one to three million kelvin, therefore emitting most of its radiation in X-rays.

The exact mechanism by which the corona is heated is still a subject of some debate. The high temperatures require energy to be carried from the solar interior to the corona by non-thermal processes. Likely possibilities include induction by the Sun's magnetic field and magnetohydrodynamics waves from below. The outer edges of the Sun's corona are constantly being transported away due to open magnetic flux generating the solar wind.

Interestingly enough, the first observational confirmation of Einstein's theory of general relativity was obtained from the total solar eclipse of 29 May, 1919. Sir Arthur Eddington measured the angular distance on the sky between some stars, with the Sun between them as observed during the totality. Later on he compared those angular distances with measurements made between the same stars at night. Although the effect measured was close to the experimental limits of accuracy at the time, work in the later half of the twentieth century confirmed his results.

If you happen to be in an area where a solar eclipse will be visible, remember that except during the totality (i.e. the Sun 100% covered by the Moon), the Sun even when partially covered must not be looked at directly; therefore, use the appropriate filters or techniques (like projection) to observe the eclipse.

Contact times for any eclipse can be found at: http://eclipse.gsfc.nasa.gov/solar.html

How to safely observe solar eclipse can be found at: http://eclipse.gsfc.nasa.gov/SEhelp/safety.html

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