Solar physics

Hot topics

A new spacecraft will be the second in 18 months to examine the sun close up

The sun is one of the most-studied objects in the sky, but plenty of mysteries remain. On February 10th a rocket blasted off from Florida carrying Solar Orbiter, a European space probe designed to solve some of them. This craft will spend the next two years performing fly-bys of Venus and Earth, using the gravity of both planets to kick itself into an unusual orbit that will take it well above the ecliptic, the plane in which all of the sun’s planets orbit.

From that vantage Solar Orbiter will peer at the sun’s poles, something no spacecraft has managed before, and do so from close up. At its nearest, it will be just 42 million km from the sun—closer than Mercury, the innermost planet, gets. One of its features is, therefore, a heat shield coated with charcoal made from cooked animal bone and designed to endure temperatures up to 500°C. Tiny windows within this will illuminate the probe’s various instruments.

Those instruments are designed to shed light, as it were, on several questions. One concerns the solar wind, a flow of charged particles that streams from the sun at a rate of more than 1 million tonnes a second. The solar wind blows at an average speed of 400 km a second, but physicists do not know exactly what accelerates those particles to such a velocity. Another mystery is the sun’s magnetic field. Every 11 years or so, for reasons only partly understood, this flips its north and south poles around. Solar Orbiter’s masters hope their charge will observe such a reversal, which is expected to happen within the next few years.

They also hope that Solar Orbiter will advance the nascent science of solar-weather forecasting. The entire solar system is bathed in the solar wind, which means that what happens on the sun can affect conditions around the planets. Solar flares—sudden spikes in the sun’s brightness—boost radiation levels in the neighbourhood of Earth, which can interfere with satellites’ electronics, alter their orbits and pose health risks to astronauts. Coronal mass ejections (CMEs), which are occasional burps of superheated plasma that the sun releases into space, can disrupt radio communications and induce large, potentially damaging electric currents in power grids, communication lines and the like.

These risks are not hypothetical. In 1859 a massive CME caused auroras as far south as the Caribbean and damaged telegraph systems all over America and Europe. An-