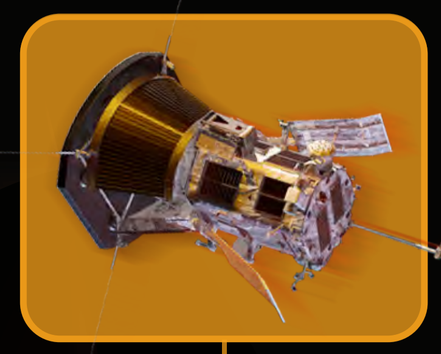
National Aeronautics and Space Administration

Solar Wind and Corona Timeline

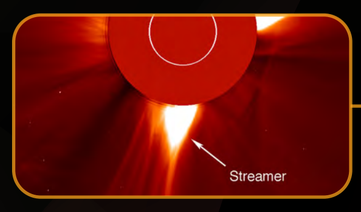
PARKER SOLAR PROBE LAUNCH

A mission to travel directly through the Sun's corona, providing up-close observations on what heats the solar atmosphere and accelerates the solar wind.



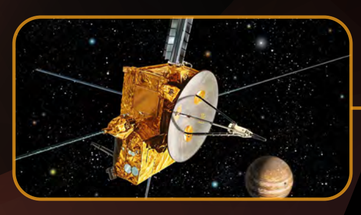
Slow Solar Wind and Helmet Streamers

Using observations from the joint ESA/NASA Solar and Heliospheric Observatory, Neil R. Sheeley Jr. and colleagues identify puffs of slow solar wind emanating from helmet streamers – bright areas of the corona that form above magnetically active regions on the photosphere. Exactly how these puffs are formed is still not known.



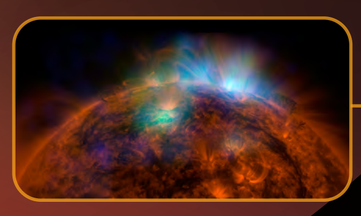
The Sun's Poles

Ulysses, a joint NASA-ESA mission, becomes the first mission to fly over the Sun's north and south poles. Among other findings, Ulysses found that in periods of minimal solar activity, the fast solar wind comes from the poles, while the slow solar wind comes from equatorial regions.



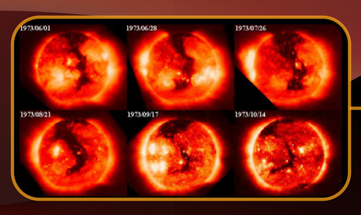
Nanoflares May Heat the Corona

Eugene Parker proposes that frequent, small eruptions on the Sun – known as nanoflares – may heat the corona to its extreme temperatures. The nanoflare theory contrasts with the wave theory, in which heating is caused by the dissipation of Alfvén waves.



Fast Wind from Coronal Holes

Images from Skylab, the U.S.'s first manned space station, identify that the fast solar wind is emitted from coronal holes – comparatively cool regions of the corona where the Sun's magnetic field lines open out into space.



The Slow and Fast Solar Wind

NASA's Mariner 2 spacecraft observes the solar wind, detecting two distinct 'streams' within it: a slow stream travelling at approximately 215 miles per second, and a fast stream at 430 miles per second.

Solar Wind Detected

The Soviet satellite Luna 1, the first spacecraft to leave geocentric orbit, measures the solar wind directly for the first time, confirming key parts of Parker's theory.

The First Theory of the Solar Wind

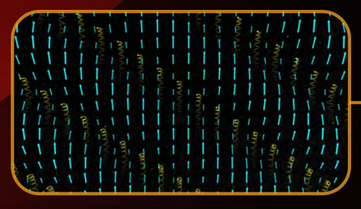
Eugene Parker connects the hot corona with the solar wind in a rigorous mathematical theory. According to the theory, heat pressure from the million-degree corona forces it to expand outward in all directions, forming a solar wind that drags the Sun's magnetic field lines deep into space.

A Solar Wind Made of Particles

Building on Kepler's hypothesis from 400 years before, Cuno Hoffmeister (and later Ludwig Biermann) proposes that the Sun emits a steady stream of charged particles that push the ions in the comet tails always away from the Sun.

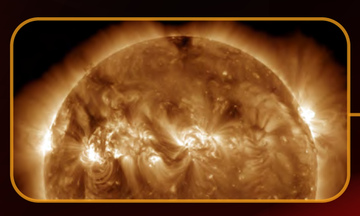
A New Heating Mechanism

Swedish physicist Hannes Alfvén proposes the existence of a new kind of wave forming in electrically conducting fluids. So-called Alfvén waves revealed a previously overlooked mechanism for heat and energy to be transferred on the Sun.



The Coronal Heating Problem

Swedish astronomer Bengt Edlen detects highly ionized iron in the corona, indicating a temperature of 1.8 million degrees Fahrenheit. Edlen's findings created the coronal heating problem: Why is the corona so much hotter than the Sun's surface?



The Corona as the Sun's Atmosphere

English astronomer Francis Baily observes a total solar eclipse and suggests that the hazy 'corona' outlining the Sun is its atmosphere.

Comet Tails in the Wind

Johannes Kepler observes comet tails and hypothesizes that they are blown by pressure from sunlight – a solar breeze.

2018
1995
1990
1988
1973
1962
1959
1958
1943
1942
1842
1610

A historical timeline of solar science discoveries—leading to the newest spacecraft in NASA's heliophysics fleet.

www.nasa.gov