SOLAR CORONAL HOLES

X-ray images of the Sun often show large dark regions. These are called coronal holes. They may extend from the Sun's equator to its poles, or even in some cases, from pole to pole. Although in the 1960's they were found in x-ray images taken by sounding rockets and detected with the Sydney Chris-Cross radio telescope (but not recognised for what they were), they were first seen most clearly in images taken by astronauts on board the Skylab space station in 1973 and 1974.

Coronal holes occur when the Sun's magnetic field is open to interplanetary space. Conversely, in regions where the solar magnetic fields loop back to the Sun forming arches, x-ray and UV images show bright areas. The brightest points in the images are generally at the top of the magnetic loops or arches.

The regions of open magnetic field lines are also found to be regions where the corona has a lower density than where the magnetic field lines are closed. The open configuration of the magnetic field in coronal holes allows particles to escape, and it is found that these holes are sources of high speed solar wind streams. When the particles from these streams hit the Earth they may cause geomagnetic storms.

At times of high solar activity, geomagnetic storms are generally the result of coronal mass ejections (CME's) intersecting the Earth's orbit, but at times of low solar activity, coronal holes are the most common source of geomagnetic storms. Because coronal holes can last for several months, it is often possible to predict the occurrence of this type of geomagnetic disturbance, as the high speed stream sweeps past the Earth with each solar rotation (like a rotating garden sprinkler).

In general, geomagnetic storms originating from a coronal hole have a gradual commencement and are not as severe as storms caused by CME's, which usually have a sudden onset.

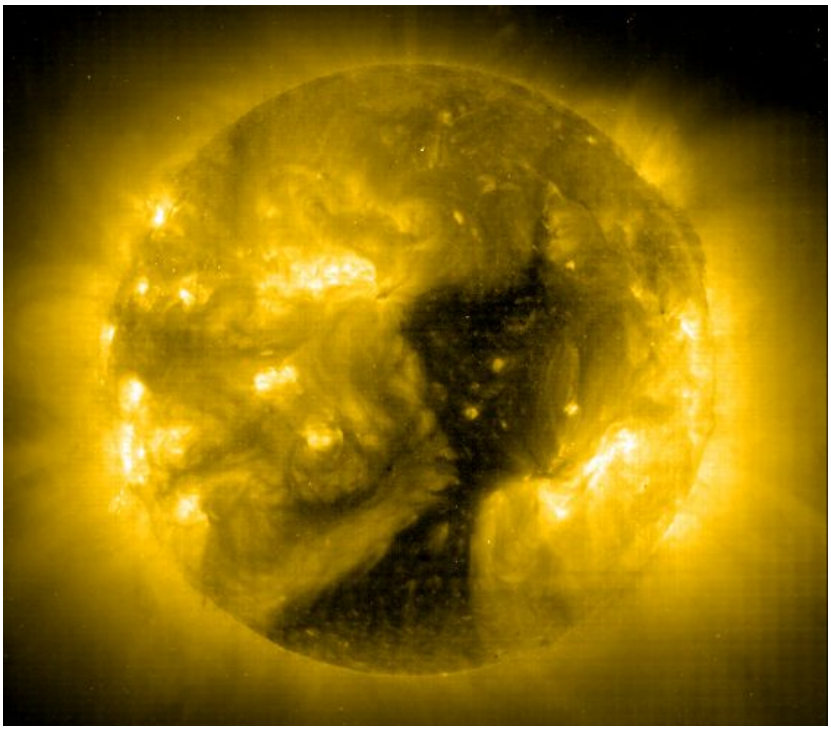

Image from SOHO spacecraft (ESA/NASA) - 2002-01-08 EIT

Although coronal holes are best observed in extreme ultraviolet or x-ray images, they can also be observed from the ground in the light of helium at a wavelength of 1083 nanometres.