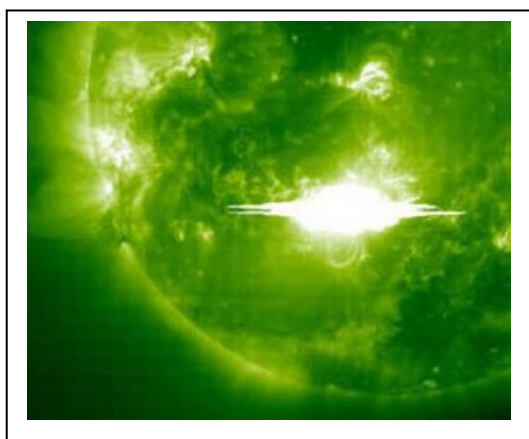


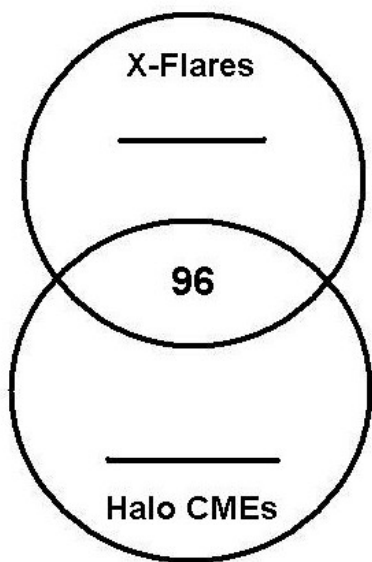
Solar storms come in two varieties:

Coronal Mass Ejections (CMEs) are clouds of gas ejected from the sun that can reach Earth and cause the Aurora Borealis (Northern Lights). These clouds can travel at over 2 million kilometers/hr, and carry billions of tons of matter in the form of charged particles (called a plasma). The picture to the left shows one of many CMEs witnessed by the SOHO satellite.



Solar Flares are intense bursts of X-ray energy that can cause short-wave radio interference on Earth. The picture to the left shows a powerful X-ray flare seen by the SOHO satellite on October 28, 2003.

Between 1996 and 2006, astronomers detected 11,031 coronal mass ejections (CMEs), and of these, 593 were directed towards Earth. These are called 'Halo CMEs' because the ejected gas surrounds the sun's disk on all sides and looks, like a halo around the sun. During these same years, astronomers also witnessed 122 solar flares that were extremely intense X-flares. Of these X-flares, 96 happened at the same time as the Halo CMEs.

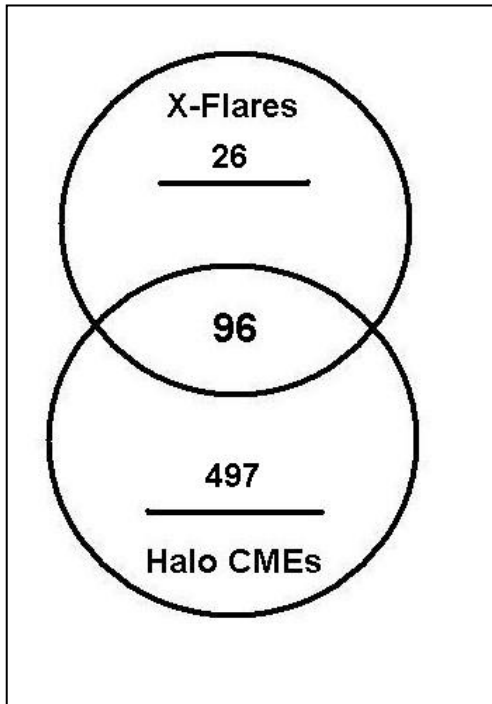


Problem 1 - From this statistical information, fill-in the mission numbers in circular Venn Diagram to the left.

Problem 2 – What percentage of X-Flares also happened at the same time as a Halo CME?

Problem 3 – What percentage of Halo CMEs happened at the same time as an X-Flare?

Problem 4 – What percentage of all CMEs detected between 1996 and 2006 produced X-Flares?



Answer 1 - The total number of Halo CMEs is 593 and the total number of X-Flares is 122. The intersecting area of the two circles in the Venn Diagram shows the 96 events in which a Halo CME and X-Flare are BOTH seen together. The areas of the circles not in the intersection represent all of the X-flares that are not spotted with Halo CMEs (top ring) and all of the Halo CMEs that are not spotted with X-Flares (bottom ring).

The missing number in the X-Flare ring is just $122 - 96 = 26$, and for the Halo CMEs we have $593 - 96 = 497$.

Answer 2 – The total number of X-Flares is 122 and of these only 96 occurred with a Halo CME, so the fraction of X-Flares is just $96/122 = 0.79$. In terms of percentage, this represents 79 %.

Answer 3 – The total number of Halo CMEs is 593 and of these only 96 occurred with an X-Flare, so the fraction of Halo CMEs is just $96/593 = 0.16$. In terms of percentage, this represents 16 %.

Answer 4 – There were 11,031 CMEs detected, and of these only 96 coincided with X-Flares, so the fraction is $96/11031 = 0.0087$. In terms of percentage, this represents 0.87 % or less than 1 % of all CMEs.