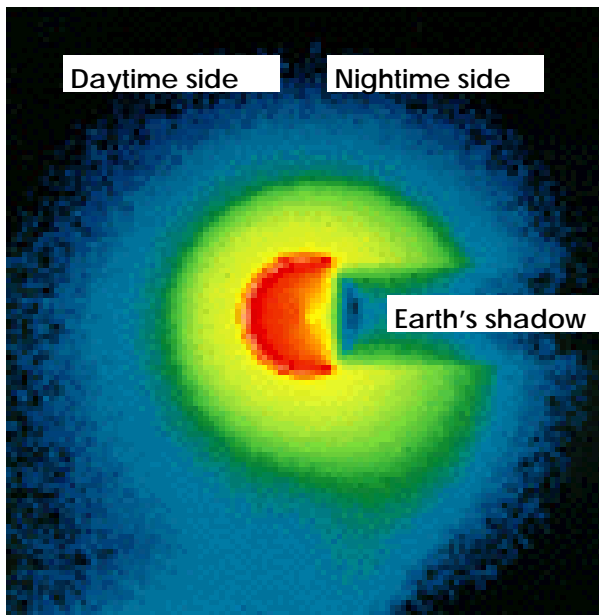




# Educational Brief

## Exploring the Plasmasphere with IMAGE



Simulated EUV image of the plasmasphere.

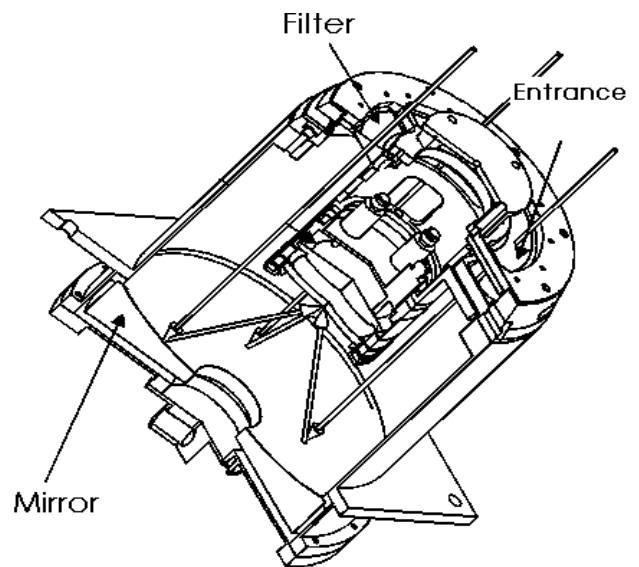
### Extreme Ultraviolet Imager (EUV)

EUV operates like an electronic camera to detect the light from the plasmasphere produced by helium atoms. The plasmasphere is an important gateway for the transfer of particles and energy into the inner magnetosphere and the upper atmosphere. It is also an important storage area for low-energy, charged particles from the Earth's ionosphere. Space scientists want to investigate how the plasmasphere changes during magnetic storms. From previous satellite investigations, we know that it fills-up and discharges low-energy plasma, but space scientists don't as yet understand where the plasma goes. There has been some speculation that the plasmasphere produces 'plasma clouds' which then leave the plasmasphere on the daytime side of the Earth, but this has never been observed.

The Earth is surrounded by an invisible, and complex, region called the *magnetosphere*, in which charged particles, called *plasmas*, are affected by the terrestrial magnetic field. A particularly large collection of plasma resides within the so-called *plasmasphere*. This zone includes the van Allen radiation belts, and is an extension of the Earth's ionosphere.

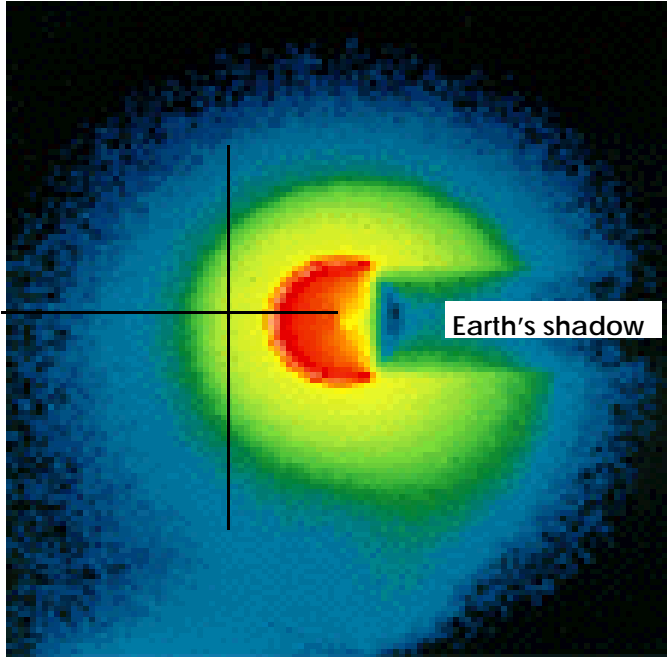
The plasmasphere consists mostly of hydrogen and helium atoms. This cold, low energy plasma is illuminated by the sun, and the light from the helium atoms can be detected. This allows space scientists to study the plasmasphere by directly imaging it with the proper instruments.

The Imager for Magnetosphere-to-Auroral Global Exploration (IMAGE) will study how aurora are produced using an instrument called the Extreme Ultraviolet Imager. (<http://image.gsfc.nasa.gov/poetry>)



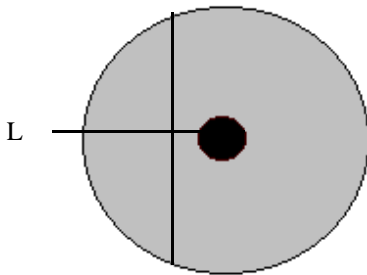
Schematic of the EUV camera.

# Where Does Outer Space Start?

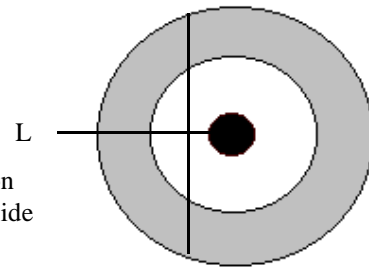


This picture, taken by the EUV camera, shows the size of the Earth's outer atmosphere. This region of the atmosphere is called the 'Exosphere'.

The colors you see, tell scientists how much gas there is at different distances from the Earth. There is about 100 times less gas in the blue areas than in the red areas of the picture.



This is a spherical cloud centered on the earth, that fills the complete volume.



This is a cloud centered on the earth that is empty inside and forms a shell of gas around the earth.

The brightness of a spot on the image of the exosphere depends on the length of the path through the cloud.

1...Draw a series of 10 equal-spaced chords along each line, L, across the two figures above. The one on the left shows a cloud of gas that completely fills the spherical volume. The one on the right shows a similar cloud that is hollow. An example of one of these lines is shown in each figure. Use the radius of the earth in each image to establish the correct scale for the plot.

2...If the intensity depends on the length of each chord that traverses the gas-filled part of the cloud, on a graph, plot the intensity of each chord (Y-axis) against the minimum distance of the chord from the center of the sphere (X-axis). For the above two lines, the one on the left will correspond to the brightest intensity because it intersects more of the light-emitting gas.

3...Use the image from the EUV camera to plot the actual intensity of the exosphere at a range of distances from the center of the earth in the figure at the top of the page. The marked line corresponds approximately to the ones in the two figures.

4...Is the exosphere brightness more consistent with a completely filled gas cloud or with a cloud that has a hollow center? How thick could the shell of gas be, and still be consistent in brightness with the EUV data?