

Plasmas in the Solar System

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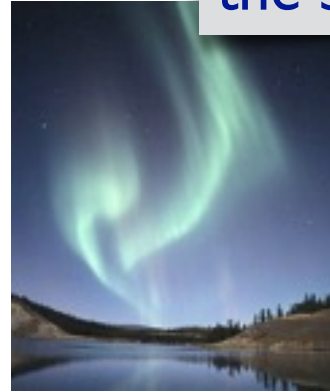
Página personal: <http://plasmalab.aero.upm.es/~lcl/>

Overview of plasmas in the Solar System.

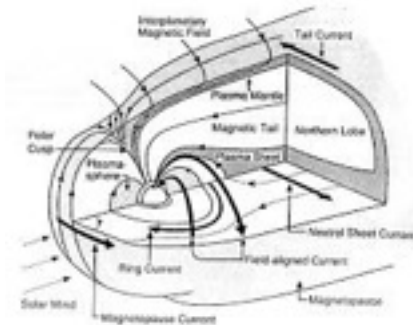
Solar flares and the sun chromosphere



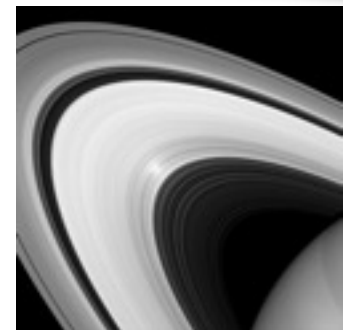
Solar storms and the solar wind



The Earth magnetosphere, ionosphere and atmosphere



The extraordinary Saturn planetary system (Cassini-Huygens mission)

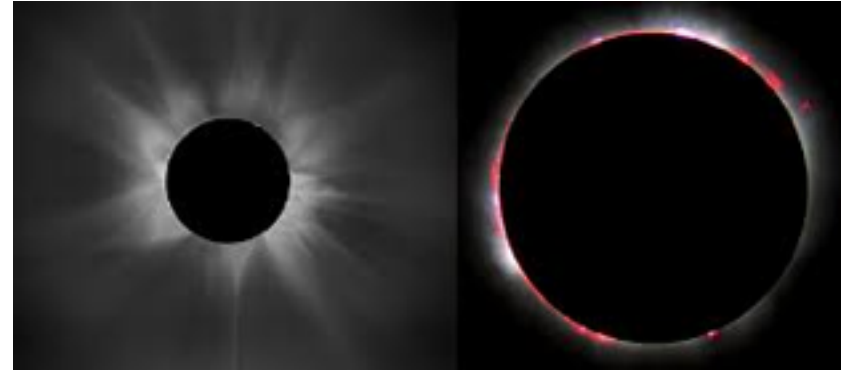


Plasmas are everywhere present in space



The Sun ejects large amounts of charged particles in the form of *solar flares*, charged particles following the local magnetic field lines. Note that we deal with false colors, we only see the radiation from the H_{α} line of hydrogen spectra.

Plasma structures in the solar chromosphere



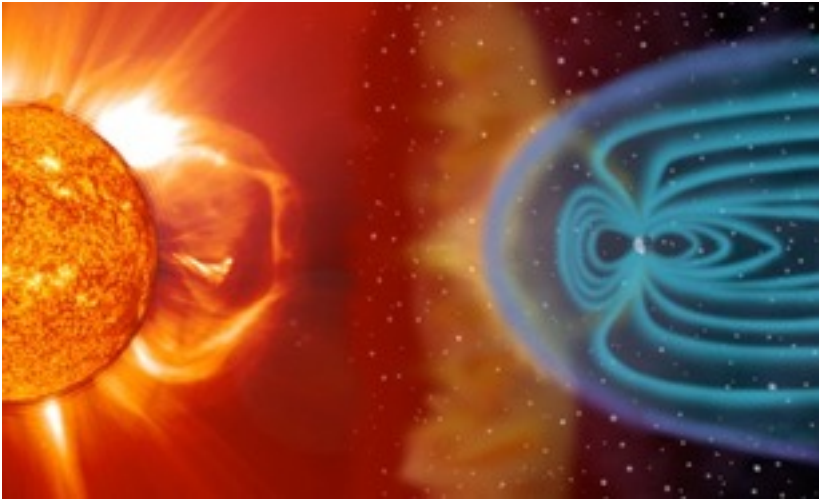
These impressive images evidence the complex structure of the [sun chromosphere](#), (we only see the H_{α} line of hydrogen spectra) where the transport of charged particles involves to [plasma waves and instabilities](#).

The length scales involved in solar flares are huge, ...



We can see these solar flares in action by courtesy of NASA, note that the time scale is not realistic,

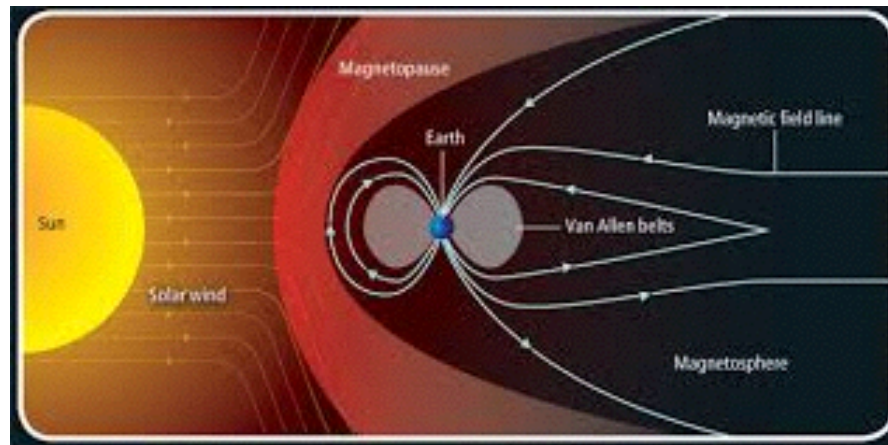
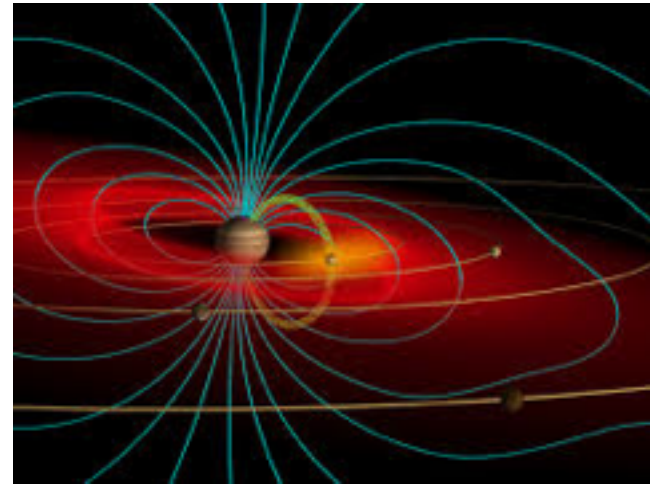
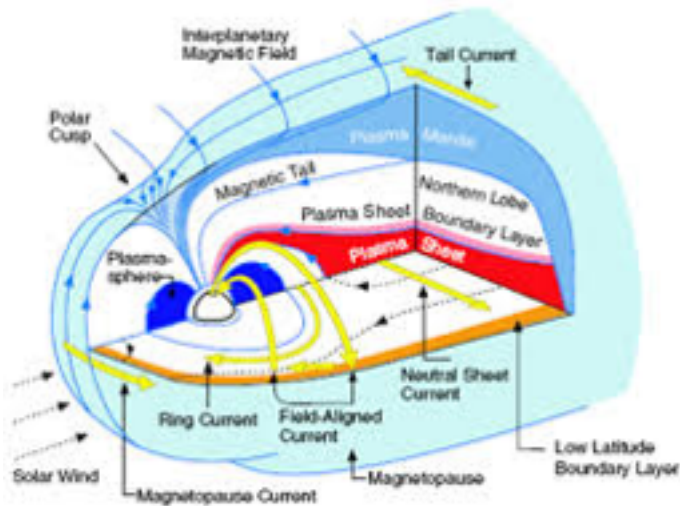
The solar activity affects the earth surroundings, ...



This solar stream of energetic particles *reach the Earth in minutes and penetrates the geomagnetic field* at the poles, forming the *aurora* at high latitudes

The particles moves along the magnetic field lines and *impact ionization* and excitation generates new particles and visible light

The Earth-Sun connection, the magnetosphere, ...



Plasmas are present in nature, ...

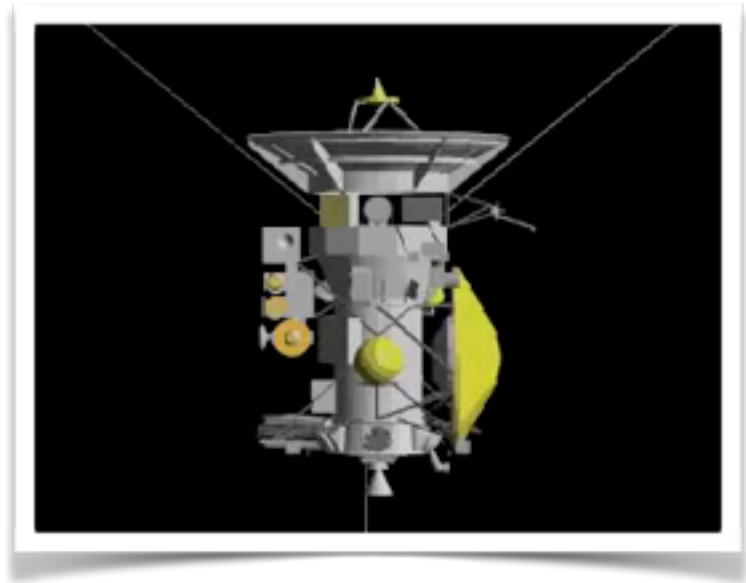


The storms release large amounts of energy that ionize the otherwise neutral gases of air in the Earth atmosphere. The medium becomes *electrically conductive*

The Cassini-Huygens mission to Saturn, ...

The main objectives of this NASA-ESA joint mission were,

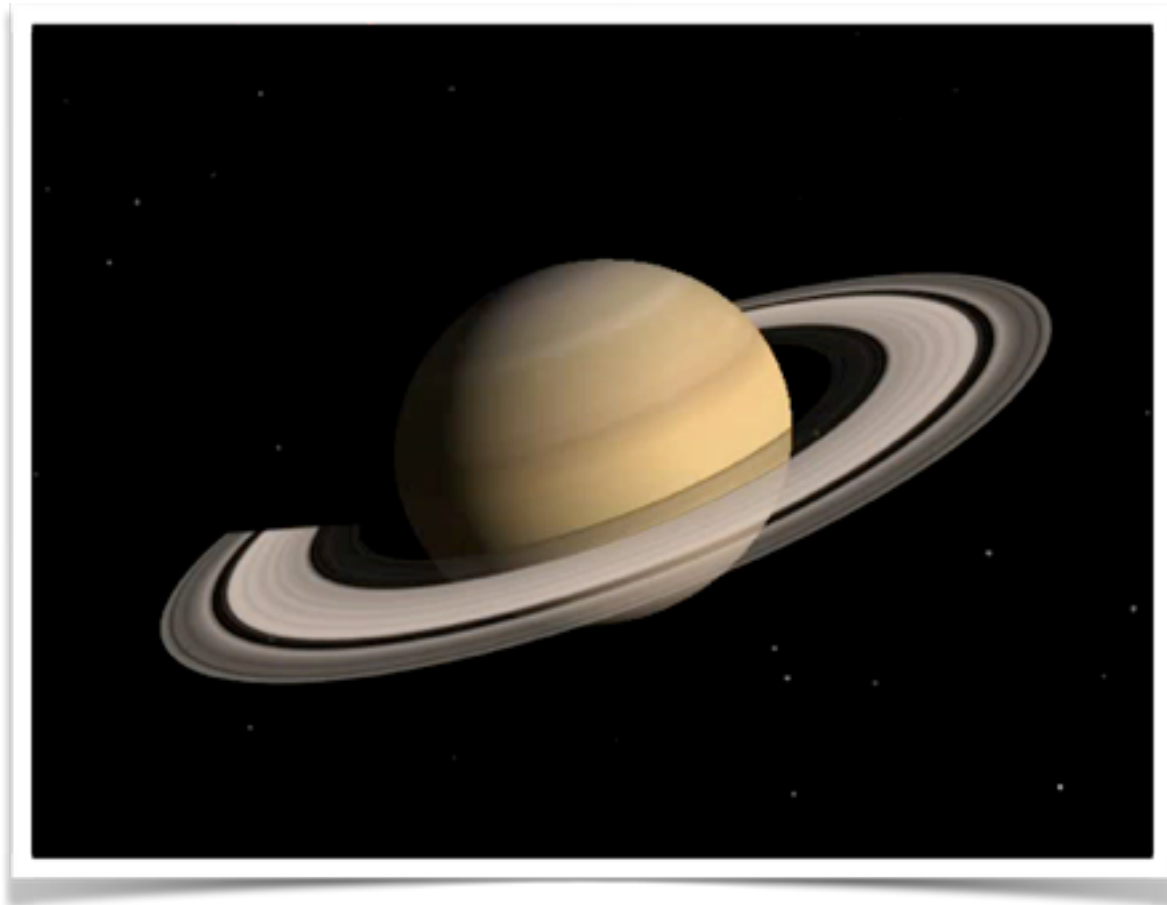
- Determine the structure and dynamic behavior of the rings of Saturn
- Measure the structure and dynamics of the magnetosphere
- Study the time variability of Titan's clouds and its surface (Huygens)



The saturnian system constitutes a huge plasma physics laboratory

http://www.nasa.gov/mission_pages/cassini/main/

Approaching Saturn, ...

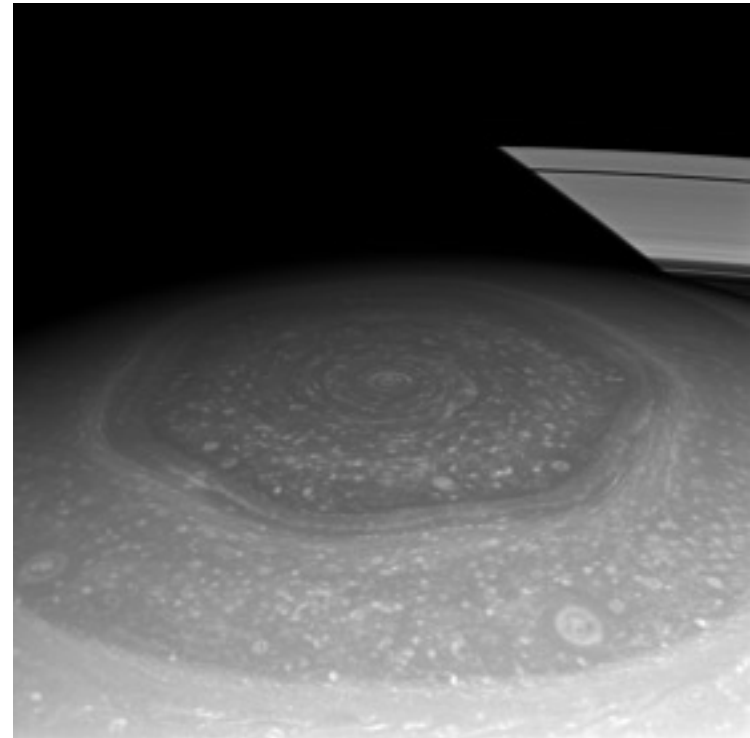
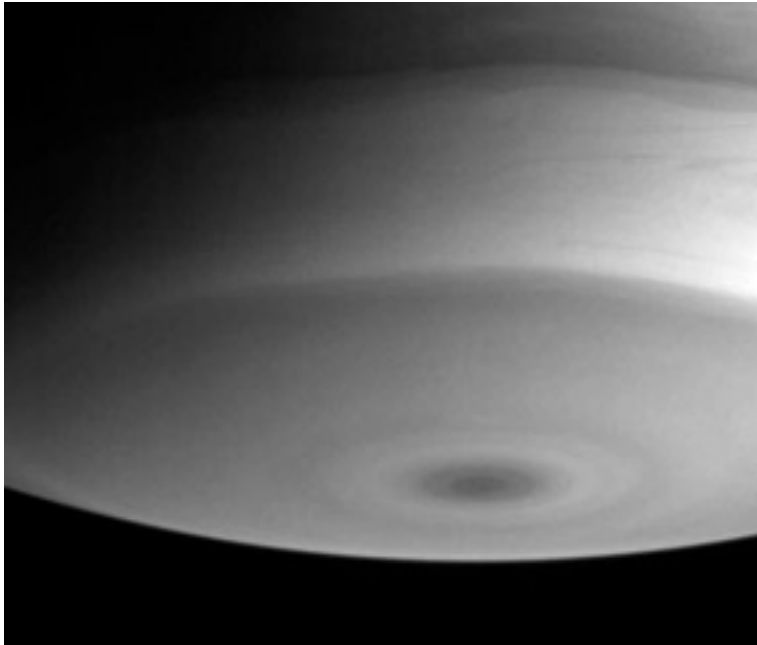


The impressive images from *Saturn* taken by Cassini show the planet shadow over the rings that are a *dusty plasma*.

The filtered light reveals plasma activity, ...

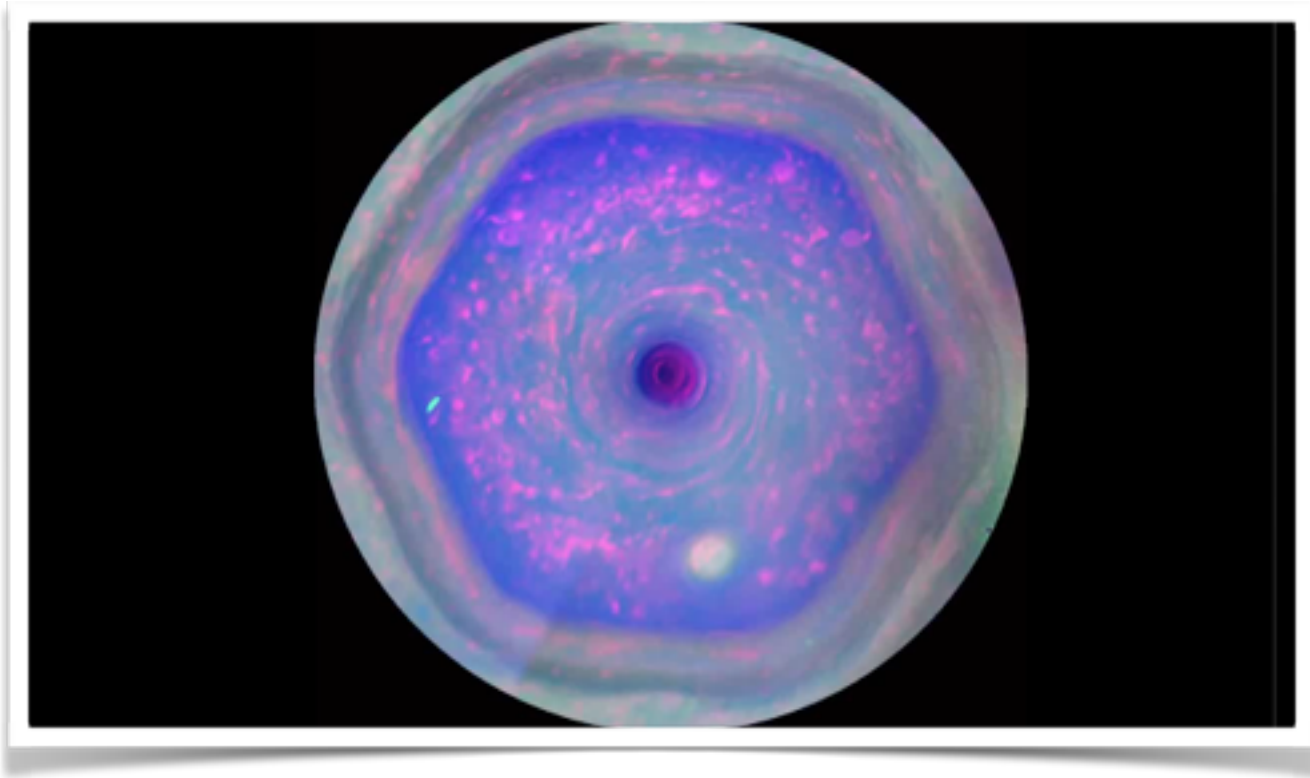


These impressive images shows the light emission caused electron impact collisions between neutrals and electrons at the poles of Saturn



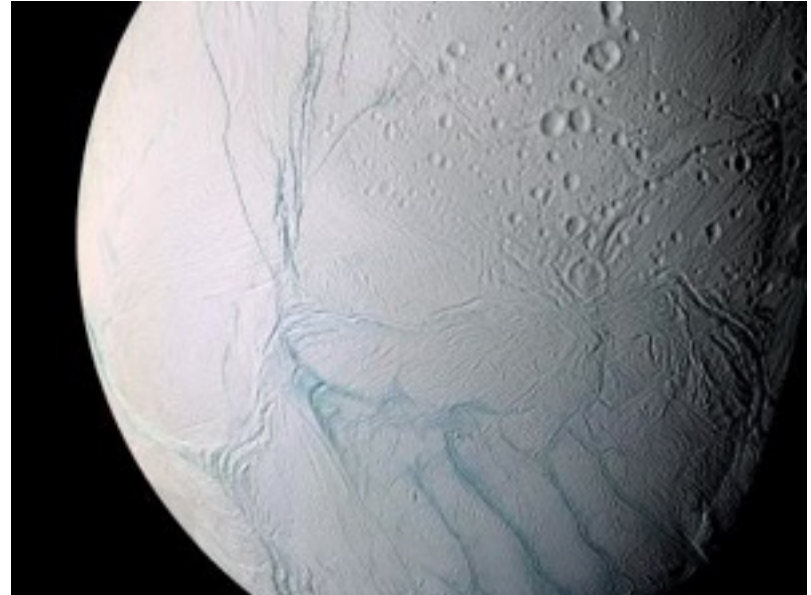
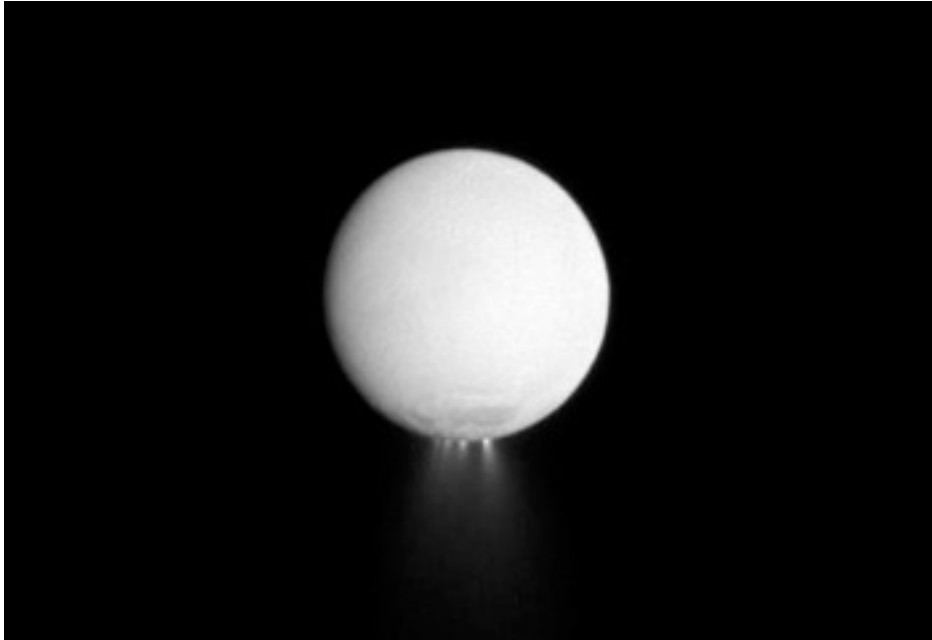
The structure of the rings is an example of a *dusty plasma* we mentioned before

A closer view of the north pole hexagon, ...



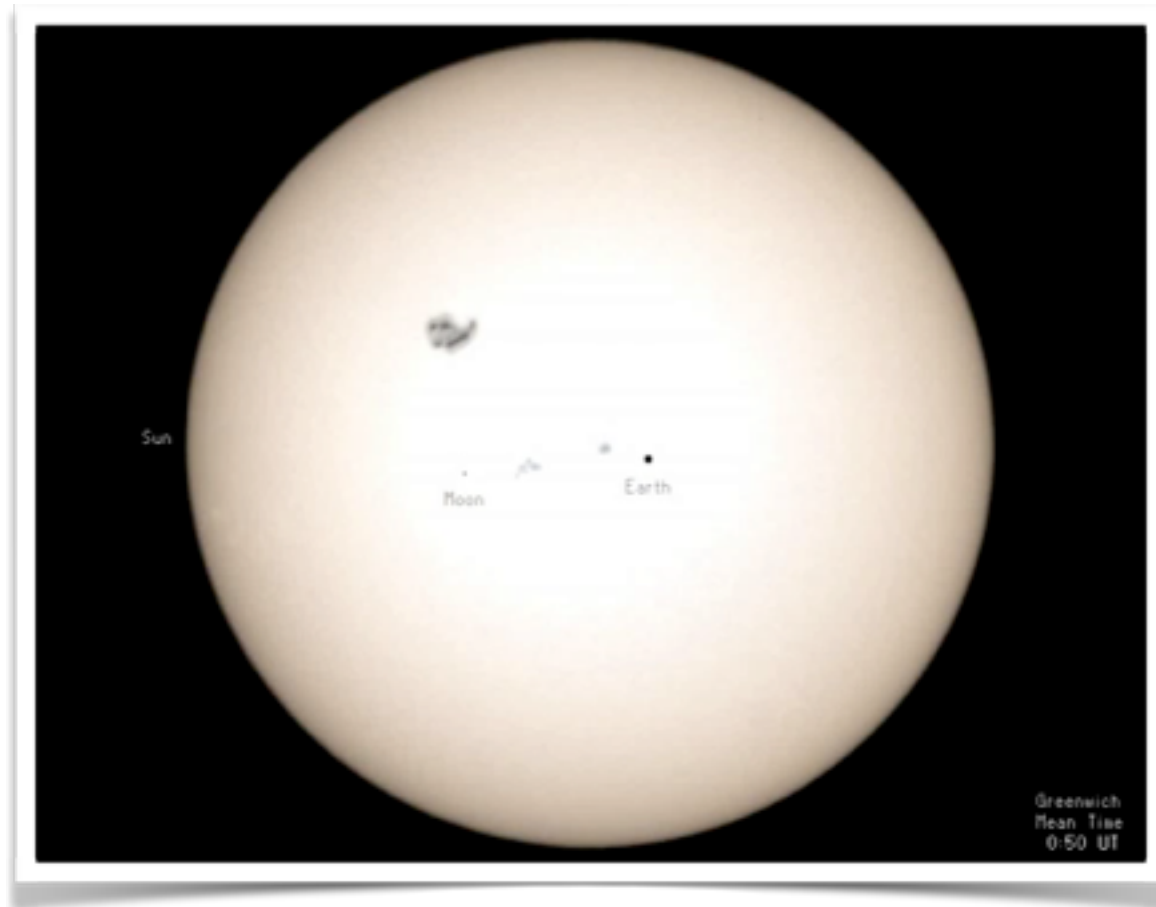
The size of the hexagon is about, ...32,000 Km in diameter!!

The intriguing moon of Encelado, ...



This satellite seems to feed the saturnian rings with material from below its iced surface, but ...how?... Is this situation stable?


Have you ever visited Titan?, ...



This is not a computer simulation!

A flyby over the lakes of Titan, ...





Unfortunately, the physical description of plasmas is hard as we will see in the following lectures, ...