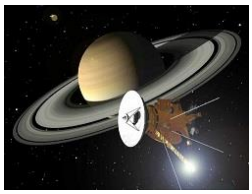


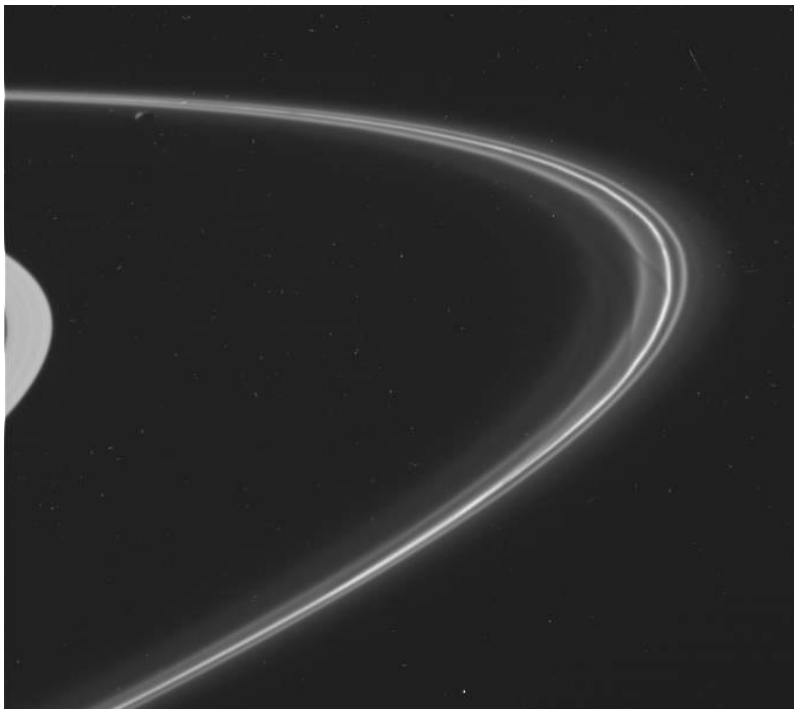
Cassini: Mission Planning Exercise

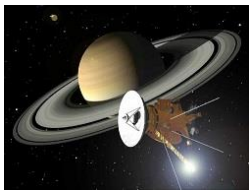
Rings

Each of the giant planets in the Solar System have rings, but Saturn's are the most spectacular. They are made of water ice and dust. The particles are small, from micrometres to metres. There are a number of different rings that have been identified and they are given the title A, B, C, etc, in the order they were named and not in order from inside to outside as you might expect. The rings are studied because they are similar to something called a "proto-planetary" disc found around stars. Our own Sun had one of these discs and it is from this material that the Solar System formed. Therefore understanding the forces and processes at work in the ring system of Saturn can give an insight into how planets form around stars.

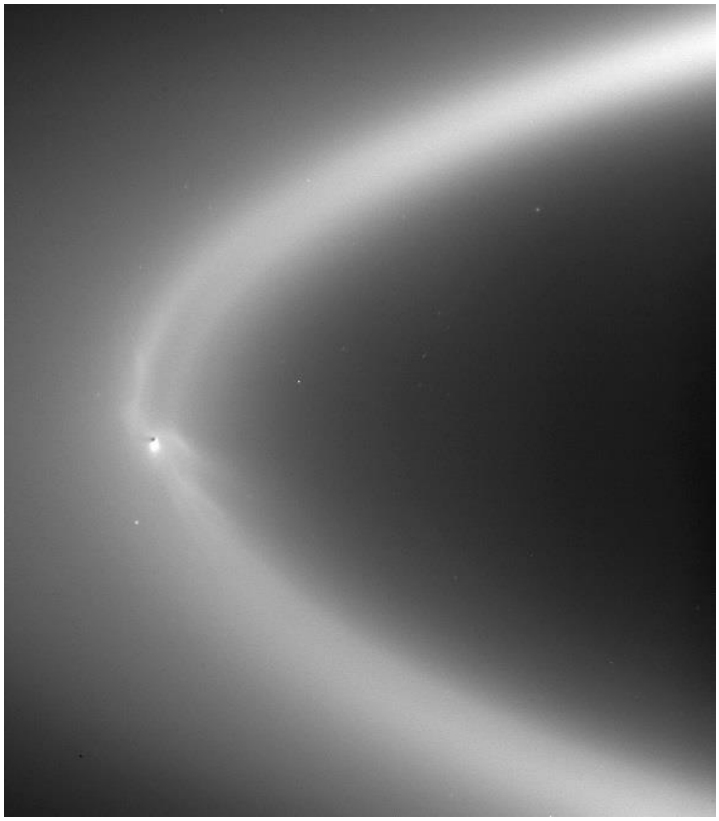
Instruments

Using the imaging system, pictures can be taken of the rings and more can be learned about what is going on. The camera system is made up of a charged coupled device (CCD) that is 1024x1024 pixels. It has extremely high resolution and can see a 10p (2.4cm across) at a distance of 4km away. Images aren't just taken in visible wavelengths. The camera system can operate from ultra-violet through to infra-red, allowing intricate details of the planet, rings and moons to be clearly viewed. For example, it can be clearly seen in the F-ring, that there is an interaction that is causing ripples or spokes to appear:





It can also be suggested that the moon Enceladus is responsible for material that is being thrown into the E ring:

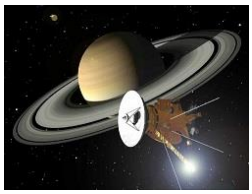


The magnetometer is also used to explore the rings. This instrument is essentially a magnetic compass and directly measures a magnetic field. The instrument is extremely sensitive to electric currents and metal components, so it is placed on an 11m boom made of non-metallic material. The boom remained folded during launch and was only deployed two years after launch. A detailed 3D model of Saturn's magnetic field will be useful in understanding more about the interaction of the rings and moons. How are they affected by Saturn's magnetic field? What about the moons of Saturn? Do they have a magnetic field and does this affect the rings?

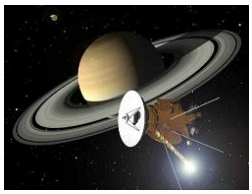
Using the dust detector important information on particles found in the Saturnian system can be identified. The instrument allows investigation of their physical and chemical properties and also the study of how they interact with the rings, moons and magnetic fields around Saturn. A grid collects the particles for study and the particle is then assessed by other components inside the instrument. This is an important instrument for learning more about the rings, as it can show the composition of the rings with regards to the type of particles but also their size and perhaps even their source.

Getting Started

- Do you get close to any moons? If so, which ones and when?
- When do you get closest to the planet?
- When do you cross the ring plane?
- Which of the four instruments do you want to use to make your observations?
- When do you want to make those observations?



Cassini: Mission Planning Exercise



Cassini: Mission Planning Exercise

Spreadsheet Instructions

When you have decided what targets you want to go for and the instruments you want to use, you are ready to fill in the spreadsheet.

There are only two different columns that you can put data into:

1. Column C: target. Type in the name of the object you want to focus on, eg Titan.
2. Column D: instrument. Next to the name of the object put in the code for the instrument you want to use.

Key for instruments:

Instrument	Symbol
Imaging	I
Magnetometer	M
Dust detector	D
Radar	R
(asleep)	Z
Telemetry Downlink	*T*

Importantly, each instrument takes up data in the memory. There is a maximum amount that can be used up in each time period. Once the memory is full, the data must be sent back to Earth. This then means new observations can be made. However, whilst the data is downloaded the spacecraft can't be used for anything else.

		Data Rate
Instrument	Symbol	(Mb per hour)
Imaging	I	200
Magnetometer	M	70
Dust detector	D	100
Radar	R	400
(asleep)	Z	0
Telemetry Downlink	*T*	*-100*

Once you have filled in all the slots where you want to make some observations (you don't have to fill in the whole spreadsheet!) you should ensure that the group knows the scientific reasons for making that observation as you may have to negotiate with other groups to get what you want…