

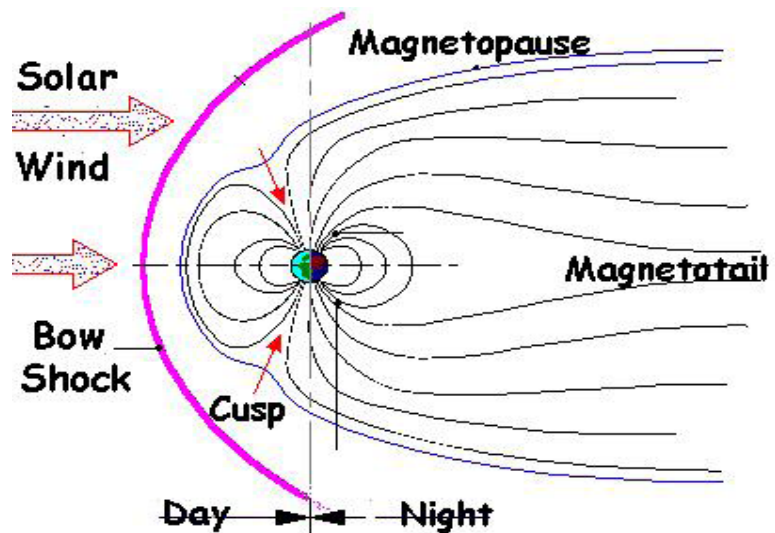
# Activity 12 - The Magnetosphere

## TEACHER'S GUIDE

In order to discuss Earth's magnetic field and its changes, we need a common vocabulary. Scientists recognize over two dozen distinct regions and processes occurring within the magnetosphere. Some are nearly permanent features, while others appear and disappear within minutes or hours. In this activity, students will visit a website and learn the main features of the magnetosphere and the functioning of the Sun-Earth system. Students should start a lab book in which to keep notes about Earth's magnetosphere, space weather, and magnetometer data.

### GOALS

- 1) Students will learn about the basic elements of the Sun-Earth system.
- 2) Students will appreciate that the magnetosphere has many different regions.



### PROCEDURE

- Students will identify the definitions for each term by reading the discovery pages from the IMAGE satellite education program.
- By reading each “discovery page,” students will learn about recent advancements and see how the terms relate to each other. In all cases, the definitions are provided at the bottom of each page.

The collection of pages at: <http://image.gsfc.nasa.gov/poetry/IMAGEDisc.html> will provide summaries of each discovery, and definitions of the terms. Also, see the web resources at the end of this guide for additional sources. Students may also use Google™ or “WIKIPEDIA” to find relevant, brief definitions. This provides a great opportunity for students to compare definitions, and for the teacher to discuss the credibility of the various resources used in student web research.

The accompanying Teacher Answer Key indicates where on the NASA-IMAGE website the definitions can be found.

## TEACHER ANSWER KEY

**Magnetosphere** - Answer at the link 2001- Discovery 14

**Bow Shock** - Answer at the link 2001 – Discovery 4

**Magnetopause** - Answer at the link 2003 – Discovery 3

**Magnetotail** - Answer at the link 2001 – Discovery 1

**Polar Cusp** – Answer at the link 2000 – Discovery 2

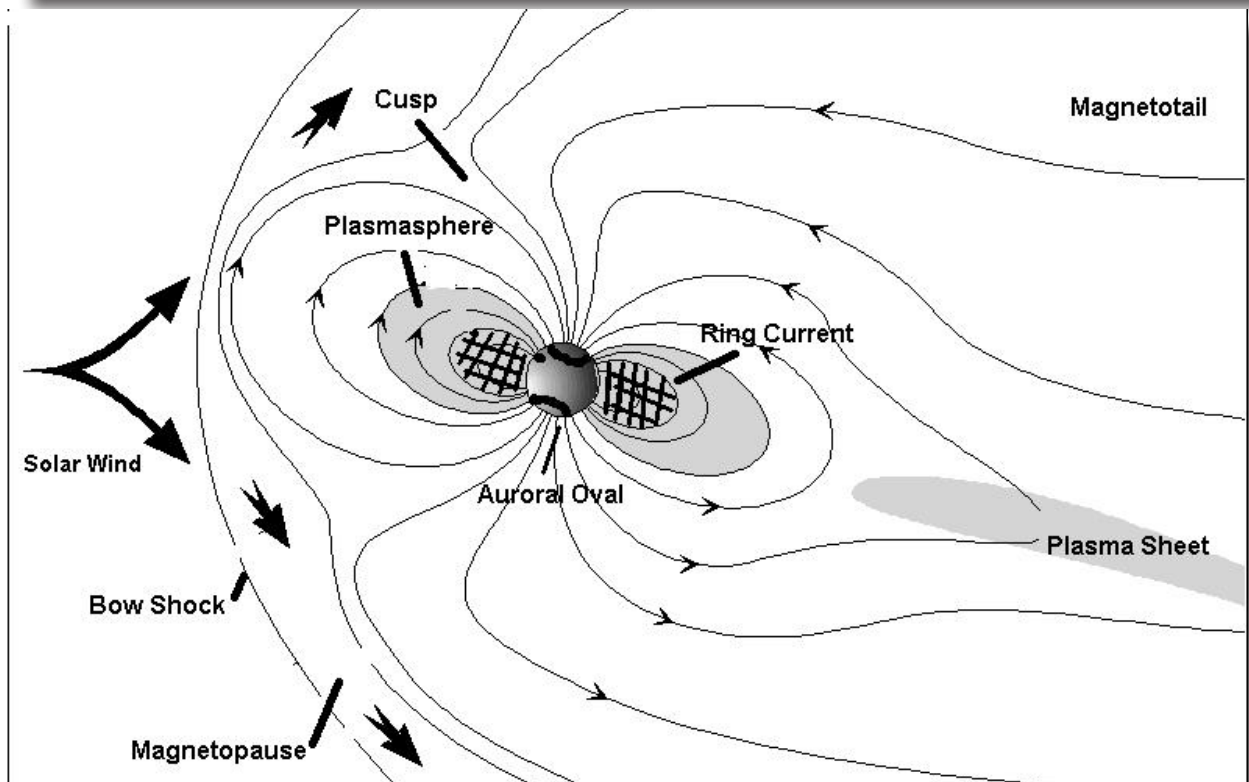
**Plasma Sheet** - Answer at the link 2001 – Discovery 8

**Auroral Oval** - Answer at the link 2001 – Discovery 7

**Ring Current** – Answer at the link 2001 – Discovery 10

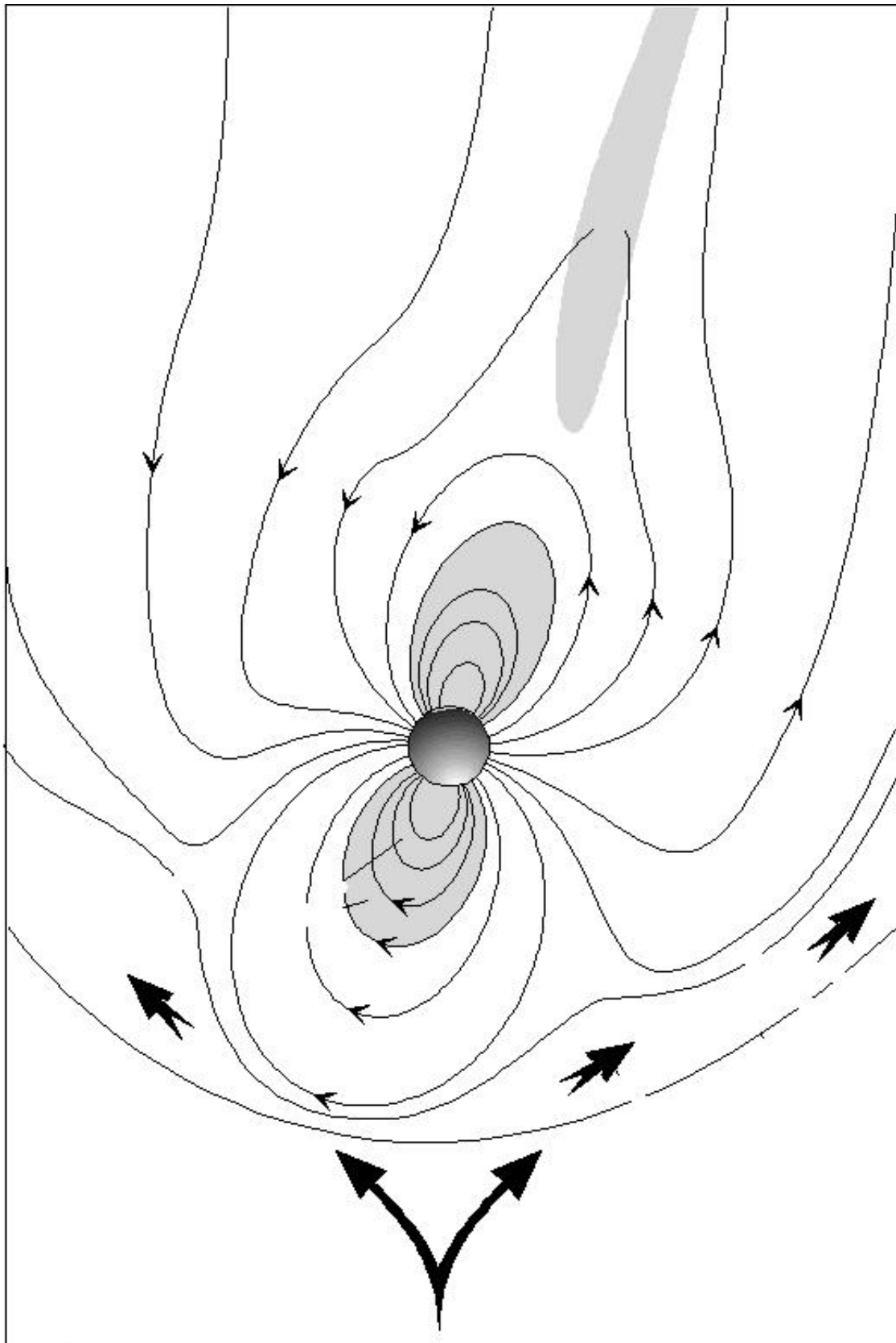
**Solar Wind** - Answer at link 2003 – Discovery 8

A Google™ image search (click on “images” under the Google™ page header) using the key word “magnetosphere” will call up many diagrams that look like the figure below. Note, the plasmasphere and ring current, as well as the inner Van Allen Belts, are situated in the same spatial locations, but differ significantly in the energy (in electron volts, or eV) of the particles involved. Plasmasphere (~1 eV), Ring Current (10,000 - 200,000 eV), Van Allen Belts (1 million to 50 million Volts). Note that 1 Joule =  $1 \text{ kg m}^2/\text{s}^2 = 10^7 \text{ ergs} = 6.242 \times 10^{18} \text{ eV}$ , which is equivalent to the energy of lifting a lemon 1 meter.



## MAGNETIC MYSTERIES OF THE AURORA

# Earth's Magnetic Field in Space



*Student Name* \_\_\_\_\_ *Date* \_\_\_\_\_

## The Magnetosphere

The goal of this activity is for you to become familiar with the main terms that scientists use to discuss Earth's magnetic field. Review the information at the following website, which contains discoveries made by the IMAGE satellite, and the definitions for magnetospheric terms:

<http://image.gsfc.nasa.gov/poetry/IMAGEdisc.html>

Start a lab book. In your lab book, provide definitions to the following terms, and locate them on the accompanying figure. You will be referring back to the entries in this book as your main source of basic information in the weeks to come.

Magnetosphere

Bow Shock

Magnetopause

Magnetotail

Polar Cusp

Plasma Sheet

Auroral Oval

Ring Current

Solar Wind

**Inquiry Problem** - Pick one of the terms and write a short essay in your own words about why scientists are trying to learn about it.