The Universe:
From Near to Far

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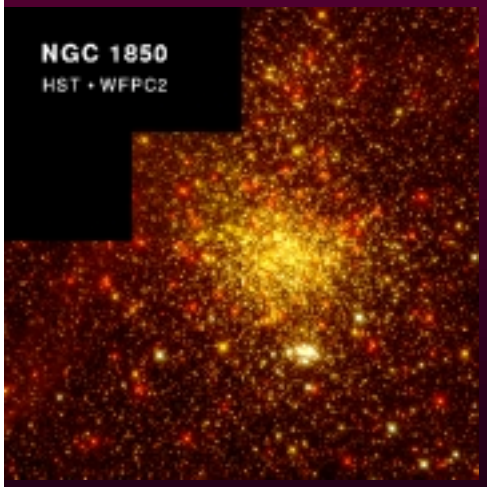
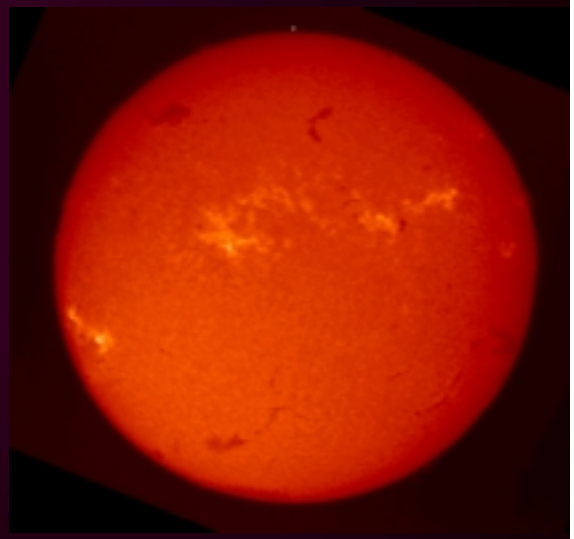




What is Space?
Why should we care?
How can we study it?
Where are the questions?

March 9, 2000

Science and Education

…if you tell me I listen … if you teach me I learn … if you involve me I remember …

(Jim Diaz quoting Ben Franklin)

Outreach and education are intrinsically linked

- Stimulate interest and you will stimulate learning

Scientists at all levels must get involved in sharing their subjects

For years the sky has entranced us

Van Gogh's Starry Night

How do we observe distant things?

- Optical Telescopes (in many different wavelengths)
  - From earth
  - From satellites (why?)
- Radio telescopes
- Landers

Distances

Diameter of Earth is about 12700 km

Sun to Earth is about 149,600,000 km

Distance from sun to pluto is 5,900,000,000 km

1 light year is 9,460,000,000,000 km

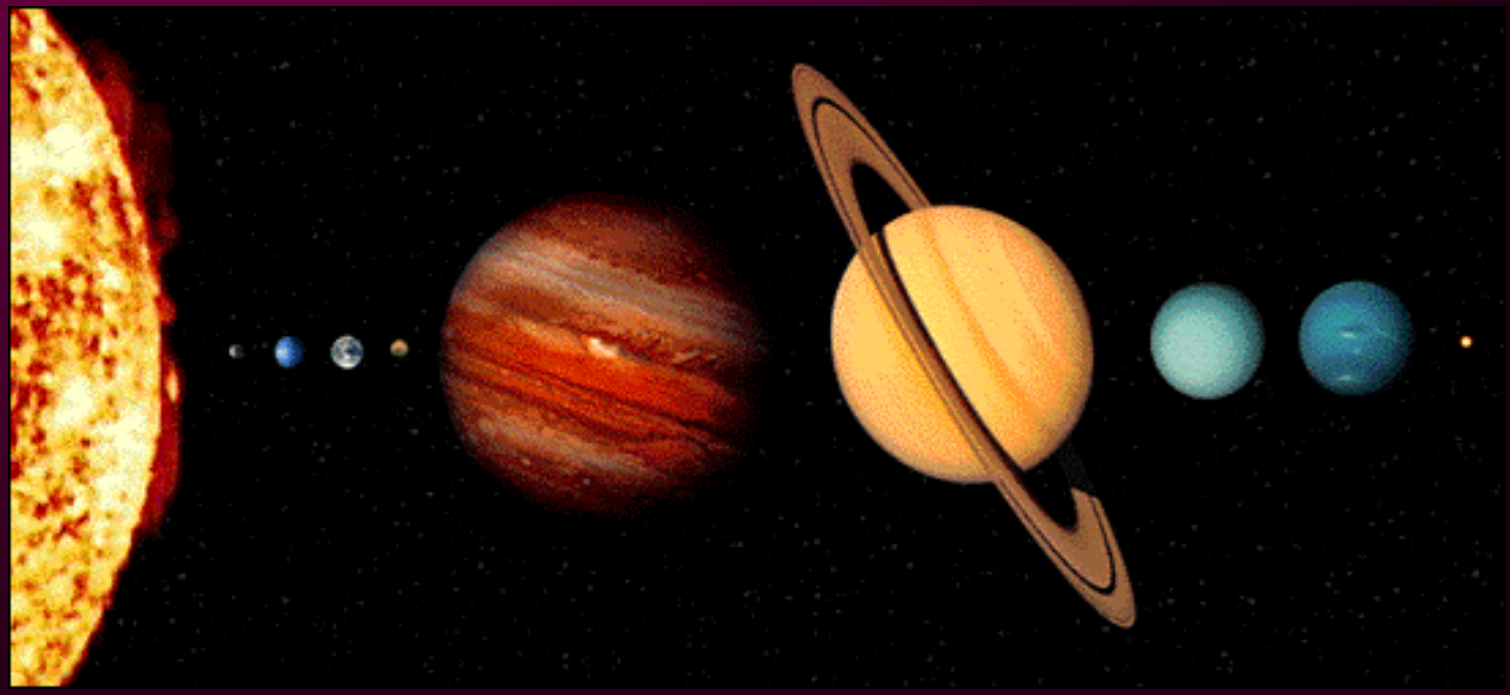
Alpha Centauri is about 4.4 light years

Milky Way is about 100,000 LY across

Relative sizes of the Planets

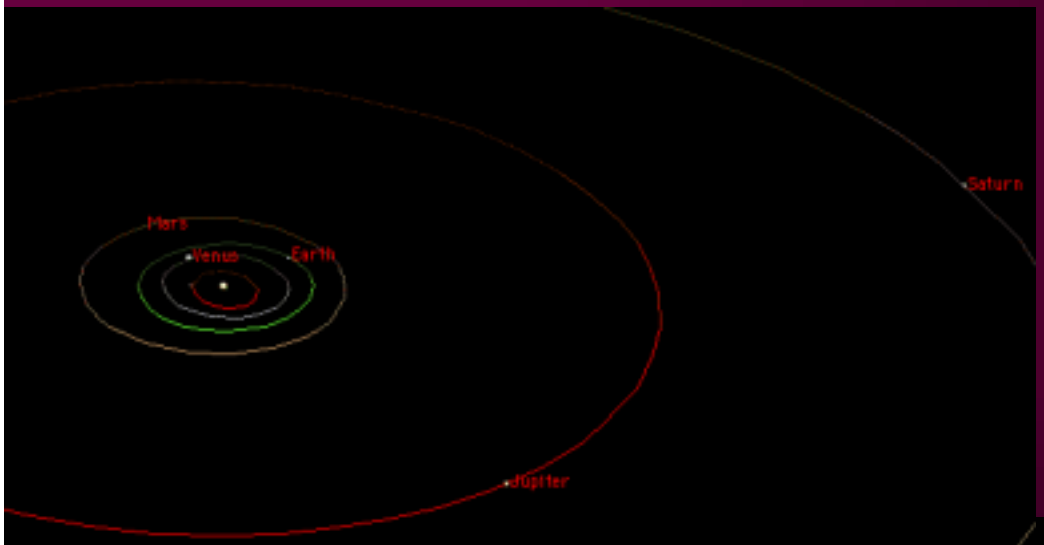
Picture from
http://seds.lpl.arizona.edu/nineplanets/nineplanets/overview.html

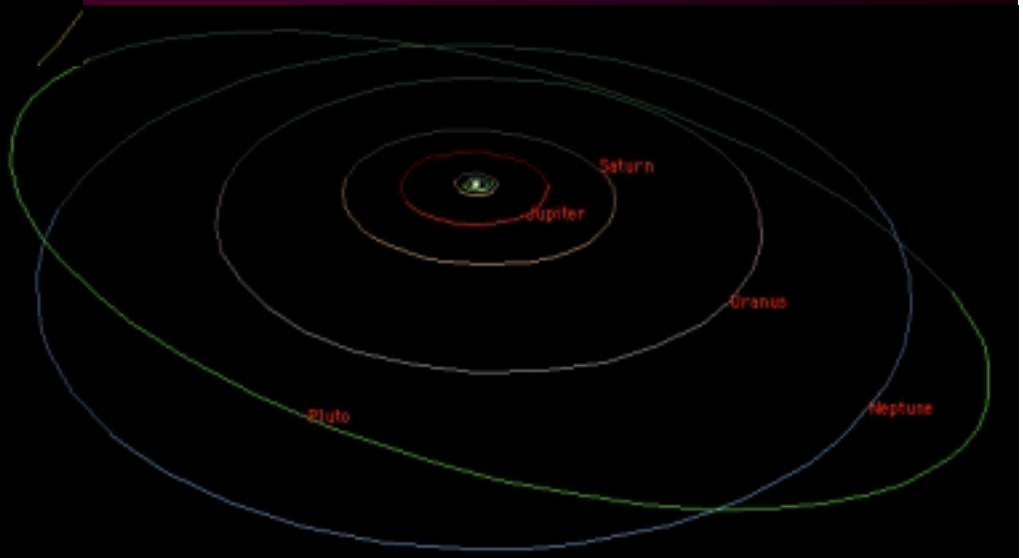
Relative sizes of the Planets



Pictures courtesy of NASA
http://nssdc.gsfc.nasa.gov/photo_gallery/

The solar system





Picture from
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The Planets

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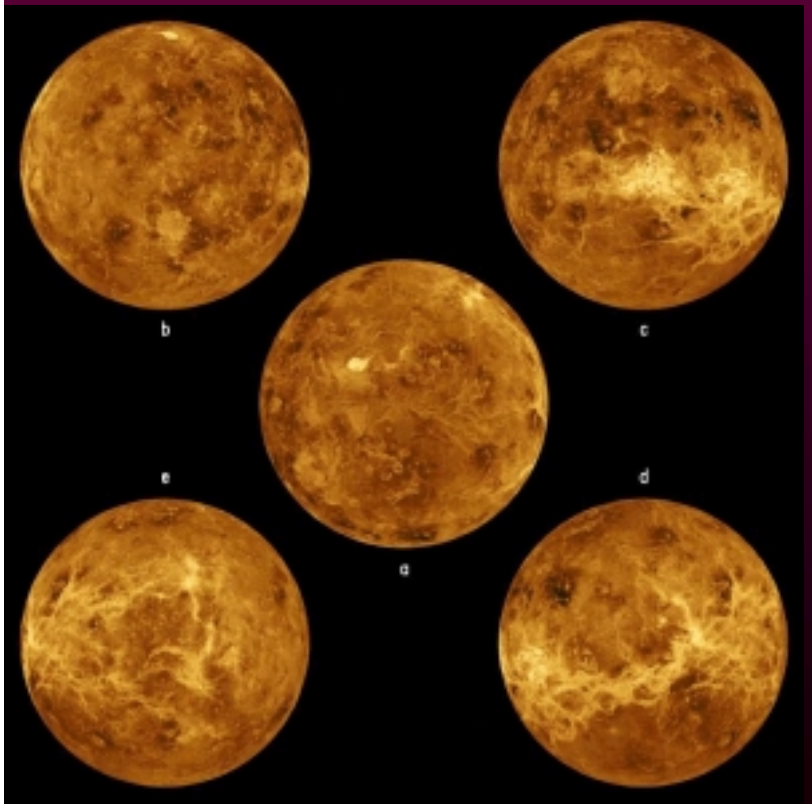
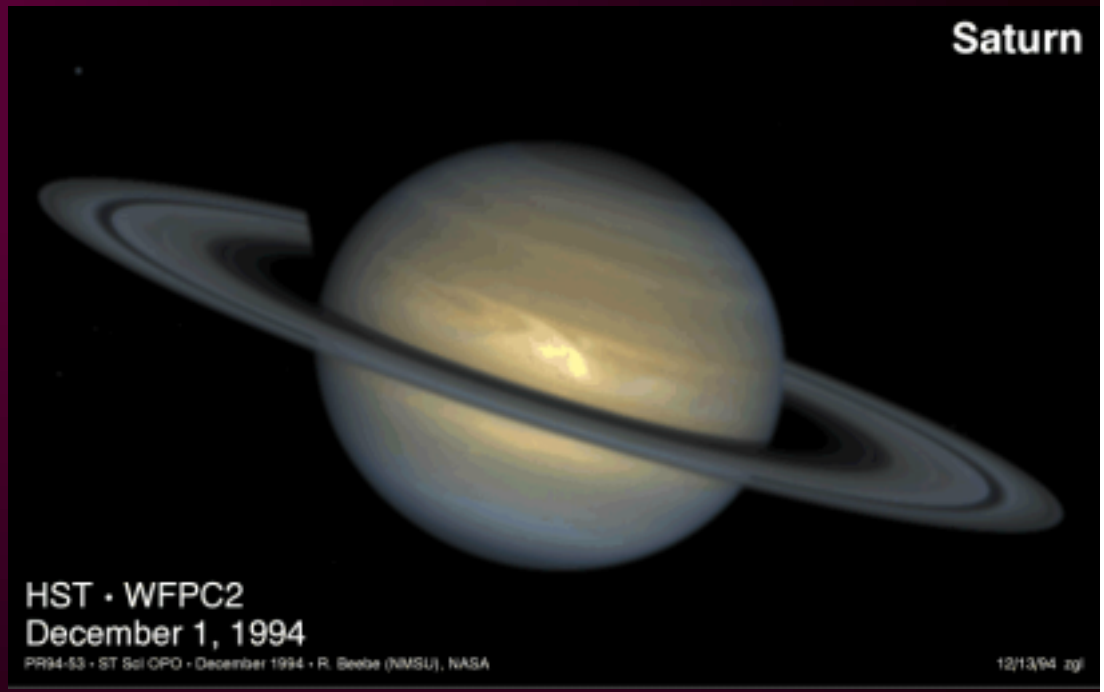
These images are composites of the complete radar image collection of Venus obtained by the Magellan mission.



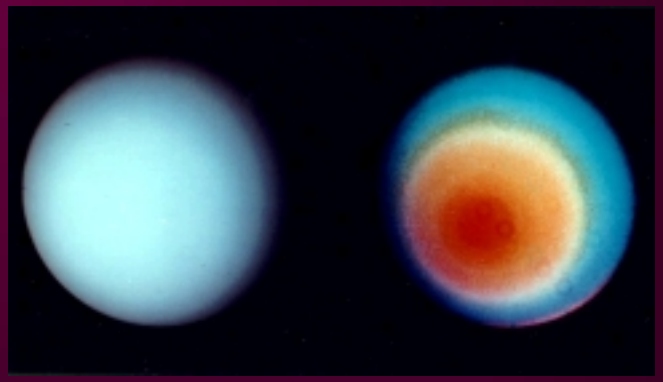


A storm on Saturn from the Hubble Space Telescope

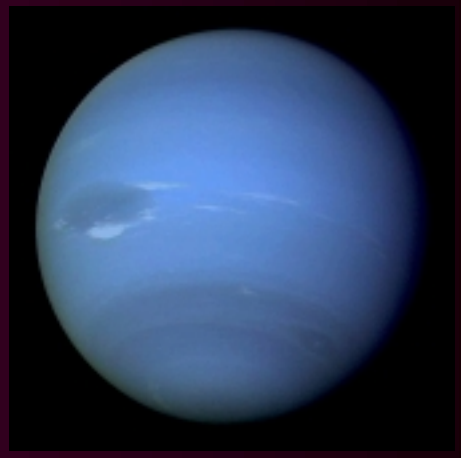
Pictures courtesy of NASA

More Planets

Mercury



Uranus



Neptune

Pluto

Pictures courtesy of NASA
http://nssdc.gsfc.nasa.gov/photo_gallery/

Mars our Neighbor

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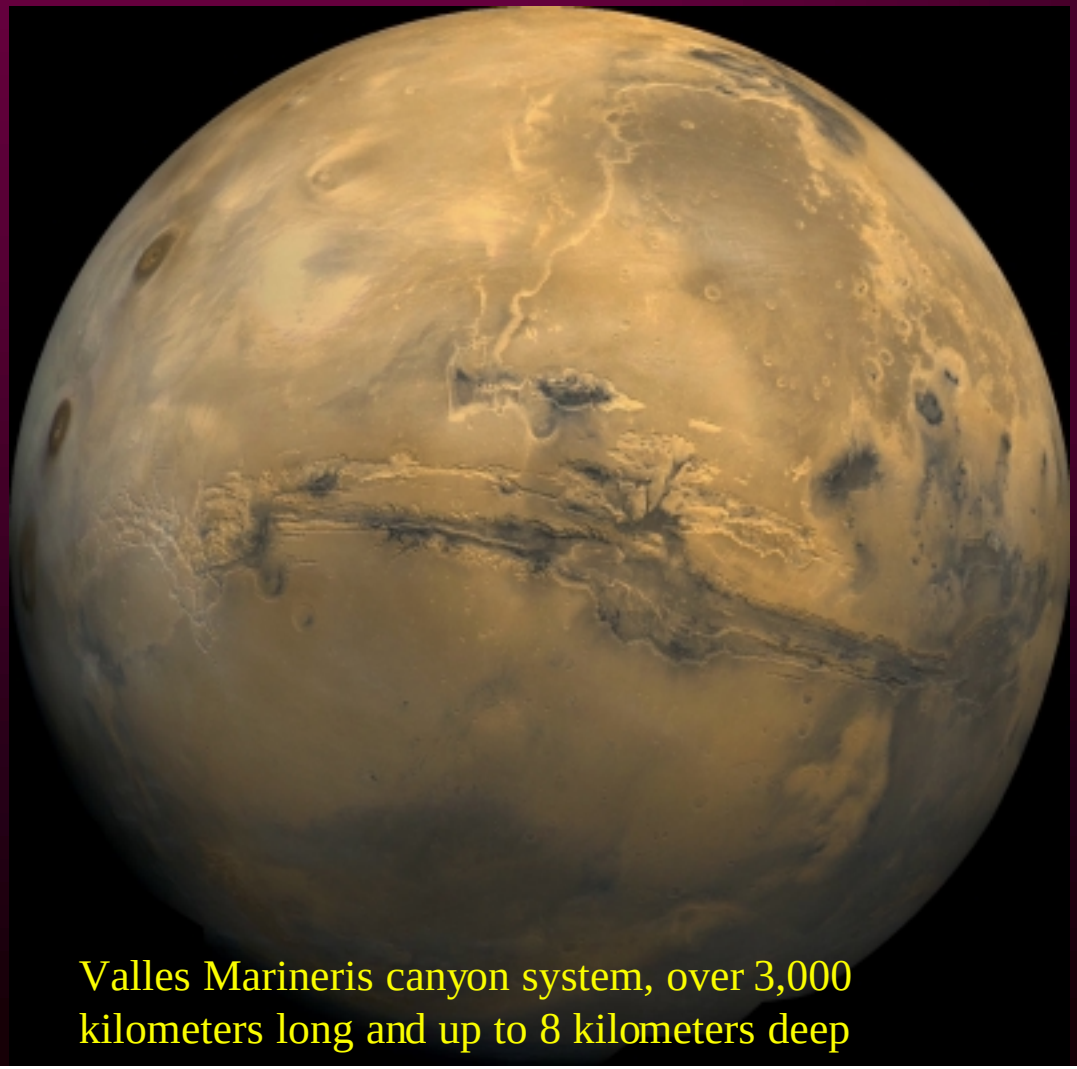
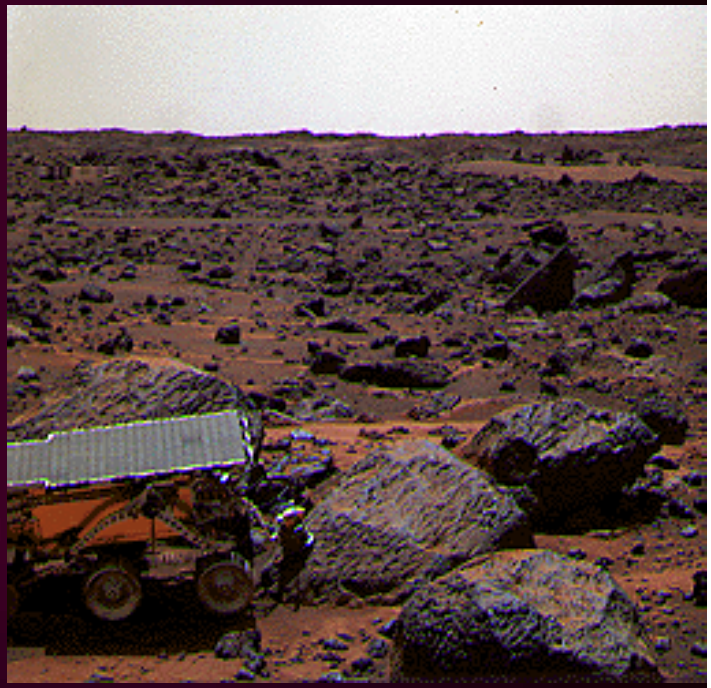


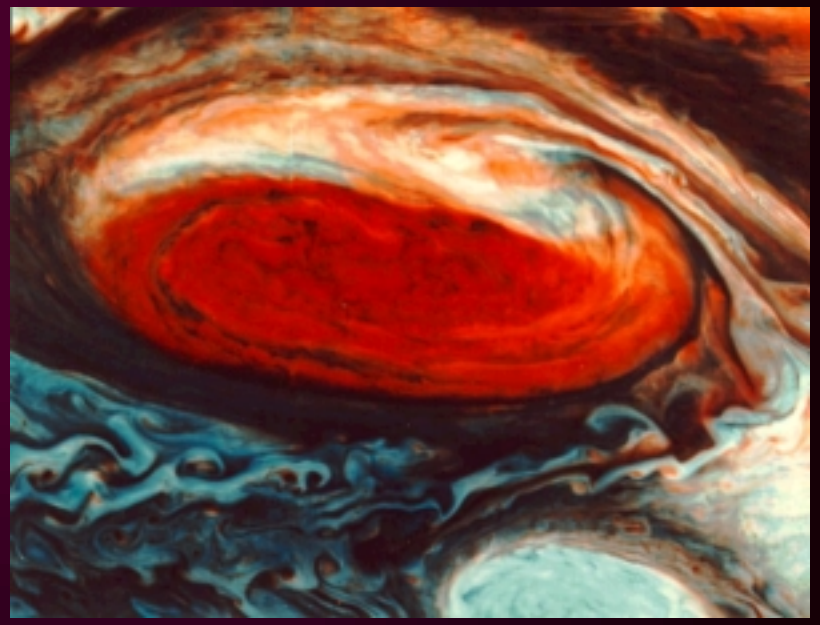
Valles Marineris canyon system, over 3,000 kilometers long and up to 8 kilometers deep



Pictures courtesy of NASA
http://nssdc.gsfc.nasa.gov/planetary/marspath_images.html

Jupiter the Giant

Jupiter and Ganymede



The Great Red Spot
(with turbulence all around it)

Pictures courtesy of NASA
http://nssdc.gsfc.nasa.gov/photo_gallery/

And finally comets, the mysterious visitors

Halleys Comet

Pictures courtesy of NASA http://nssdc.gsfc.nasa.gov/photo_gallery/

Other members of the Solar system

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The asteroid Eros as filmed by the NASA NEAR project on Monday

http://near.jhuapl.edu/NEAR/

Astrophysical plasmas

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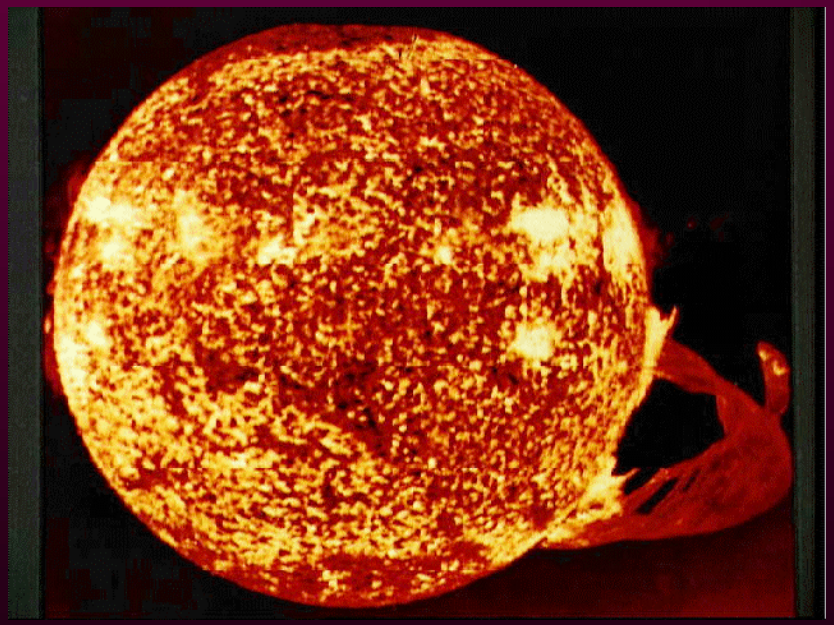
The Sun



http://bang.lanl.gov/solarsys/

Catseye Nebula

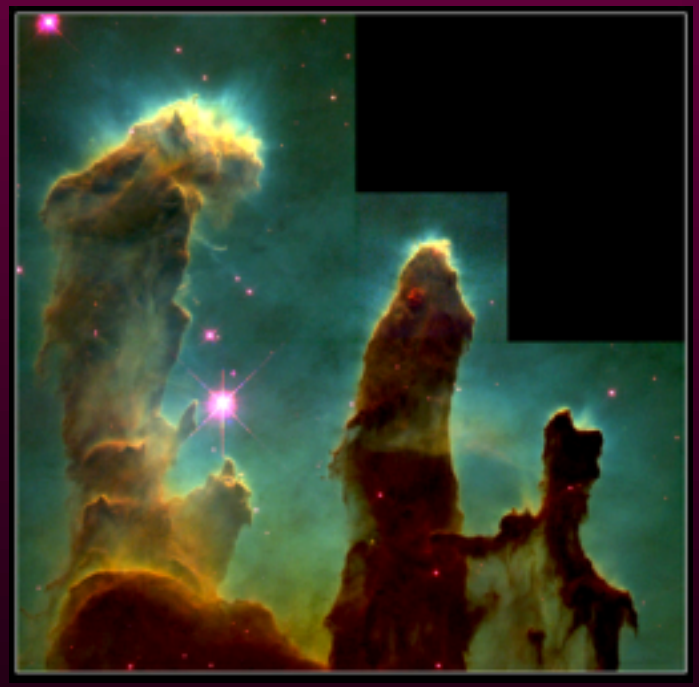
http://www.stsci.edu:80/

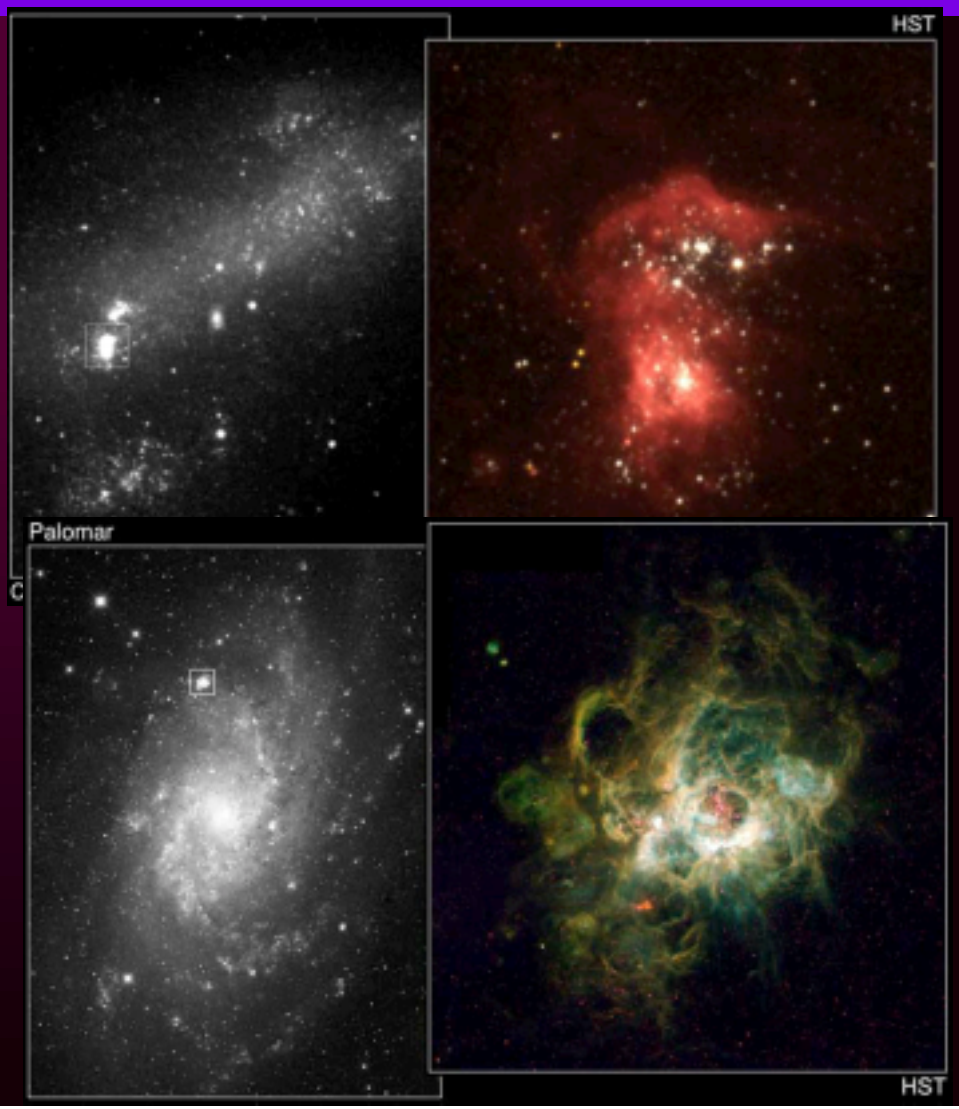
Deep space

The distance to NGC 4414, is 19.1 megaparsecs or about 60 million light-years

Pictures courtesy of NASA http://nssdc.gsfc.nasa.gov/photo_gallery/

Stars forming and dying in distant nebula





Pictures courtesy of NASA
http://nssdc.gsfc.nasa.gov/photo_gallery/

Strange structures

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MyCn18, a young planetary nebula located about 8,000 light-years away

Pictures courtesy of NASA
http://nssdc.gsfc.nasa.gov/photo_gallery/

One-half light-year long interstellar "twisters" in the Lagoon Nebula (M8) in the constellation Sagittarius

Plasmas on Earth

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Laboratory Experiments

http://FusEdWeb.pppl.gov/

Lightning

The Earth

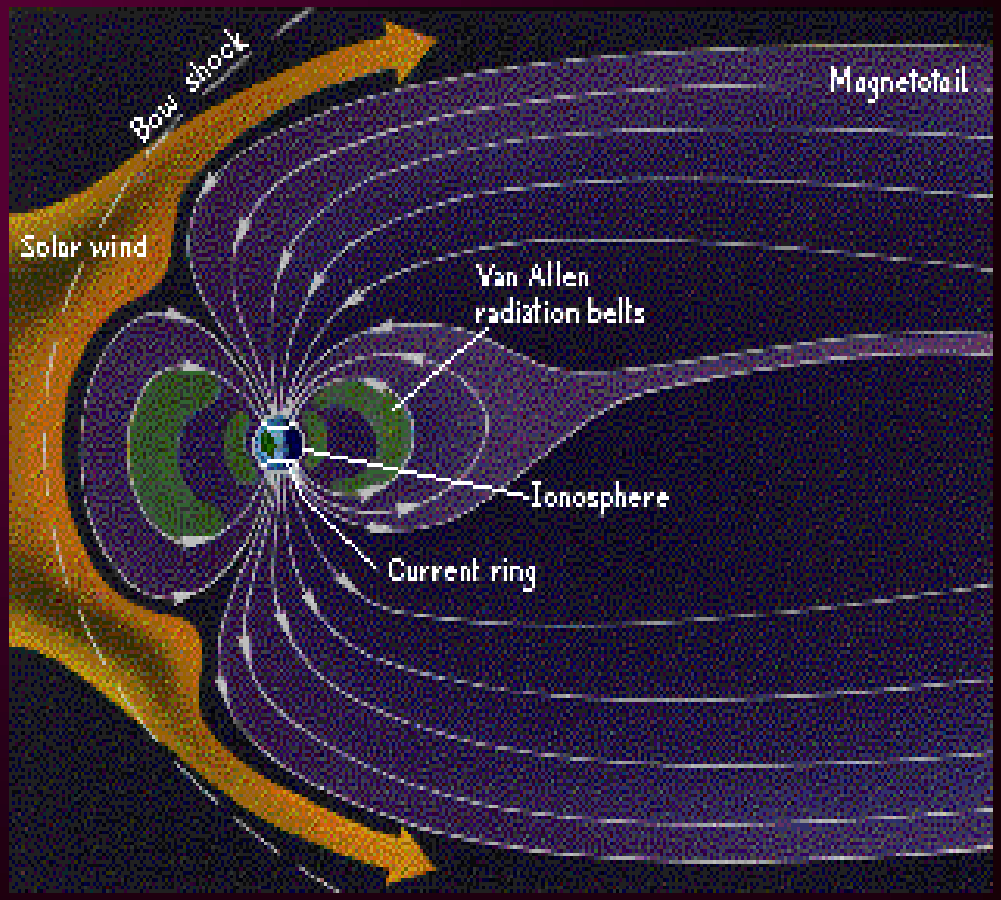
Our home viewed from the moon

Picture courtesy of NASA
http://nssdc.gsfc.nasa.gov/photo_gallery/photogallery-earthmoon.html

The solar wind (a plasma) interacts with the Earth's magnetic field

The sun emits mass in the form of plasma at velocities of up to 500 km/s.

This solar wind causes the Earth's magnetic field to compress creating a shock wave called the Bow wave.



From Stars, James Kaler

Interactions between the earth's magnetic field and a plasma can have spectacular results

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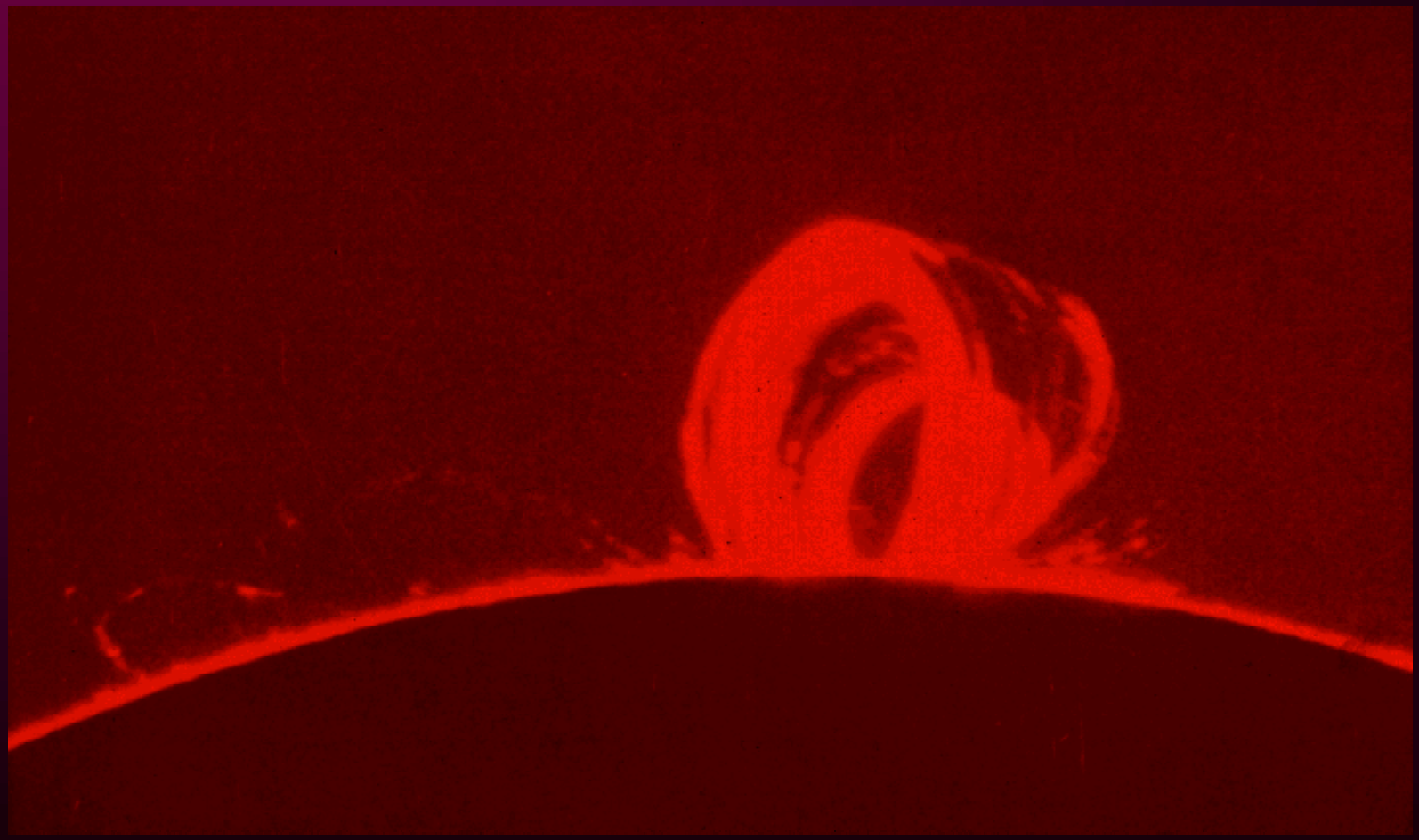
The northern lights (aurora borealis)

Photo by David Fritts
http://dac3.pfrr.alaska.edu:80/~pfrr/AURORA/INDEX.HTM

Particles in a Magnetic field



Turbulence is everywhere in nature

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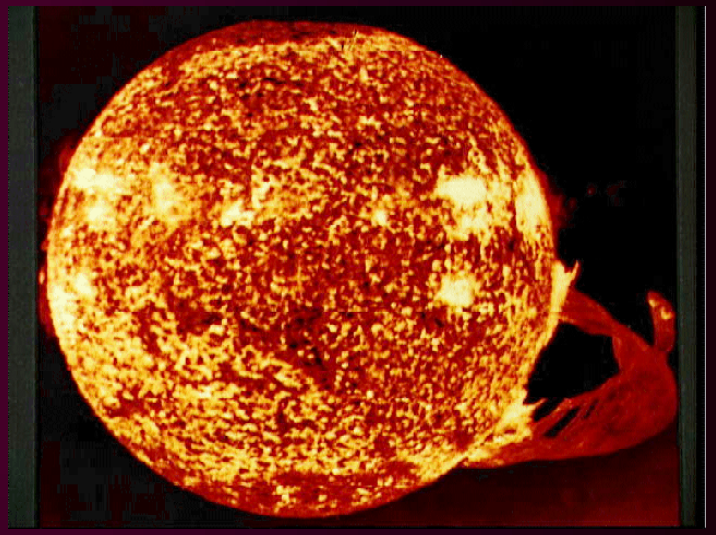
Turbulent transport is one of the main methods for relaxing gradients



ftp://mojave.wr.usgs.gov/pub/spurr/Spurr.html

http://info.pitt.edu/~maarten/work/soapflow/soapjpgs/dense.turb.JPG

Web References

Astrophysics sites

http://umbra.nascom.nasa.gov/spd/ NASA Space Science

http://nssdc.gsfc.nasa.gov/photo_gallery/ Great Photo Gallery

http://seds.lpl.arizona.edu/nineplanets/nineplanets/overview.html The Nine Planets

http://www.stsci.edu:80/ Space Telescope Science Institute

http://bang.lanl.gov/solarsys/ Views of the Solar System

http://www.gi.alaska.edu/ Geophysical Institute (Aurora and Sprite info)

http://www.sec.noaa.gov/ NOAA Space weather site

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