The Universe: From Near to Far

David Newman

Physics Department
University of Alaska - Fairbanks

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

March 9, 2000
…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
http://seds.lpl.arizona.edu/nineplanets/nineplanets/overview.html
The Planets

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/
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

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

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

The Sun

Catseye Nebula

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

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

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

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

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

Laboratory Experiments

Lightning

http://FusEdWeb.pppl.gov/
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.

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

Turbulent transport is one of the main methods for relaxing gradients


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

Email me at: ffden@uaf.edu  URL http://ffden-2.phys.uaf.edu