

Low Frequency Astrophysics from Space

(Opening the Last EM Window on the Universe)

Summary of Space Initiatives to the Radio/Submm Panel

16 February 1999

(<http://rsd-www.nrl.navy.mil/7214/weiler/lfraspce.html>; http://sgra.jpl.nasa.gov/html_dj/ALFA.html)

Frequency Range: Above IPM cutoff /Below ionospheric cutoff – ~30 kHz to ~30 MHz

Background

The low frequency window from ~30 kHz (just above the local plasma frequency of the IPM) to ~30 MHz (where high resolution observations from the ground become possible most of the time) spans three orders of magnitude in frequency, wider than the infrared window opened by IRAS and ISO or the ultraviolet window opened by IUE and EUVE. It is the last region of the electromagnetic spectrum which is accessible from the vicinity of the Earth and still largely unexplored. Many important astrophysical questions concerning the solar system, Galaxy, and distant universe, such as CMEs, the distribution and turbulence properties of the interstellar and interplanetary plasmas, the lifetimes and evolution of extended radio sources, and the origin of cosmic rays can be answered with observations at frequencies of a few MHz and angular resolutions near an arcminute. From the Earth's surface, high angular resolution observations in this region of the spectrum are blocked by the obscuring veil of the ionosphere.

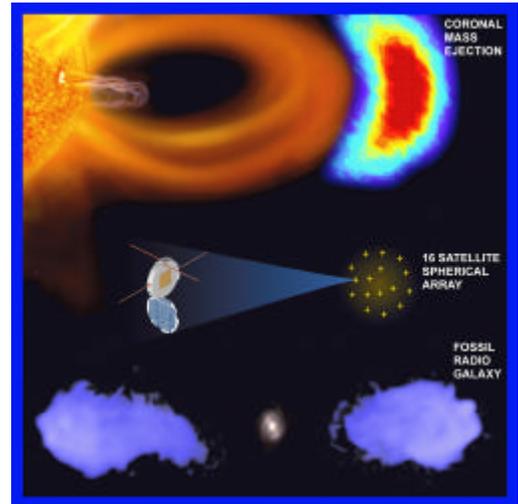
Key Science Drivers

➤ Solar Physics

- Solar variability
 - ◆ Physics of solar transient disturbances
 - ◆ Evolution of coronal and solar wind structures
 - ◆ Interaction of plasma & magnetic field topology on the Sun
- Solar/Terrestrial response
 - ◆ Solar interactions with Earth's magnetosphere
 - ◆ Geomagnetic storms and space weather
 - ◆ Forecast coronal mass ejection (CME) arrival

➤ Astrophysics

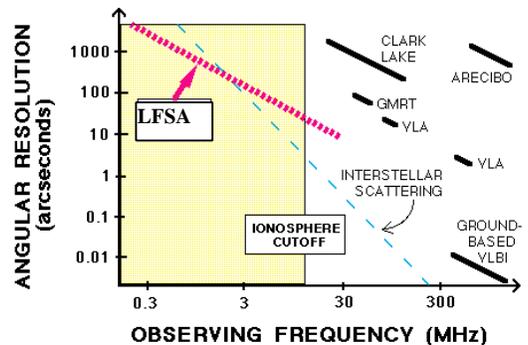
- Galaxy evolution
 - ◆ Detection of fossil radio galaxies
 - ◆ Detection of very high redshift radio galaxies
 - ◆ Study of cosmic ray diffusion times
 - ◆ Study of magnetic field distributions in galaxies
- Life cycles of matter
 - ◆ Distribution of diffuse ionized hydrogen in the ISM
 - ◆ Energy transport via interstellar plasma turbulence
 - ◆ Origin of cosmic ray electrons
 - ◆ Detection of old galactic supernova remnants
- Discovery of new phenomena & tests of physical theories
 - ◆ New sources of coherent radio emission
 - ◆ Pulsar emission regions
 - ◆ Shock acceleration processes
 - ◆ Physics of electrically charged, dusty plasmas
 - ◆ New classes of objects not seen at higher frequencies



Instrumental Concept

➤ Low Frequency Space Array (LFSA)

- Numerous (>12) identical small satellites
- Crossed dipole antennas
- Spherical array ~100 km in diameter
- Distant, interference-free, stable orbit
- National/International scientific team
- National Lab/University/Commercial collaboration



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