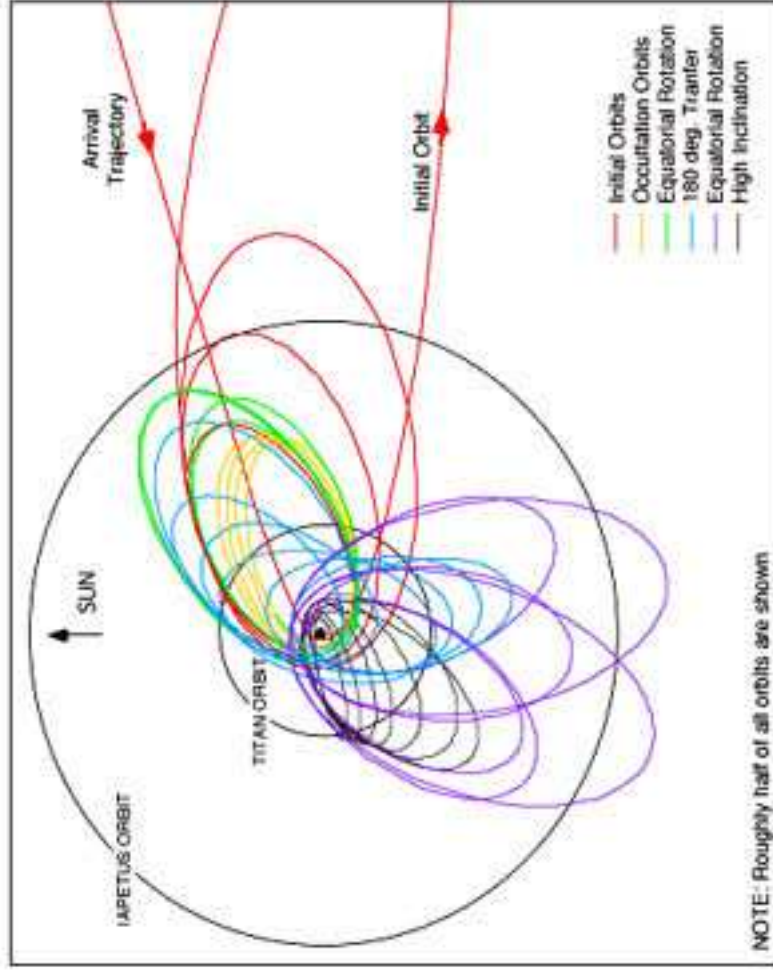


Cassini UV Imaging Spectrograph First Saturn Observations

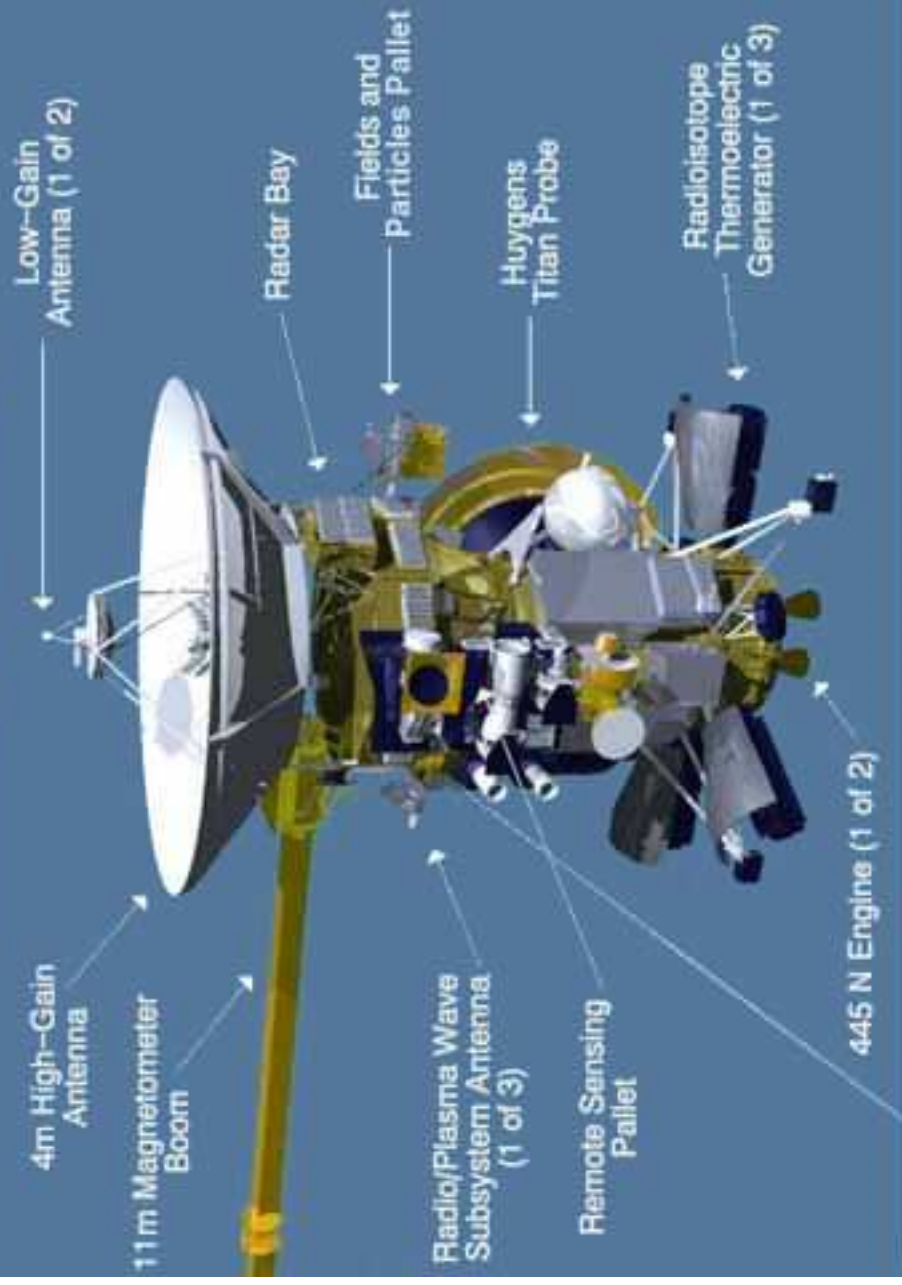
Larry W. Esposito
LASP, U. Colorado

CASSINI - SATURN ORBITAL SAMPLE TOUR

Saturn North Pole View



CASSINI SPACECRAFT



Cassini UV Imaging Spectrograph

- Spectra and images from 550 -1900Å
- Hydrogen-Deuterium cell measures D/H
- High speed photometer has 20m resolution
- Chemistry of Saturn, Titan clouds
- Exospheres of moons
- Saturn's magnetosphere neutrals; thermosphere airglow and aurora
- Ring origin and evolution





UVIS OBSERVATIONS

- SATURN SYSTEM SYSCANS
- SATELLITES DISTANT OCCULTATIONS
LONGITUDE COVERAGE
- ATMOSPHERE OCCULTATIONS
STARE
LIMB SKIM
AURORAL/AIRGLOW MAPS
SPECTRAL IMAGES
- RINGS OCCULTATIONS
SPECTROSCOPY
- MAGNETOSPHERE SURVEY & AURORA

SATELLITES

- LATITUDE, LONGITUDE AND PHASE COVERAGE COORDINATED WITH CAMERAS
- CLOSE-UP OBSERVATIONS WITH ISS, VIMS
- DISTANT STELLAR OCCULTATIONS TO DETERMINE SATELLITE ORBITS AND SATURN REFERENCE FRAME.
DURATION: 1.5 HOUR, 10-25 PER MOON.
ENCELADUS, DIONE, MIMAS, TETHYS

ATMOSPHERE

- SOLAR OCC : VERTICAL PROFILES OF H, H₂, HYDROCARBONS, TEMP IN EXO, THERMOSPHERE
- STAR OCC: SAME FOR UPPER ATMOSPHERE
- UVIS STARE: LONG INTEGRATIONS MAP HYDROCARBONS, AIRGLOW
- LIMB SKIM: MAP EMISSIONS WITH HIGHEST RESOLUTION AT THE LIMB
- AURORAL MAP: H&H₂ EMISSIONS OVER SEVERAL ROTATIONS
- UVIS EUVFUV SPECTRAL IMAGES: MAP HYDROCARBON, AIRGLOW, AEROSOLS

FREQUENCY, DURATION, VOLUME

- SUNOCC'S TO COVER RANGE OF LATITUDES:
40MIN @ 32 KBITS = 77Mbit EACH.
- STAROCC'S 19 PROPOSED: 58 Mbit EACH
- UVIS STARE: ONCE PER ORBIT, 1-11 HOURS, 18-198 Mbit EACH
- LIMB SKIM: ABOUT ONE/ORBIT, 1-2 HOURS @
1kbit= 4-7Mbit EACH
- AURORAL MAP: SEVERAL TIMES DURING TOUR,
11-33 HOURS @2Kbit= 79-238Mbit EACH.
- SPECTRAL IMAGES: 532 HOURS REQUESTED @
5Kbit. 76, 152Mbit/ IMAGE CUBE.

Ring Stellar Occultation Objectives

- Highest radial resolution (20 m) structure of rings. [Full radial scans at high and low incidence angles.](#)
- Discovery and precise characterization of dynamical features generated by ring-satellite interactions. [Multiple radial scans.](#)
 - Density waves and bending waves.
 - Edge waves and ring shepherding.
 - Embedded moonlets and discovery of new moons from dynamical response in rings.
- Discovery and precise characterization of azimuthal structure in rings. [Multiple radial scans and azimuthal scans.](#)
 - Eccentric rings.
 - Density waves and edge waves.
 - Small-scale self-gravitational clumping in rings.

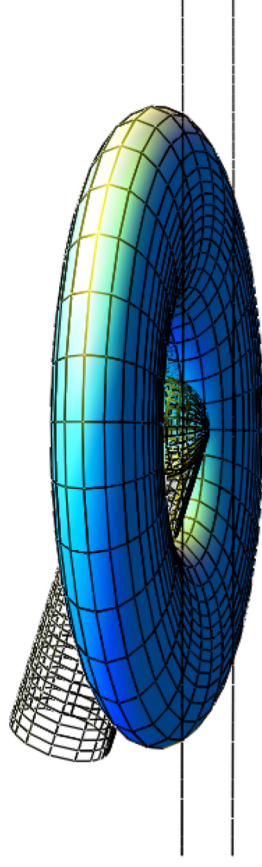
UVIS system scans

- EUV and FUV low resolution spectra of magnetosphere neutral and ion emissions.
- System scans at every apoapsis.
- Typical observation periods: 12 h per day for 100 – 150 days. Data volume: 21Mb/day
- Some observations also in inner magnetosphere.

UVIS Images

- Spatial information from 64 1-mr pixels along slit
- Spectral information from 1024 wavelength elements in 2 channels: 55-115 nm & 115-190nm
- Slewing the slit creates a 2D image
- Current spatial resolution: 1-2 R_s from 60 - 90 Mkm

Shemansky_fig1



More about Imaging

- Maps cover $30 \times 50 R_s$
- Exposures: 200 - 1000 sec per slit position
- Total exposure: 40000 sec
- Data are at solar phase 62.5, sub-spacecraft point at 13.4 south

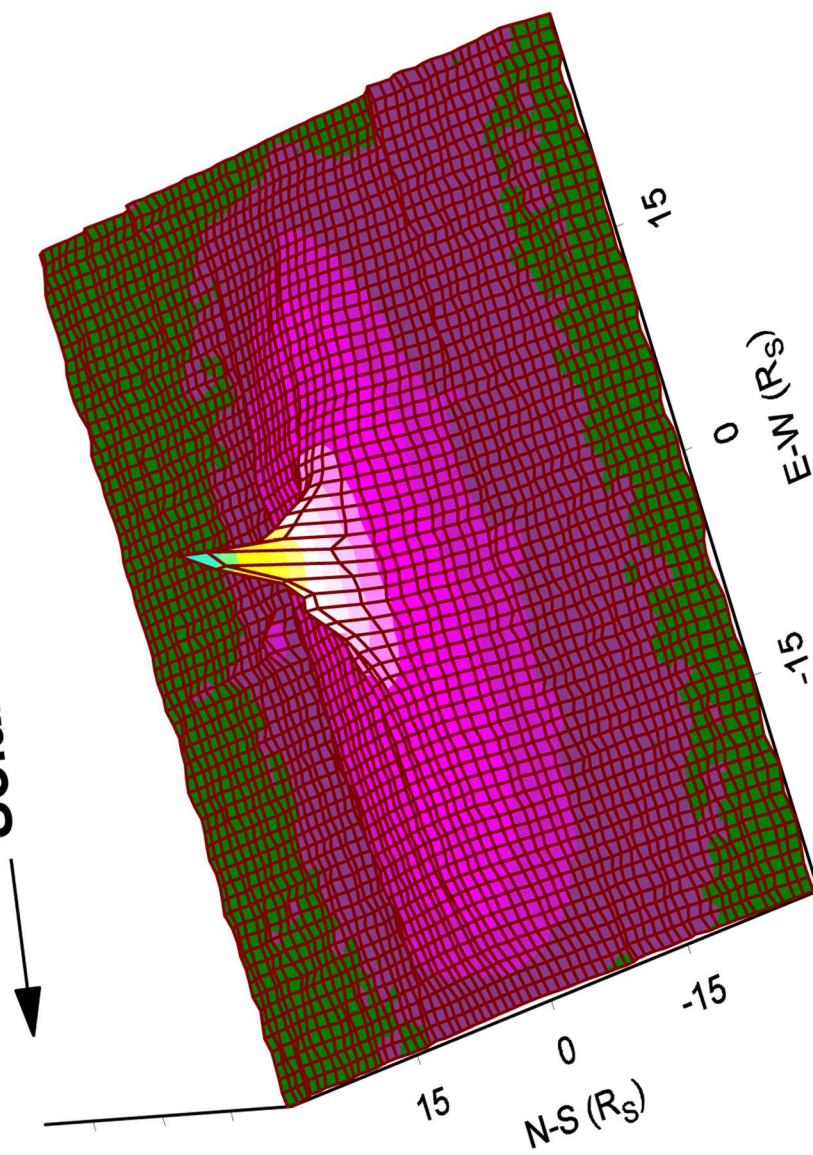
Hydrogen Observations

(Shemansky et al, submitted to Nature)

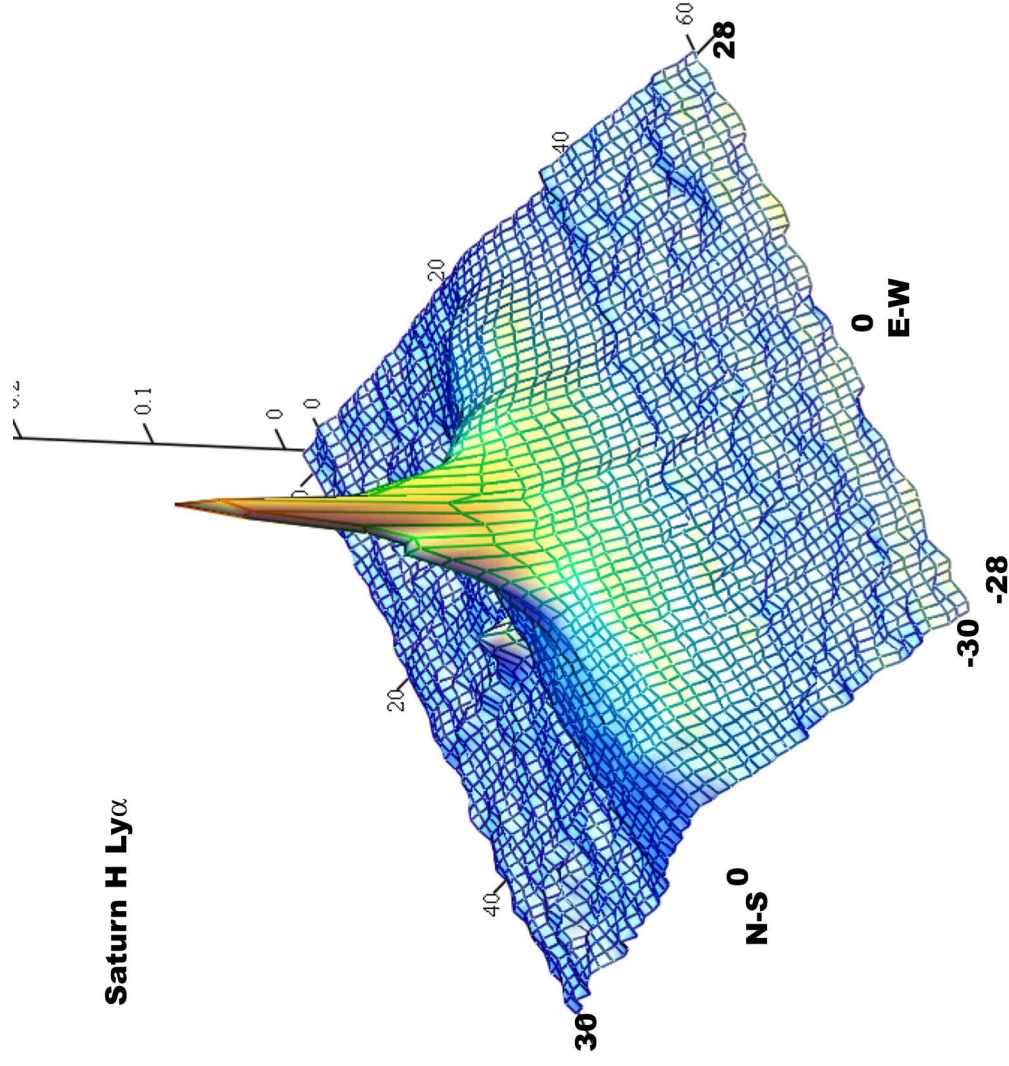
- Lyman alpha at 1216A
- Saturn corona, aurora, and dayglow
- Extension: 45 R_s from planet equatorial; 30 R_s polar
- Emission declines steadily away from Saturn
- Local time asymmetry same as Voyager saw

Saturn H Ly α

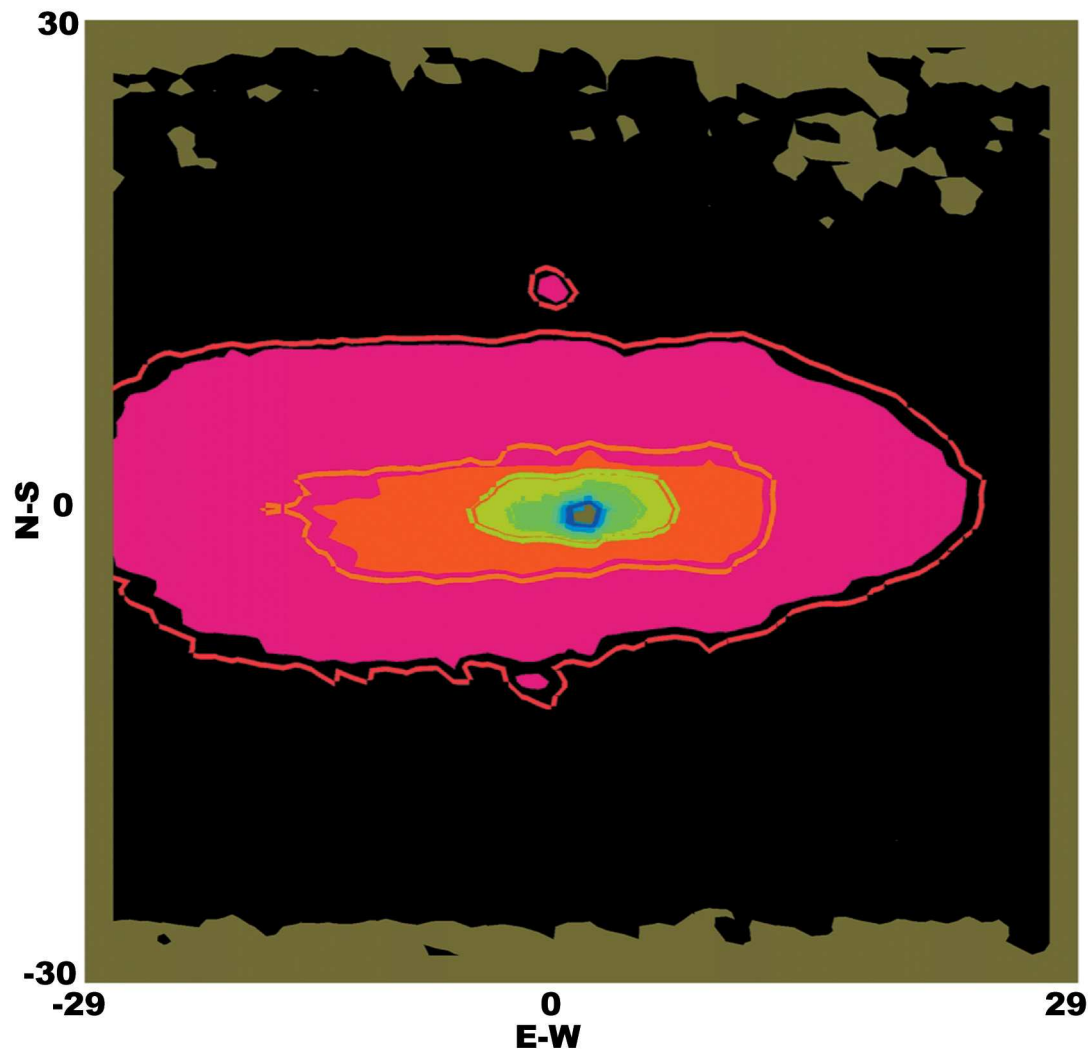
Solar flux



Saturn H Ly α



Lyman alpha contour plot



Interpretation

- No gas torus from Titan or other satellites
- More lines of sight needed to determine 3D structure
- Large vertical extent indicates energetic processes, possibly charge capture by protons accelerated along field lines
- Total magnetosphere content: 2×10^{35} atoms