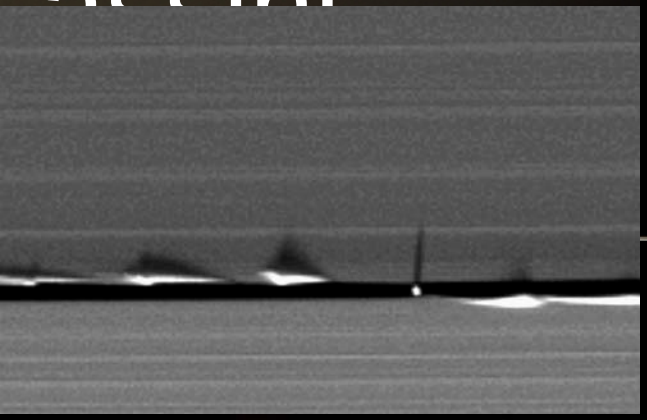
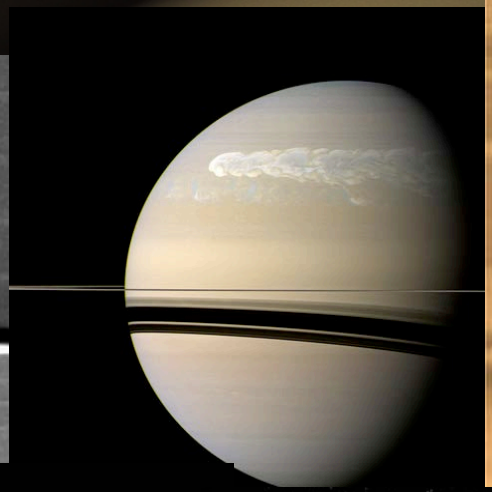
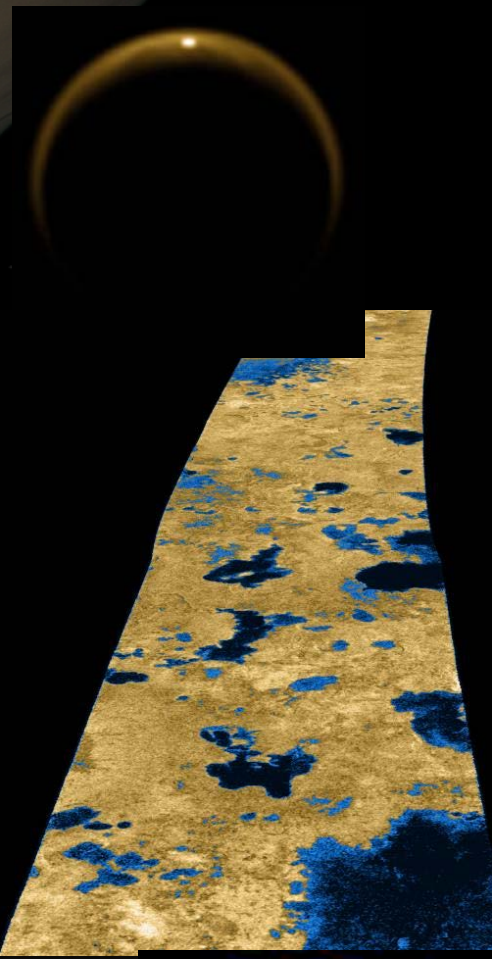
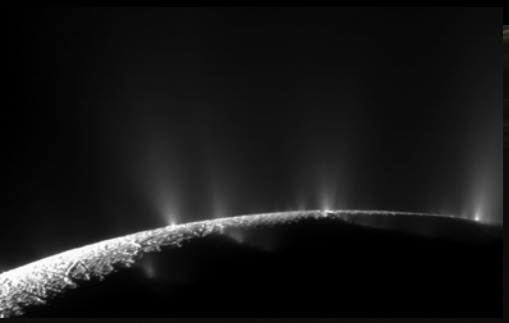
Moons: Future Plans for Cassini

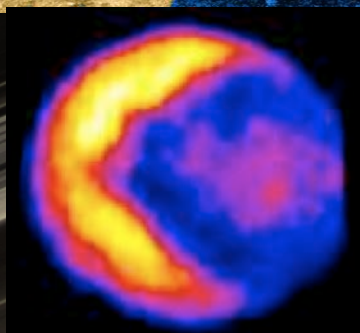






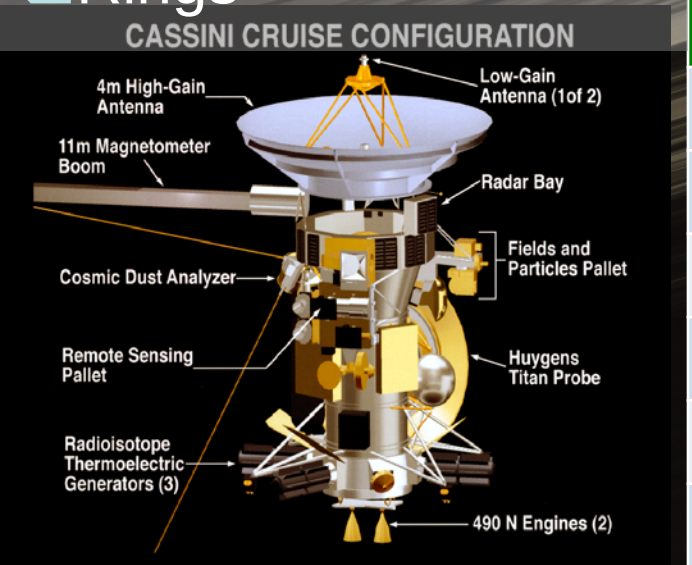


N. Altobelli
PS for ESA-CASSINI
ESLAB 2012-ESTEC



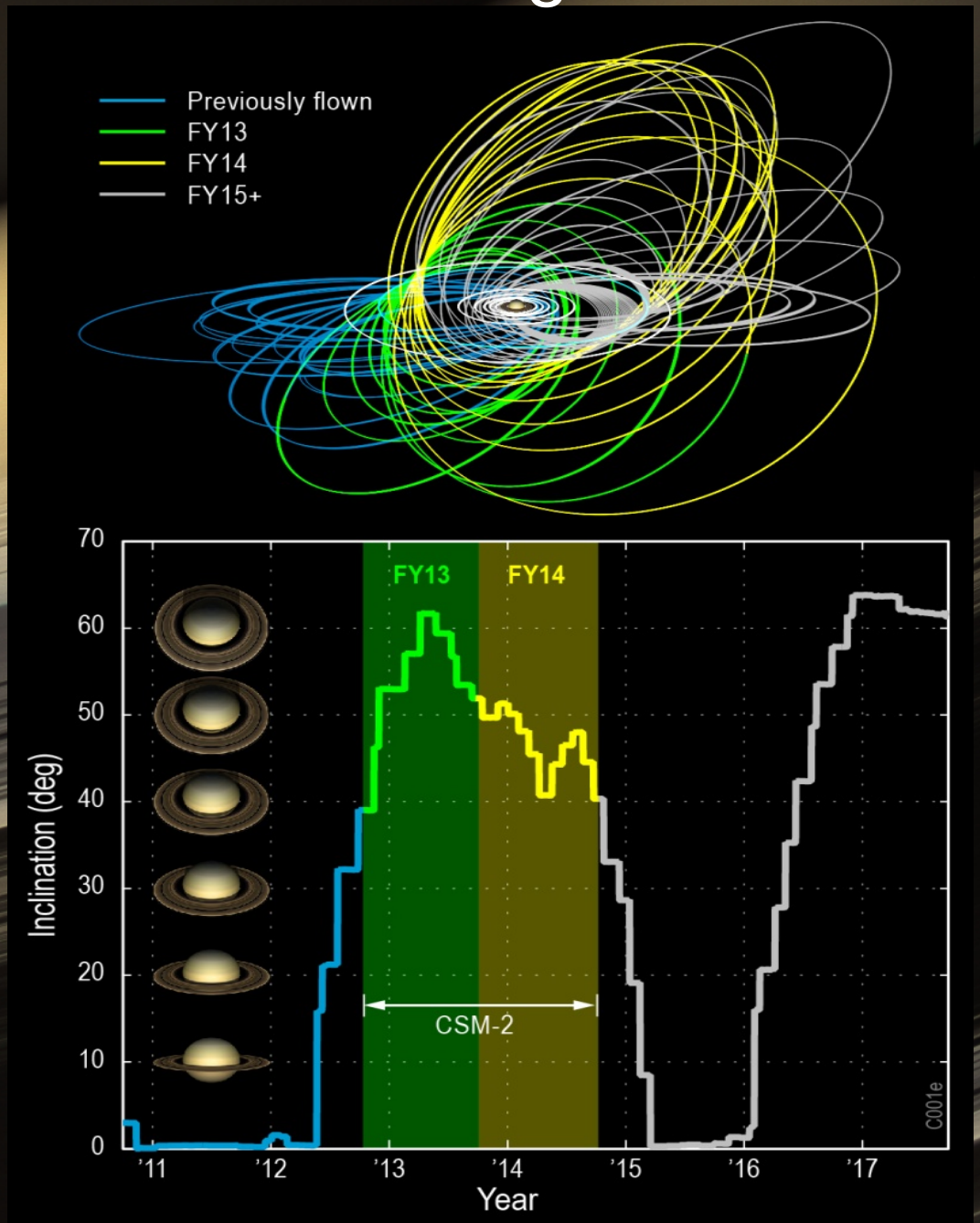
Instruments and Science Disciplines

- Saturn
- Icy Moons
- Magnetosphere
- Titan
- Rings

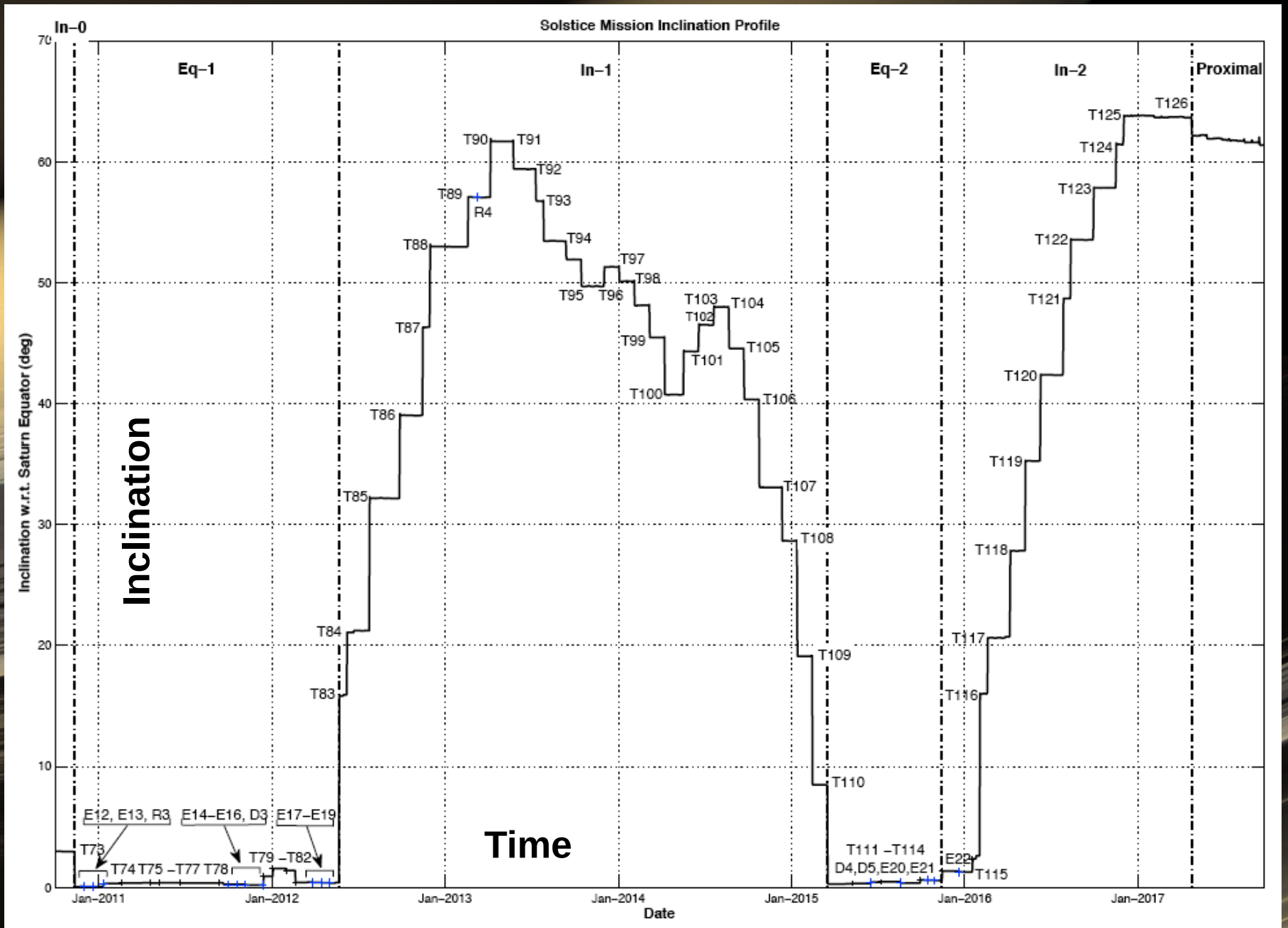


Optical Remote Sensing
CIRS
ISS
UVIS
VIMS
Microwave Remote Sensing
RADAR
RSS
Magnetosphere and Plasma Instruments
MAG
CAPS
CDA
INMS
MIMI
RPWS

A ‘touring’ mission

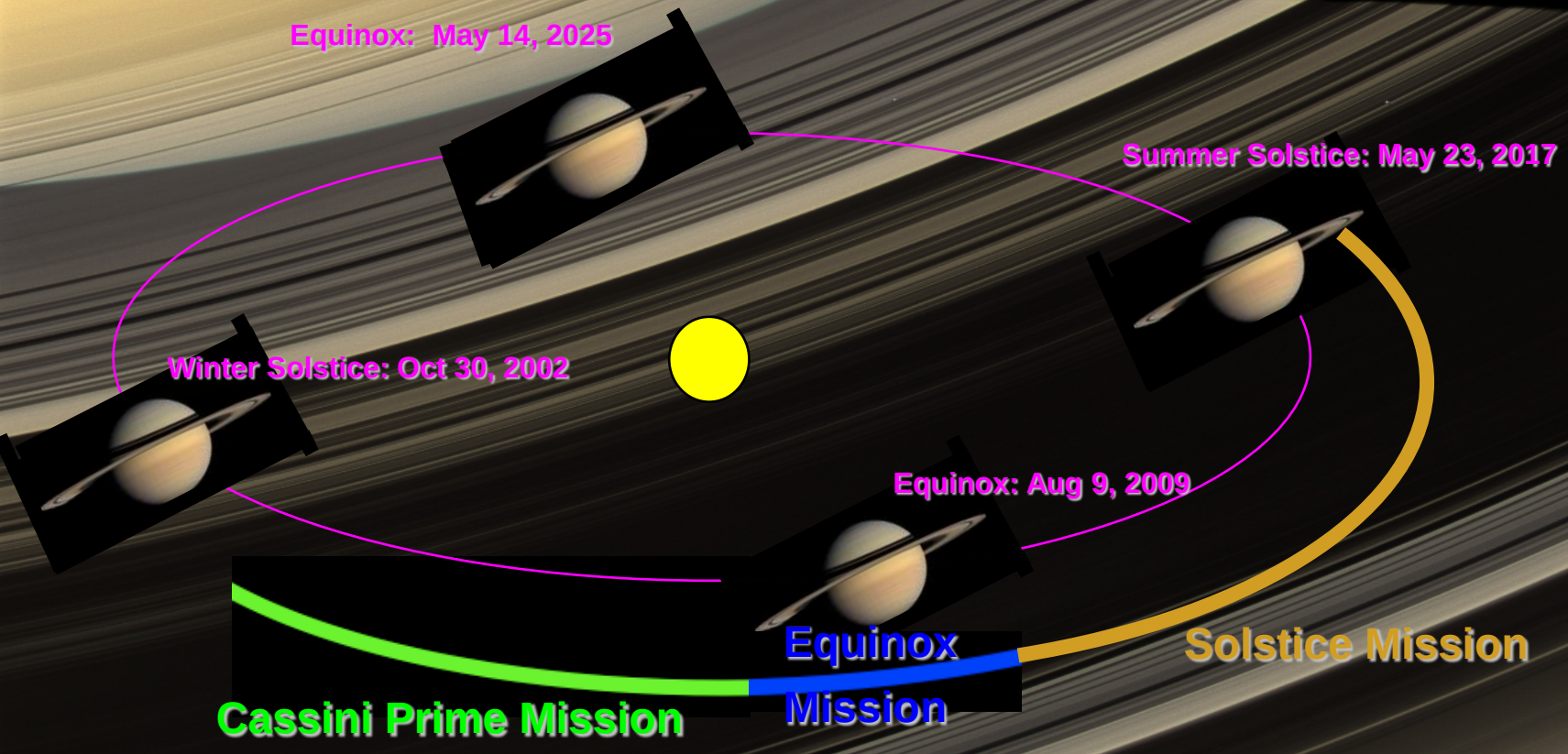


Mission Phases until 2017



Major driver of future exploration by Cassini (2012-2017)

→Seasonal dependence on processes observed at Saturn,
Moons, Magnetosphere and Rings System



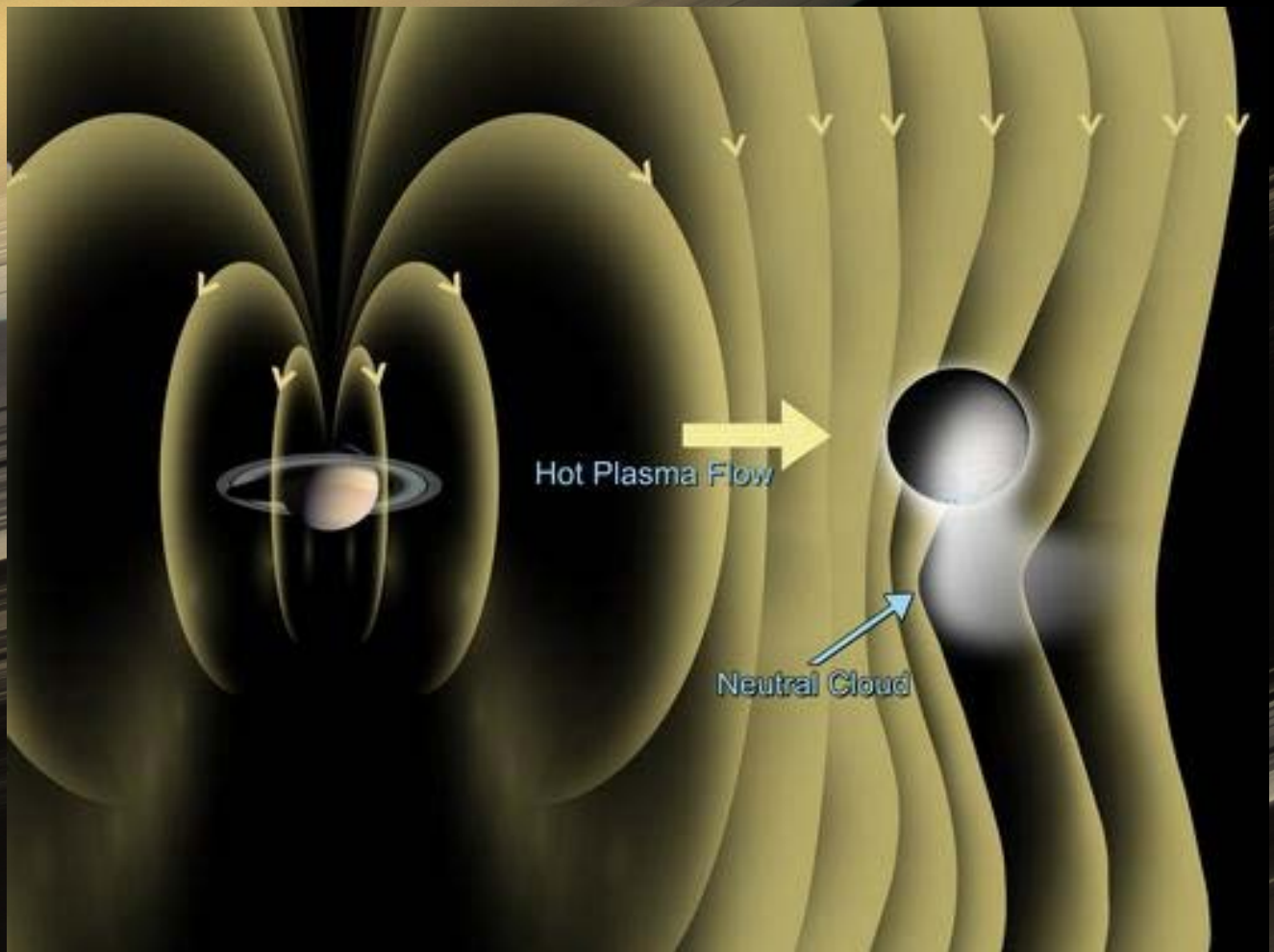
Upcoming scientific campaigns

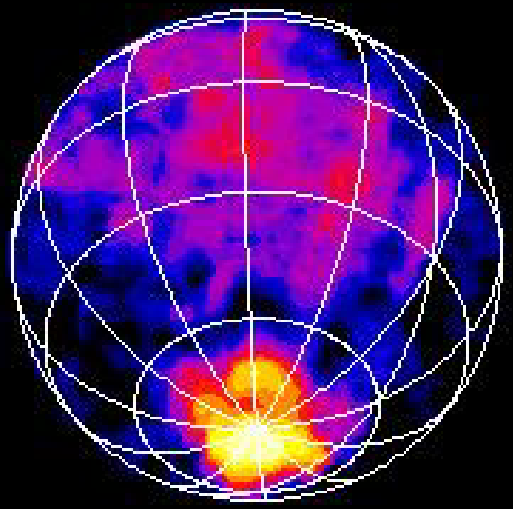
Overarching theme:
Monitoring seasonal changes in the Saturnian System'

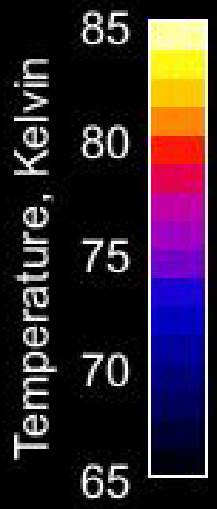
Titan	Icy Satellites	Rings	Magneto-sphere	Saturn
(E.1.1) Titan Great Seas	(E.2.1) Enceladus	(E.3.1) Changing Rings	(E.4.1) Periodicities	(E.5.1) Aftermath of Giant Storm
(E.1.2) Titan Global Seasonal	(E.2.2) Rhea and Dione	(E.3.2) Composition, Origin, and Evolution of Rings	(E.4.2) Aurora: Imaging the Magneto-sphere	(E.5.2) Seasonal and Temporal Changes
(E.1.3) Titan Interior Ocean	(E.2.3) Small Moons	(E.3.3) Rings, Protoplanets, and Exoplanets	(E.4.3) Magneto-spheric Interactions of Satellites	(E.5.3) Polar Studies
			(E.4.4) Water Dominated Magneto-sphere	(E.5.4) Probe Saturn's Interior


ENCELADUS

July 2005 flyby provided first hint that something unusual is going on…(Magnetometer)

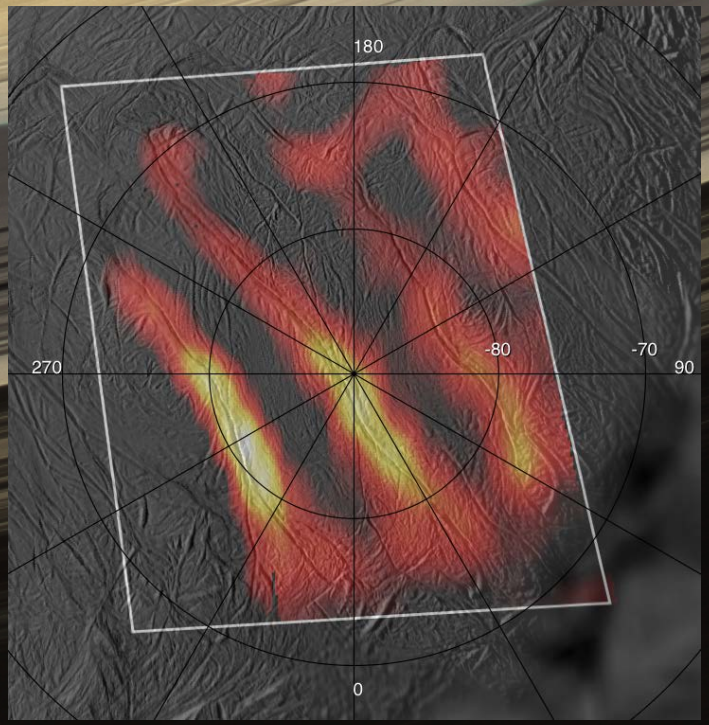






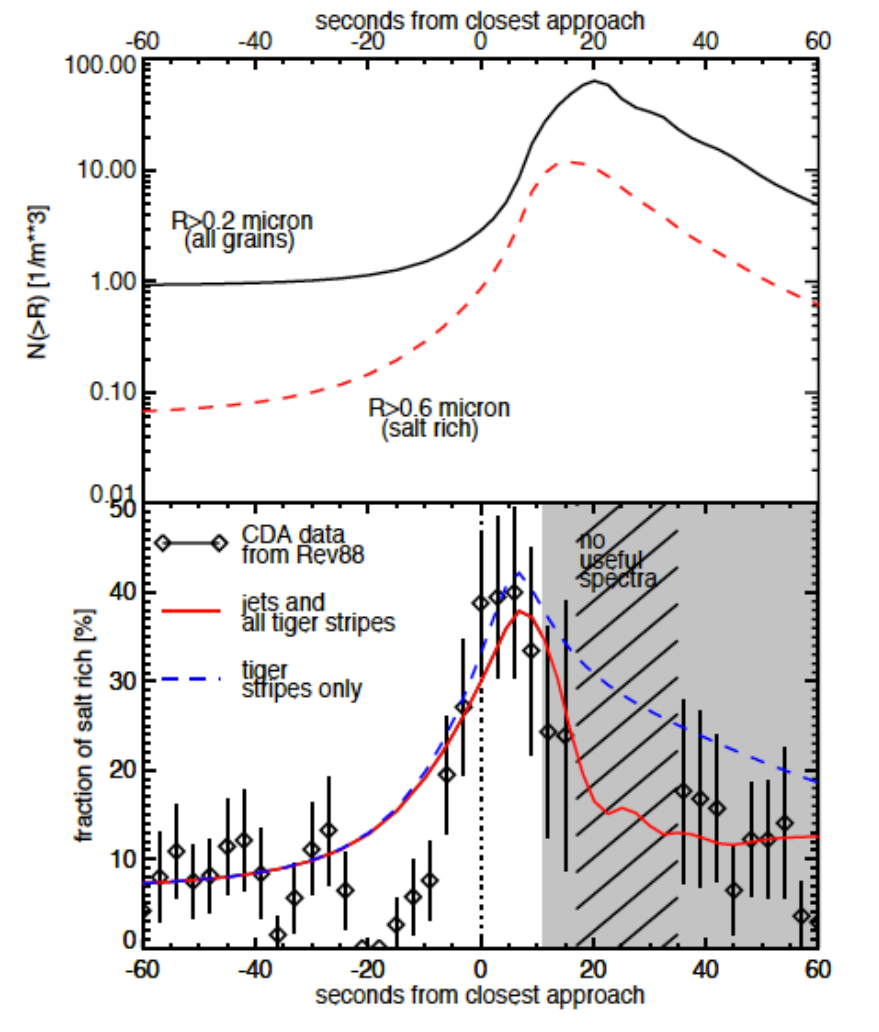
CIRS 2005 Temperature Map

- Global temperature map indicates hot spot at south pole.
- Warm region occurs in region of fractured terrain
- Hottest temperatures occur over “tiger-stripe” fractures



Enceladus Geyser Composition

Mostly Water!!



And salty icy dust grains!! (Postberg et al. 2011)

→FLASH-FREEZING OF SALTY WATER

ENCELADUS QUESTIONS TO BE ADRESSED BY CASSINI

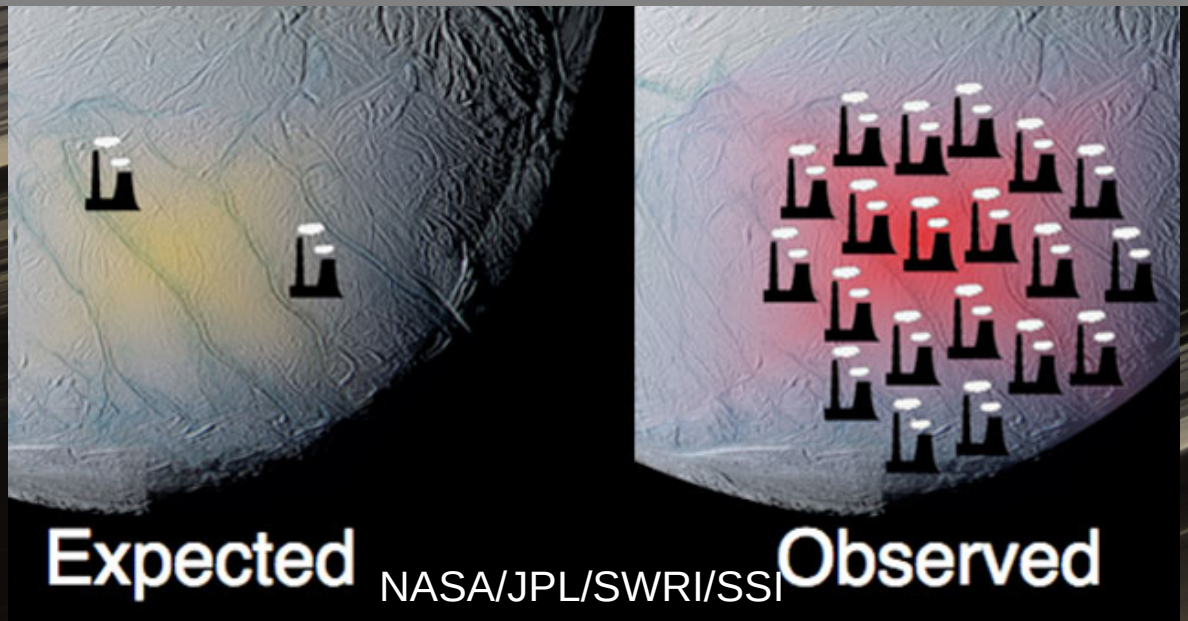
→Variability of Plumes

→Connection to surface features

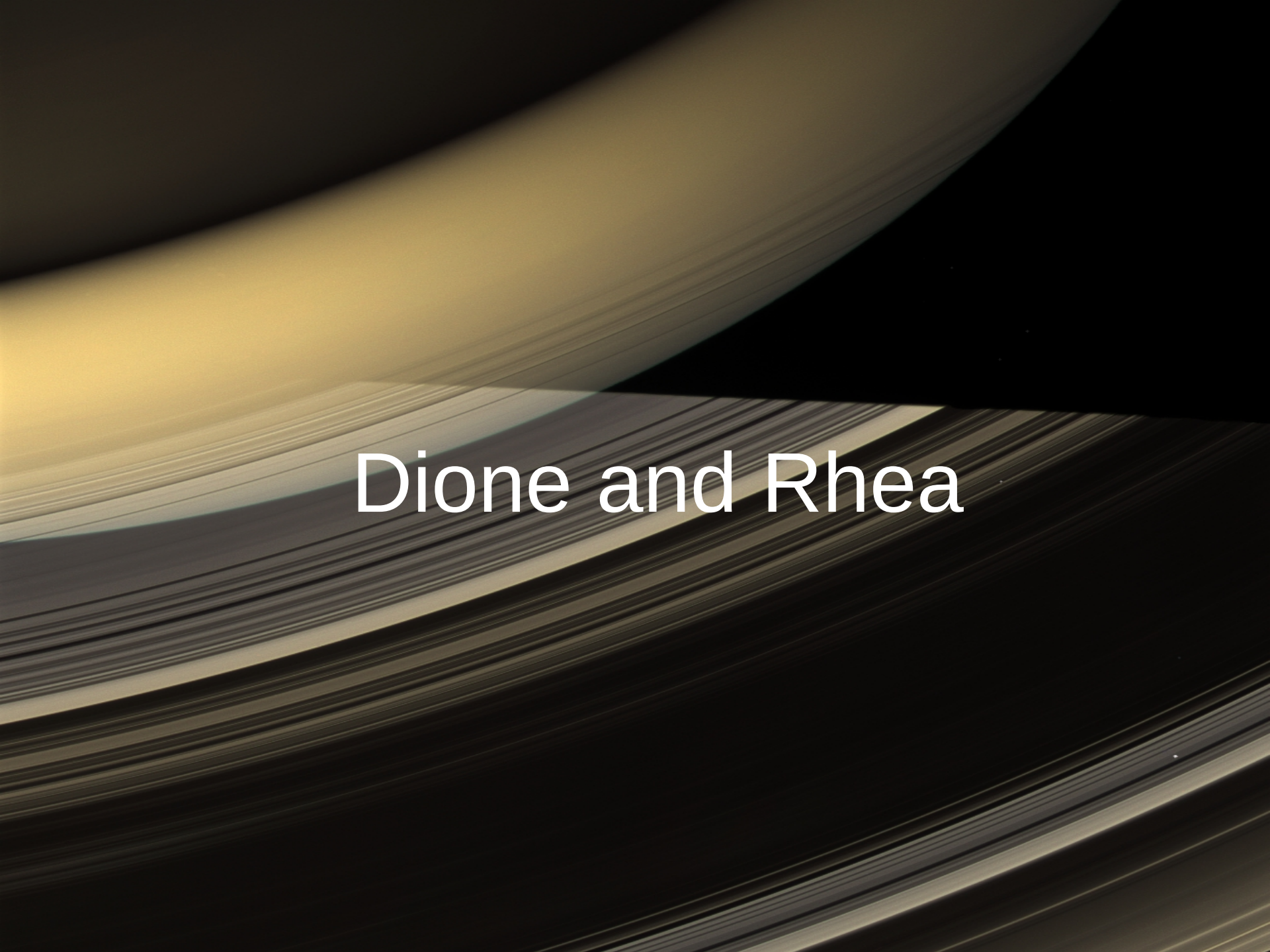
→Detailed mechanisms to inject material into Saturnian's system [dust/plasma]

→How does Enceladus generate so much heat?

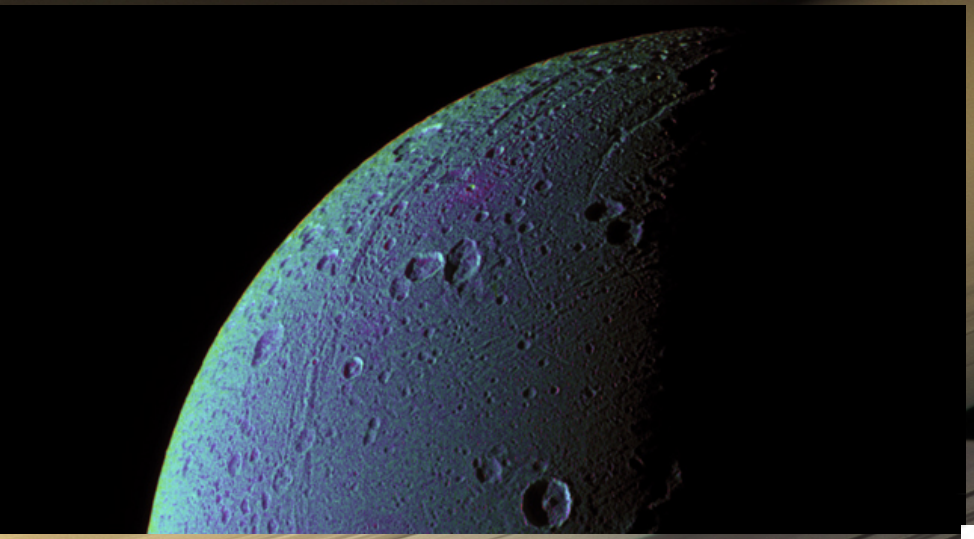
15.8 GWATTS
2.6 TIMES POWER OF ALL HOT-SPRINGS IN YELLOSTONE (HOWETT ET AL. 2011)



NASA/JPL/SWRI/SSI


Dione and Rhea

DIONE/RHEA CAMPAIGN



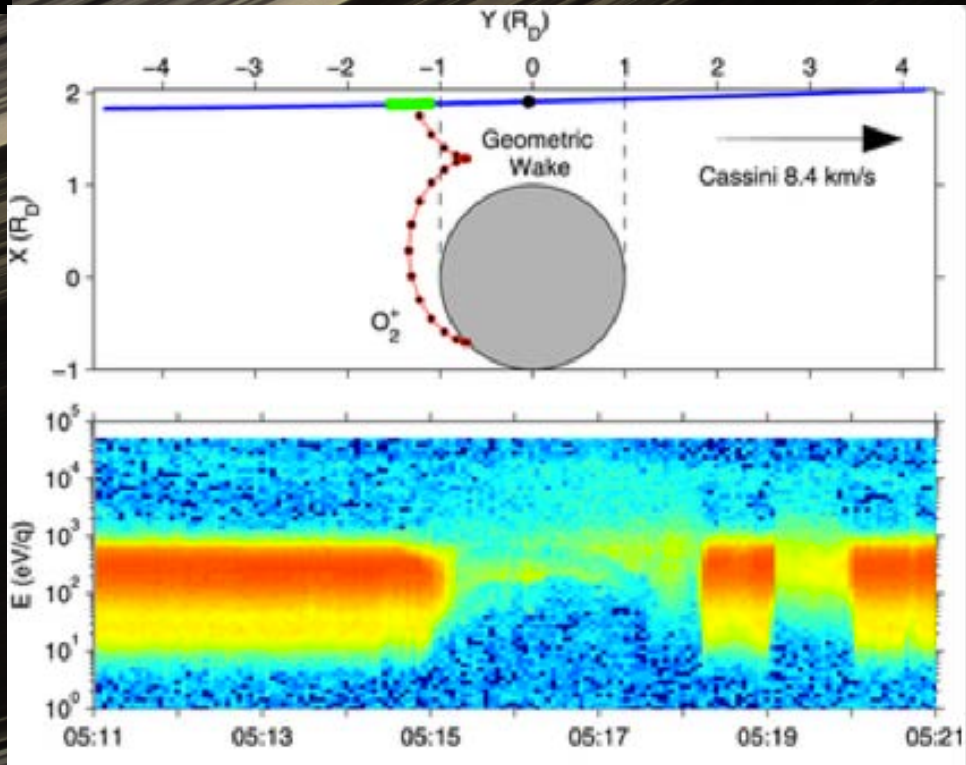
Oxygen exosphere discovered by CAPS in 2011 around Dione

Possible sputtering by ambiant plasma

Similar finding O/CO_2 at Rhea in 2010, by CAPS (Teolis et al. 2010)

Endogenous activity not ruled out yet: Cassini will keep looking for outgassing !

Tokar et al. 2011



Rhea/Dione: questions to be addressed by Cassini until 2017

→Are the moons differentiated (RSS obs) ?

→Are the moons active ?

- Monitor the vicinity: plasma, magnetic field, dust debris

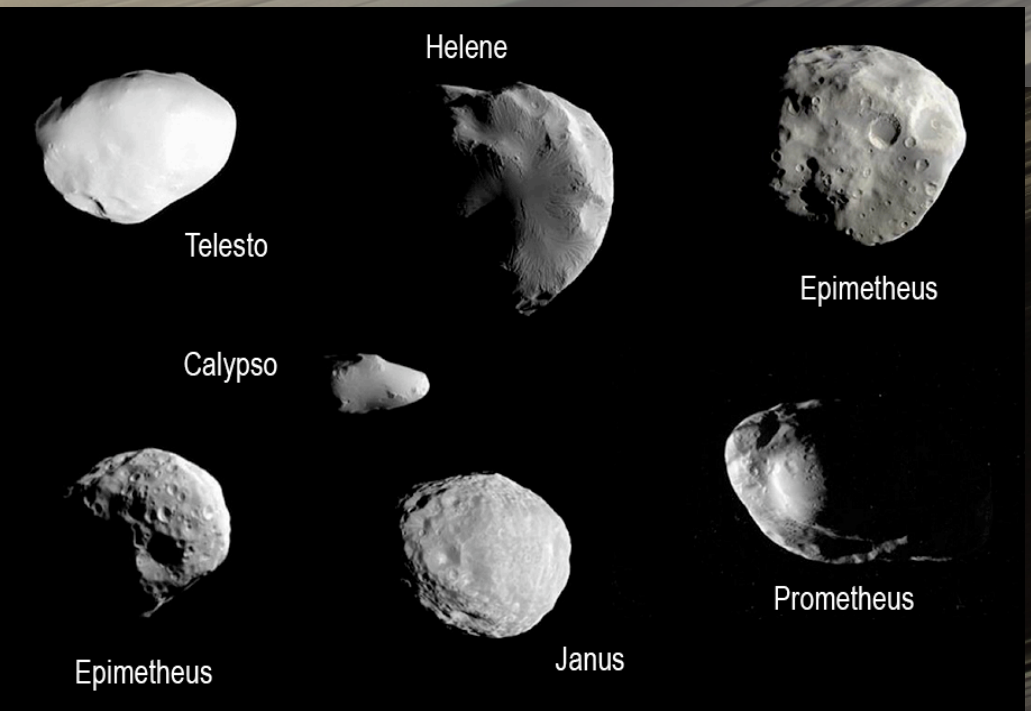
- Geologic mapping, look for surface changes, plumes


Small Moons and Moonlets

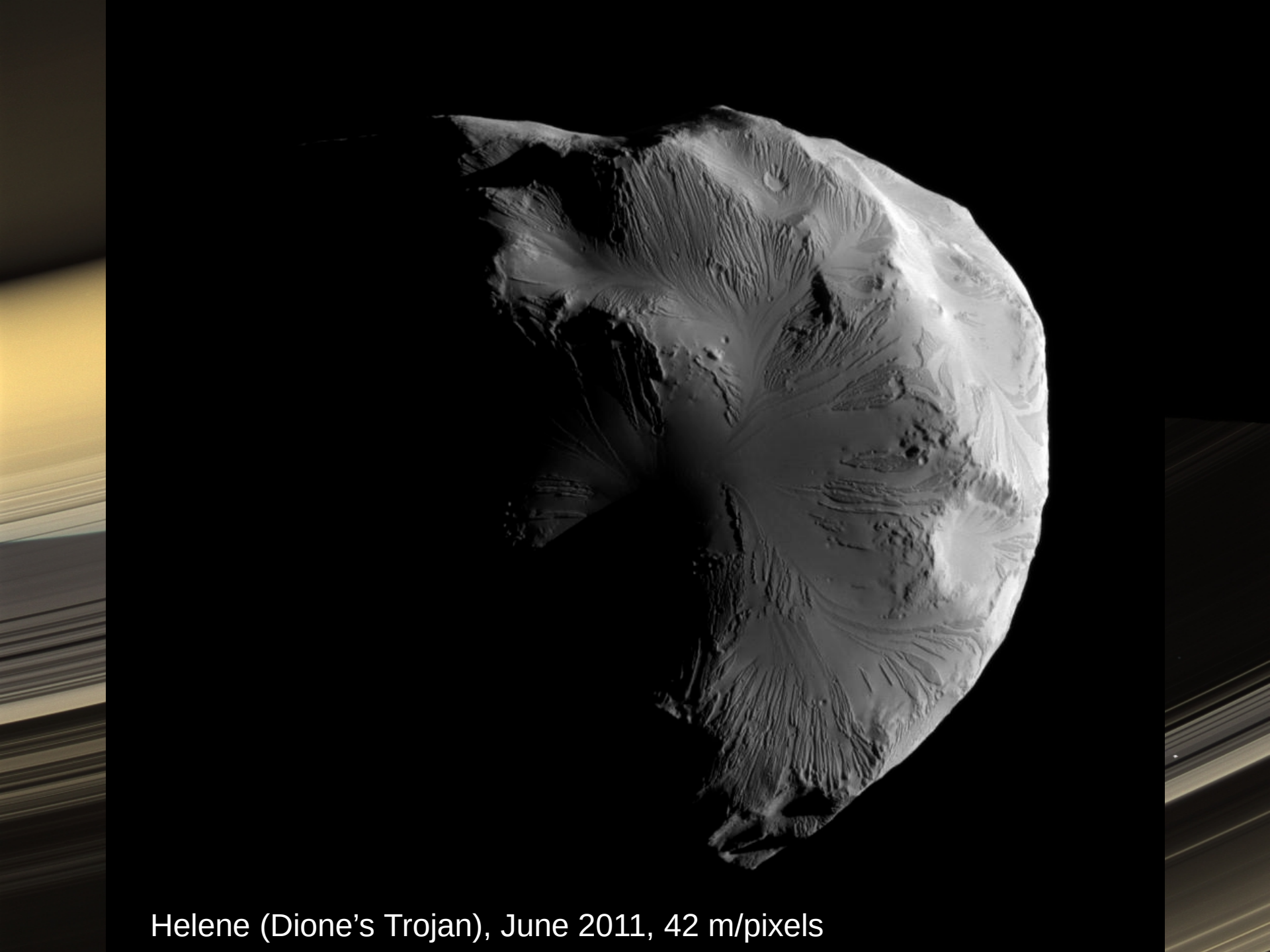
Small Moons

→Study transport of E ring material on their surface, color and spectroscopy

→Any hints that these bodies might be differentiated ?

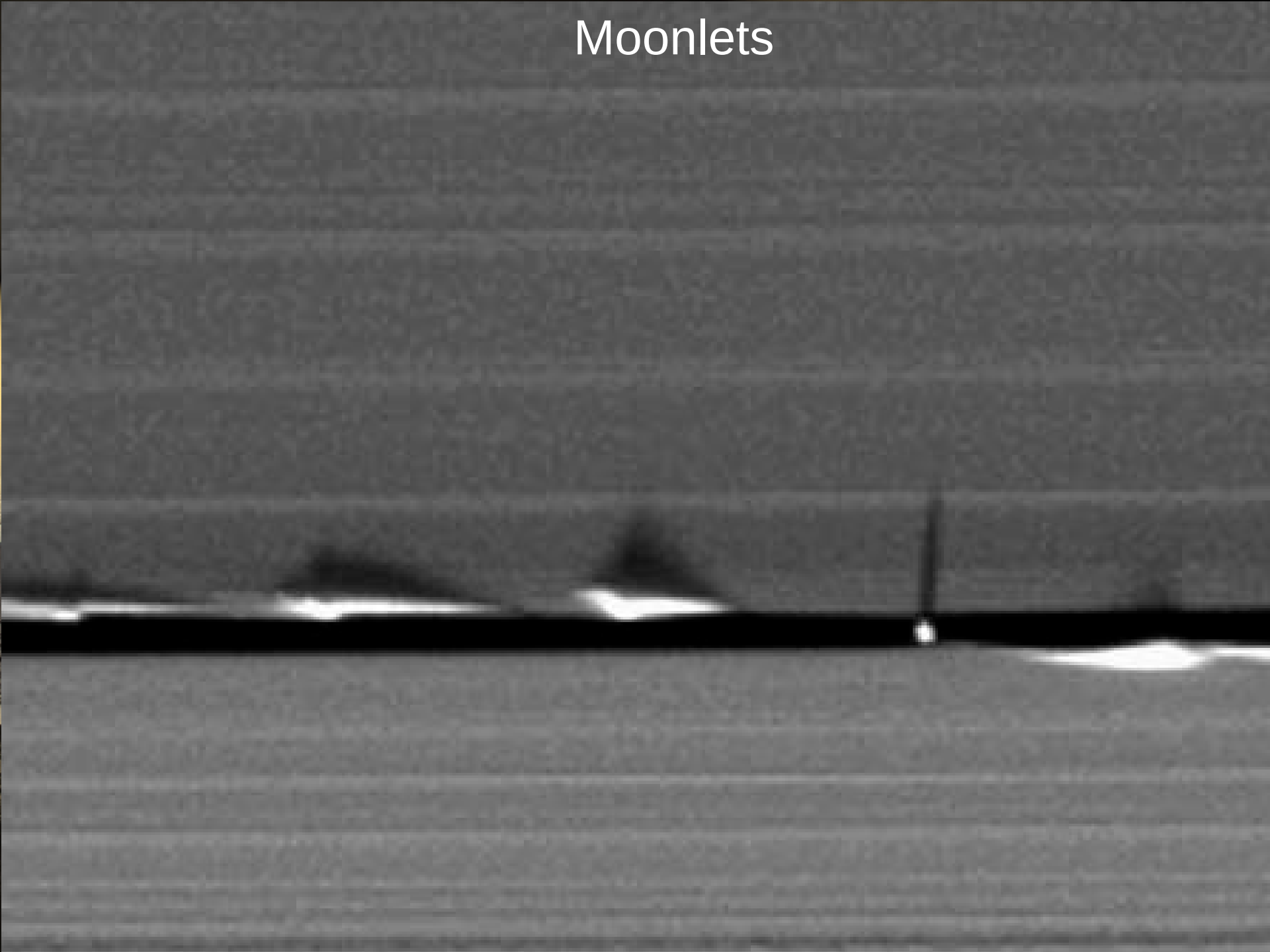


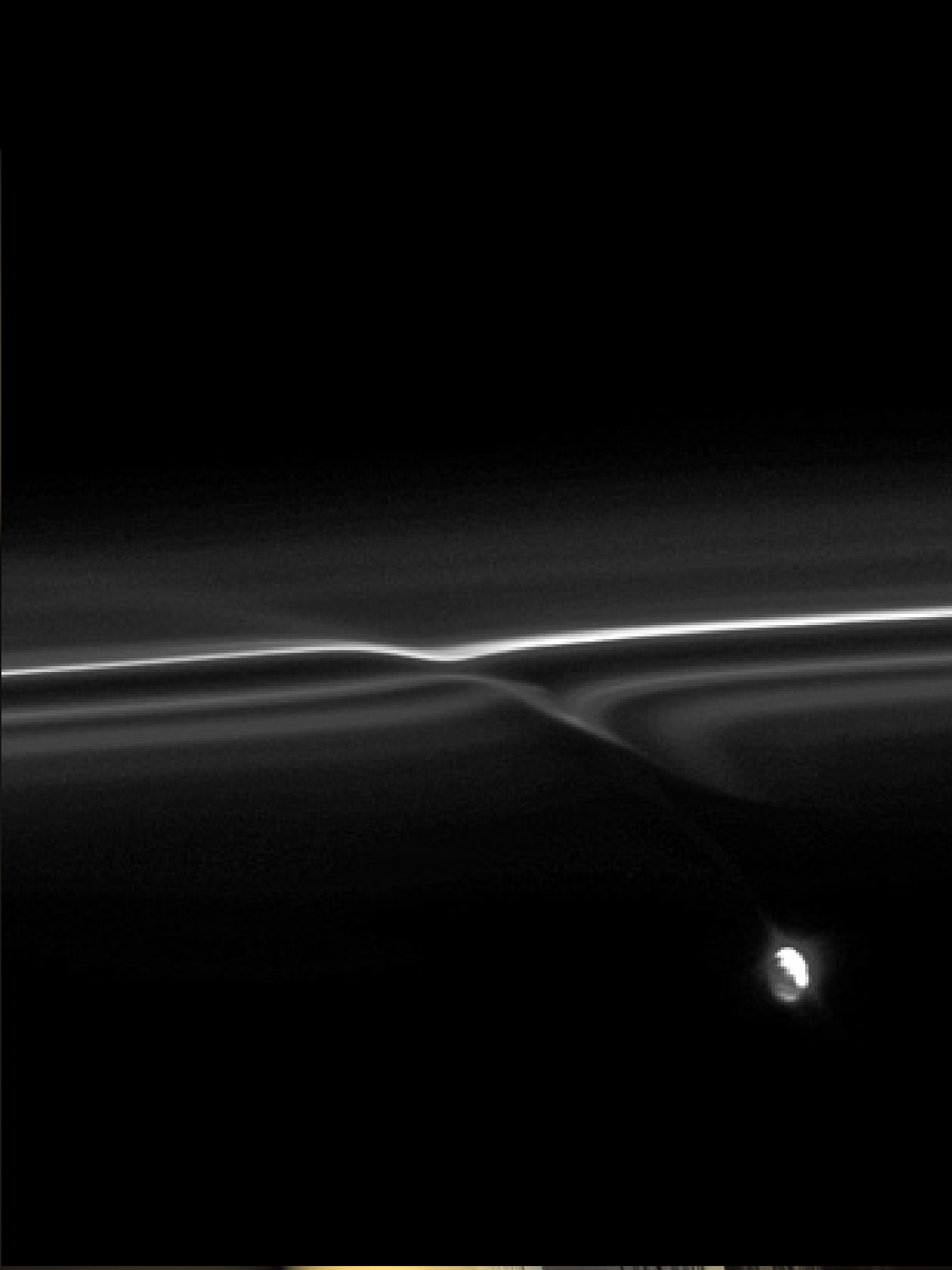
Methone 2012,NASA/JPL/SSI



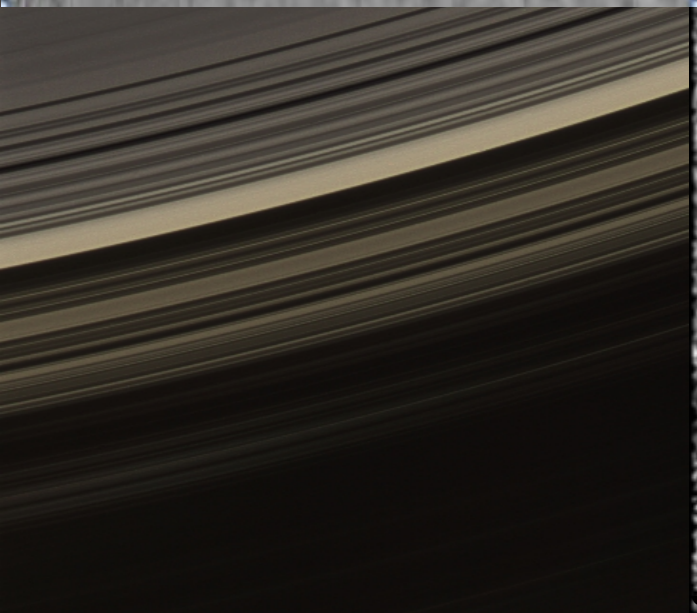
Helene (Dione’s Trojan), June 2011, 42 m/pixels

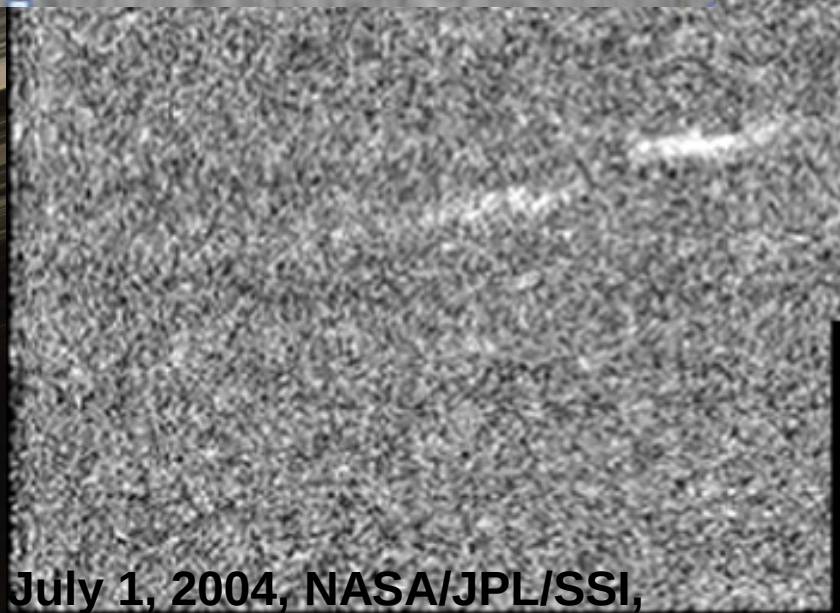
Moonlets

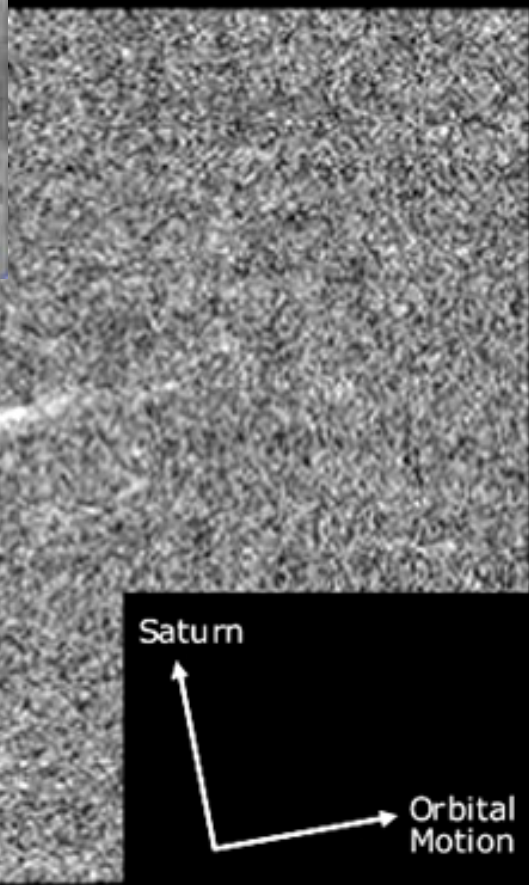




Looking for the ‘missing link’: Rings and ‘Protoplanets’

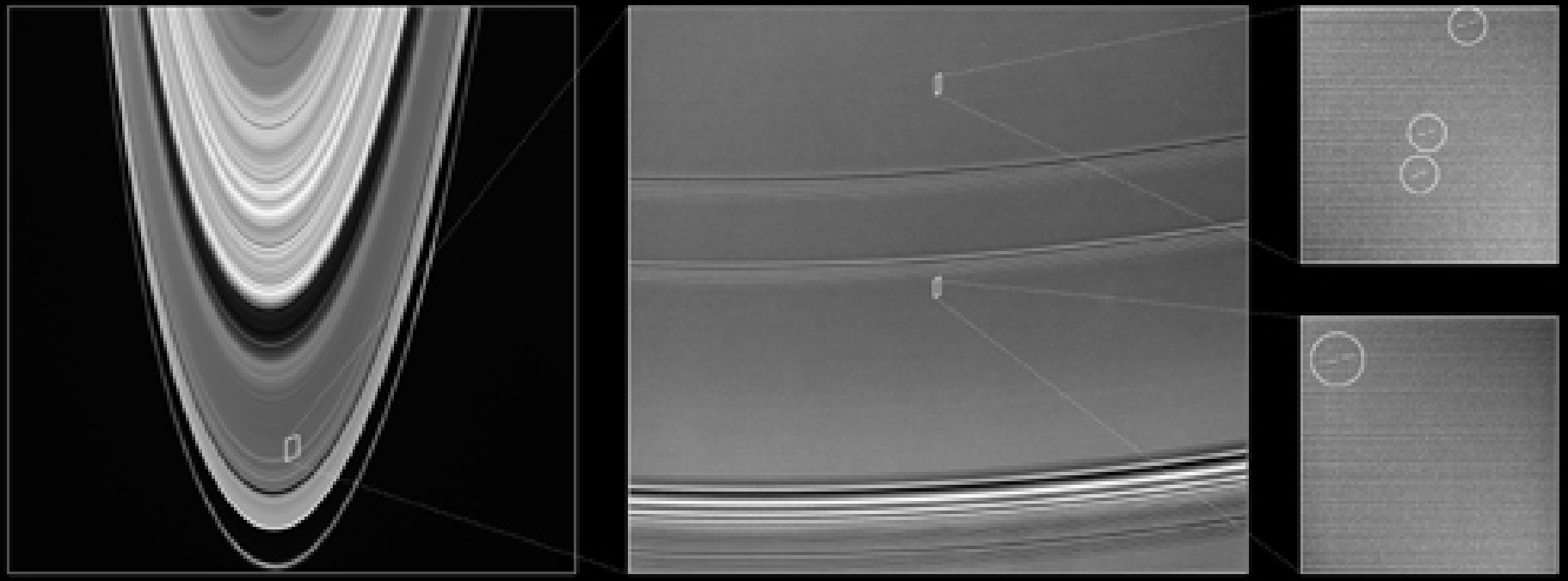






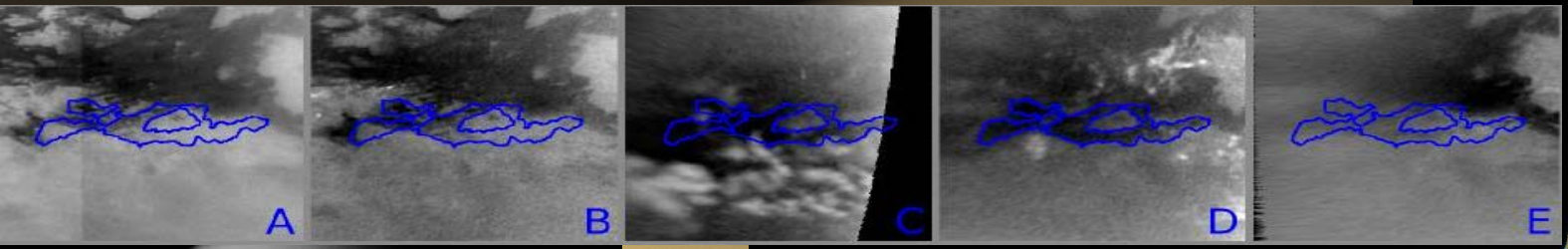
July 1, 2004, NASA/JPL/SSI,

Cassini will keep looking for Propellers and their evolution with time

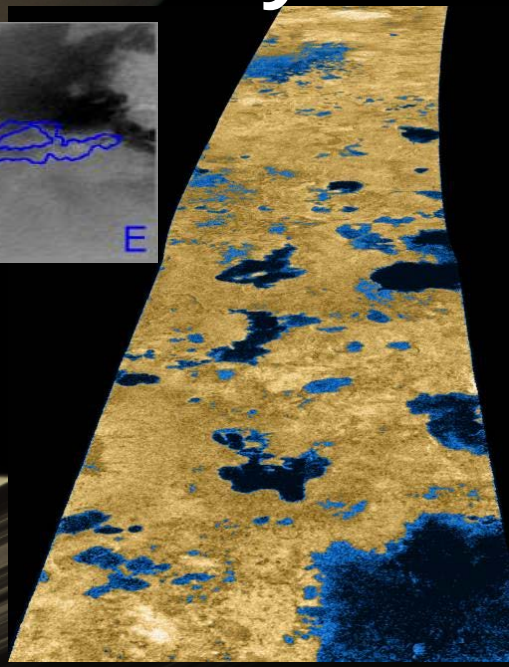



TITAN

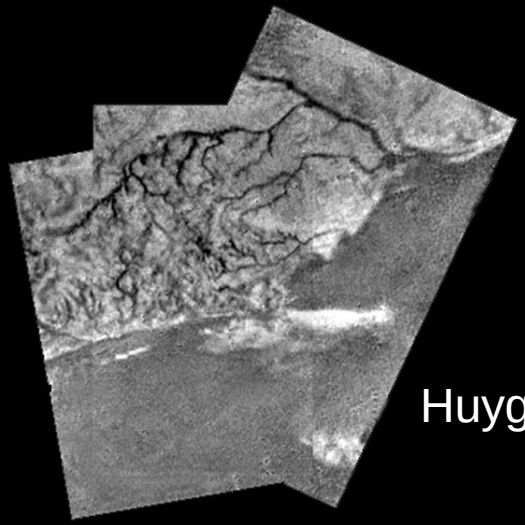
Titan’s lakes and hydrological cycle



Equatorial Storm, Sep. 2010

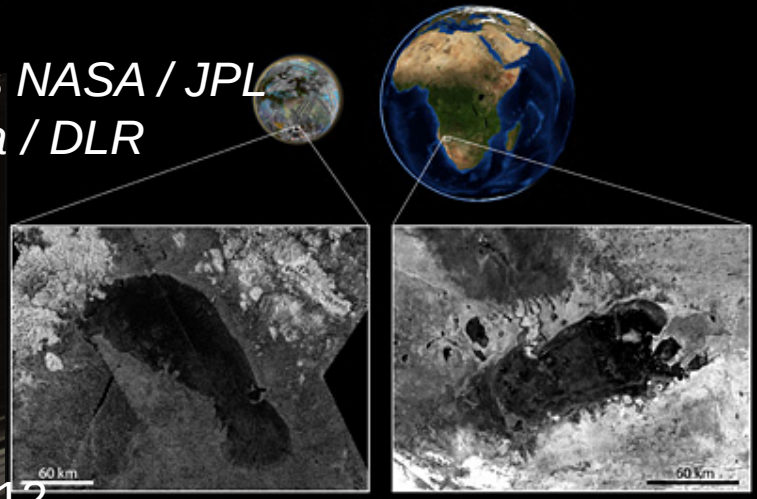


Radar,2006



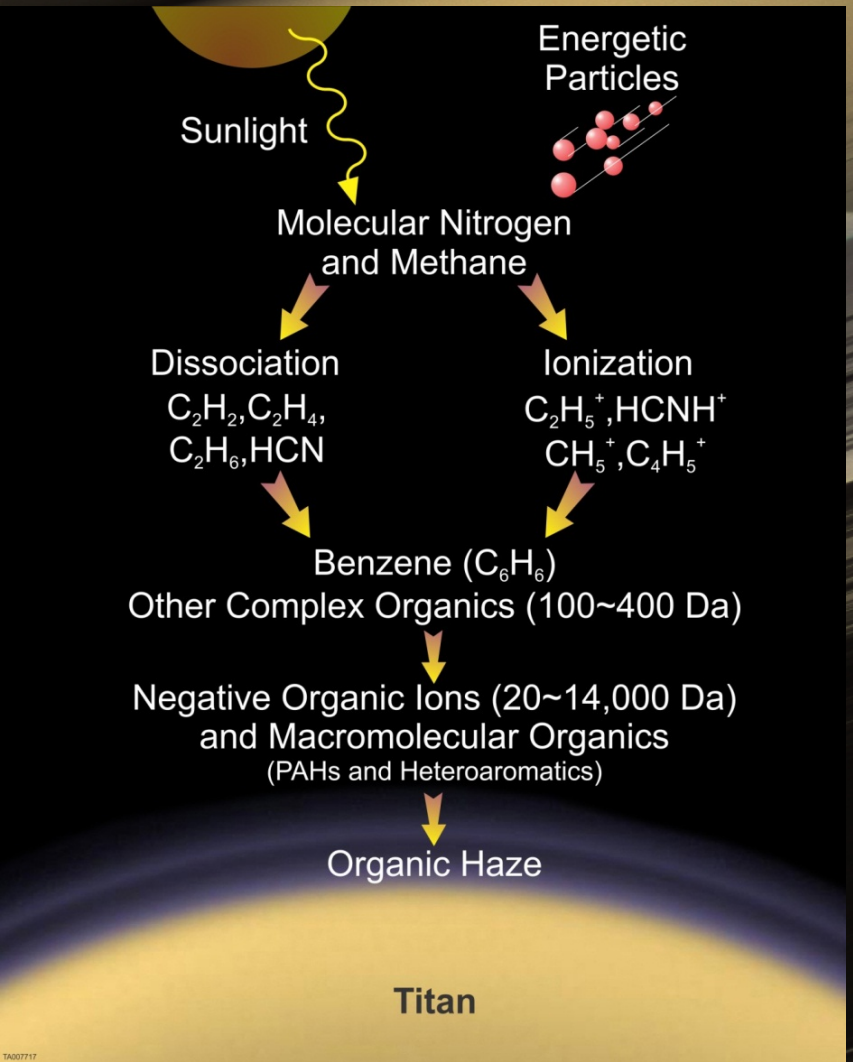
Huygens DISR,2005

2009 VIMS 5 microns *NASA / JPL / University of Arizona / DLR*

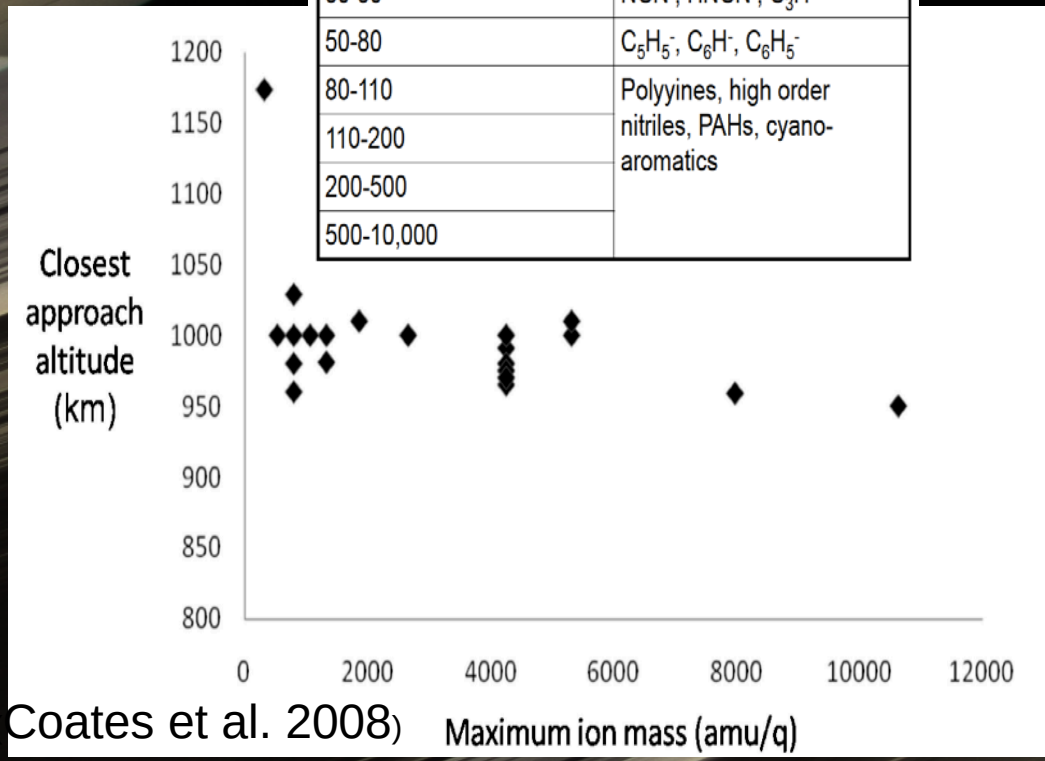


Cornet et al - ESA. 2012

Titan's chemistry factory (yesterday's talk by A. Coates…)



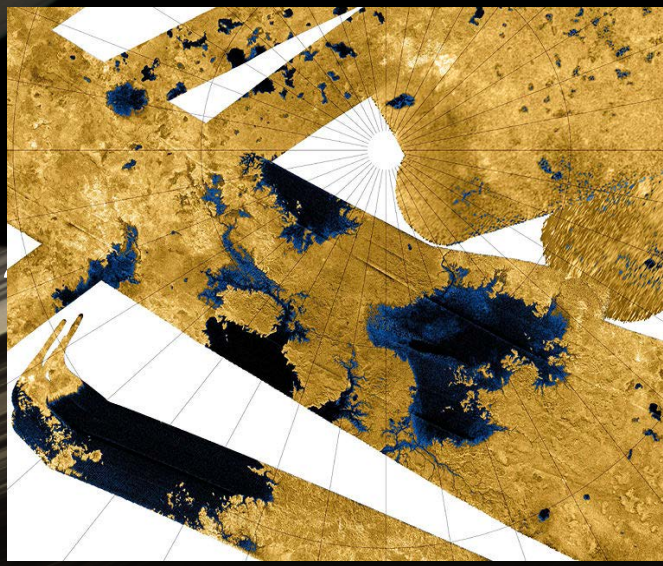
Mass group (amu/q)	Identification
10-30	CN^-, NH_2^-, O^-
30-50	NCN^-, $HNCN^-$, C_3H^-
50-80	$C_5H_5^-$, C_6H^-, $C_6H_5^-$
80-110	Polyyines, high order nitriles, PAHs, cyano-aromatics
110-200	
200-500	
500-10,000	



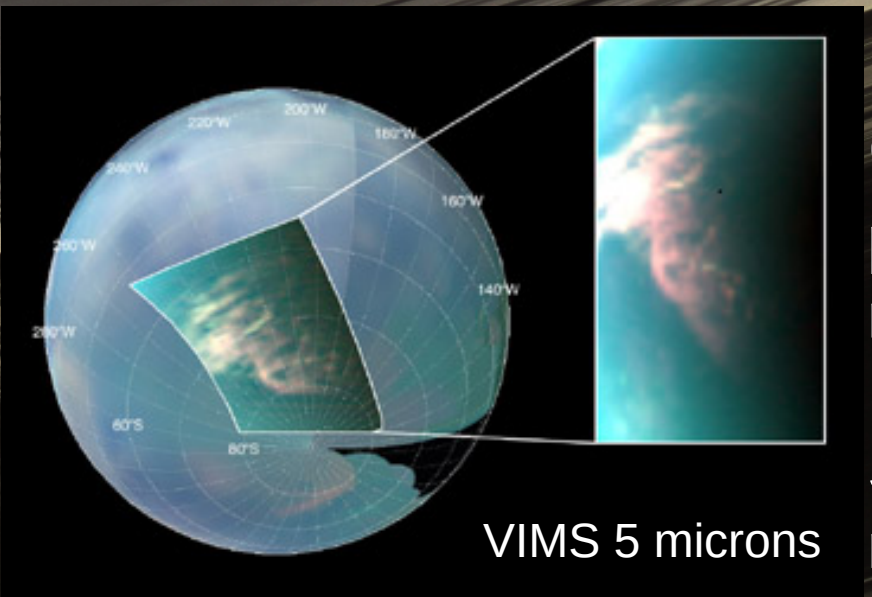
(Coates et al. 2008)

Question to be addressed by Cassini until 2017

Lakes: changes in Northern hemisphere linked to Spring? Distribution of small lakes



Radar

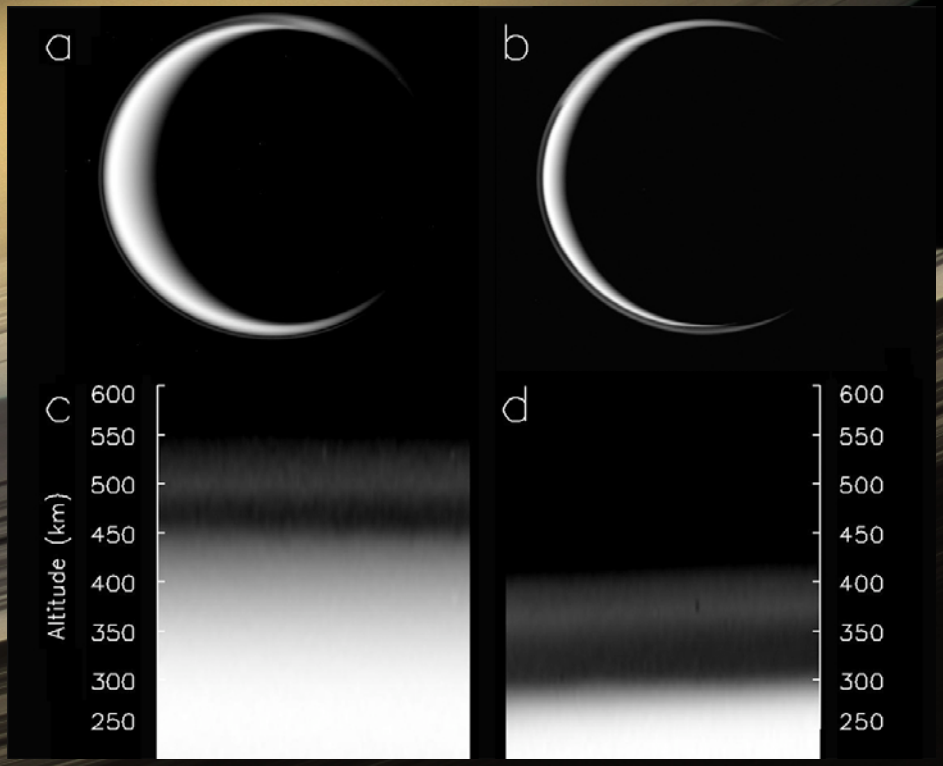


VIMS 5 microns

Clouds/Winds: follow predictions from meteorological models ?

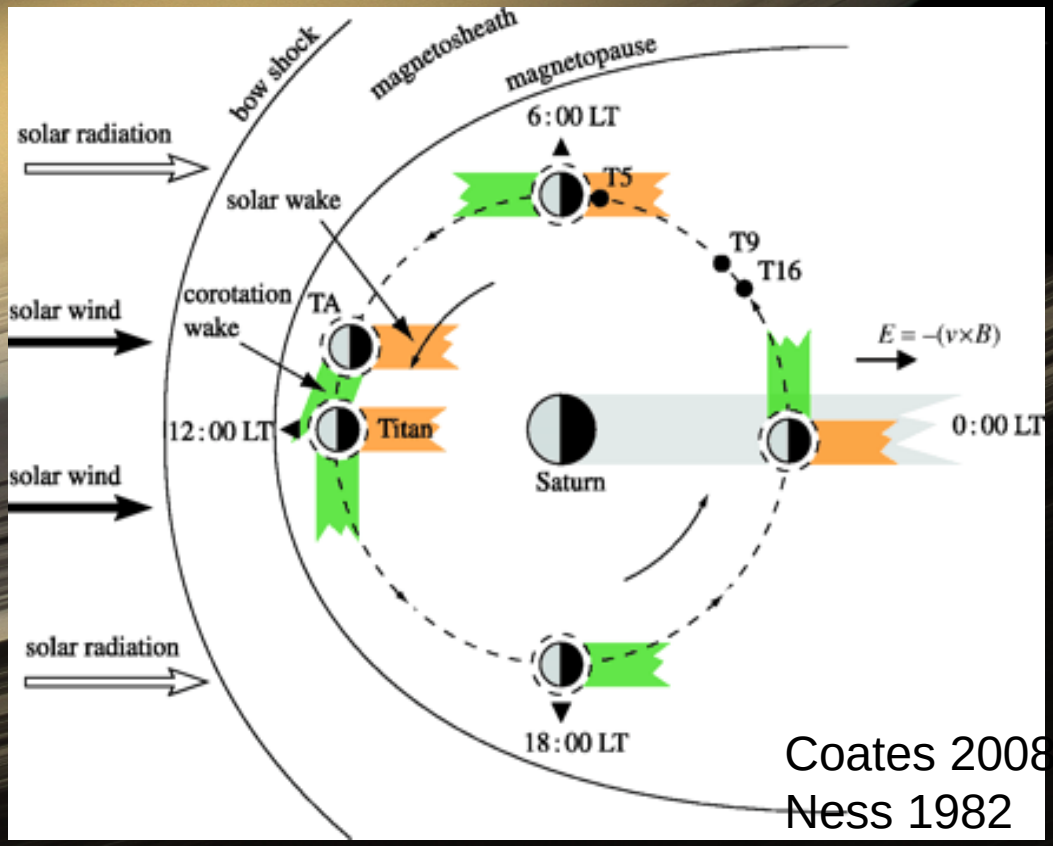
Search for mid-latitude clouds in northern hemisphere

- Haze layer seasonal evolution: recovery from equinox drop ?



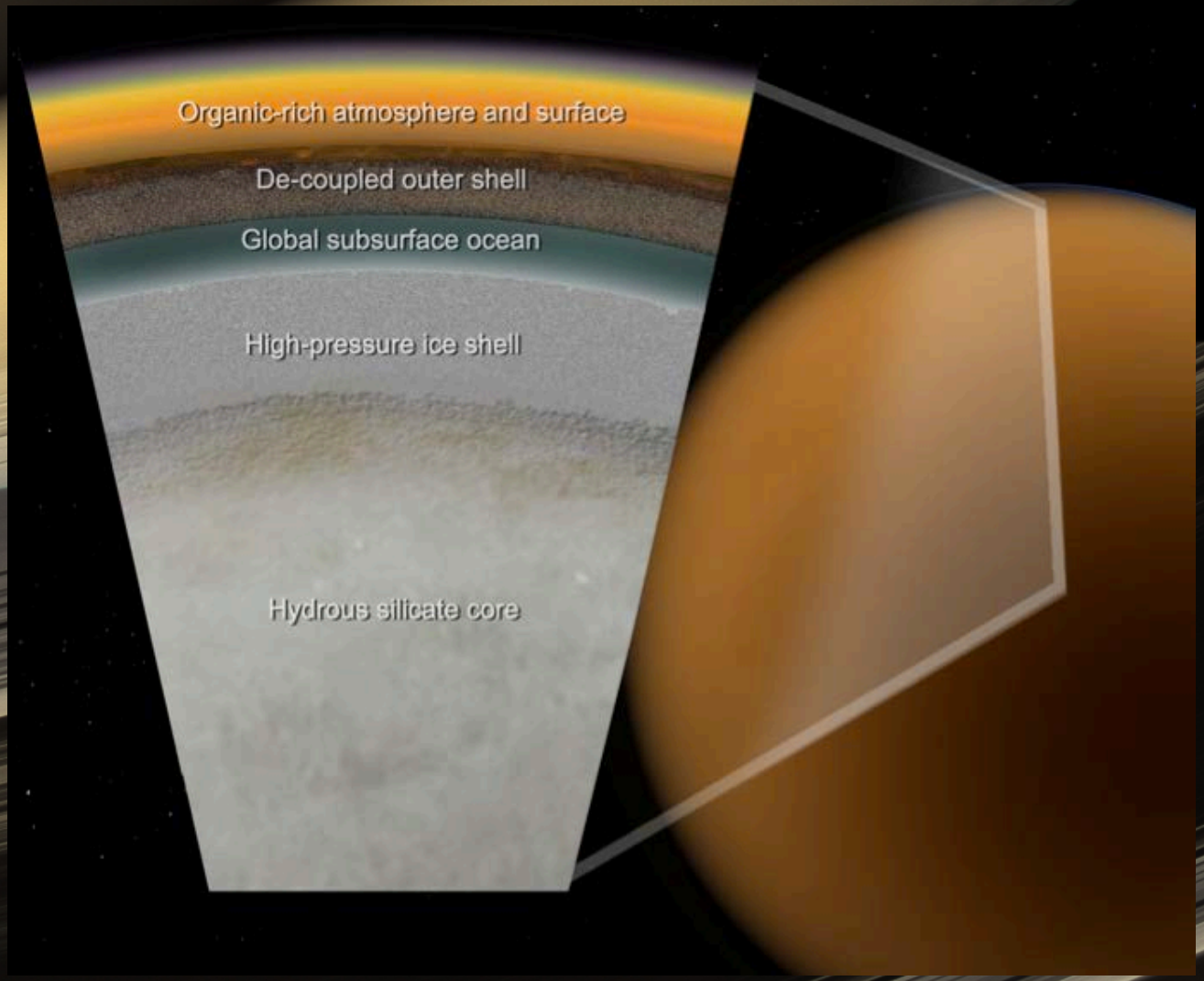
West et al, 2011

-Evolution of Titan's ionosphere/magnetosphere interaction as we are approaching solar maximum (2013-2014)

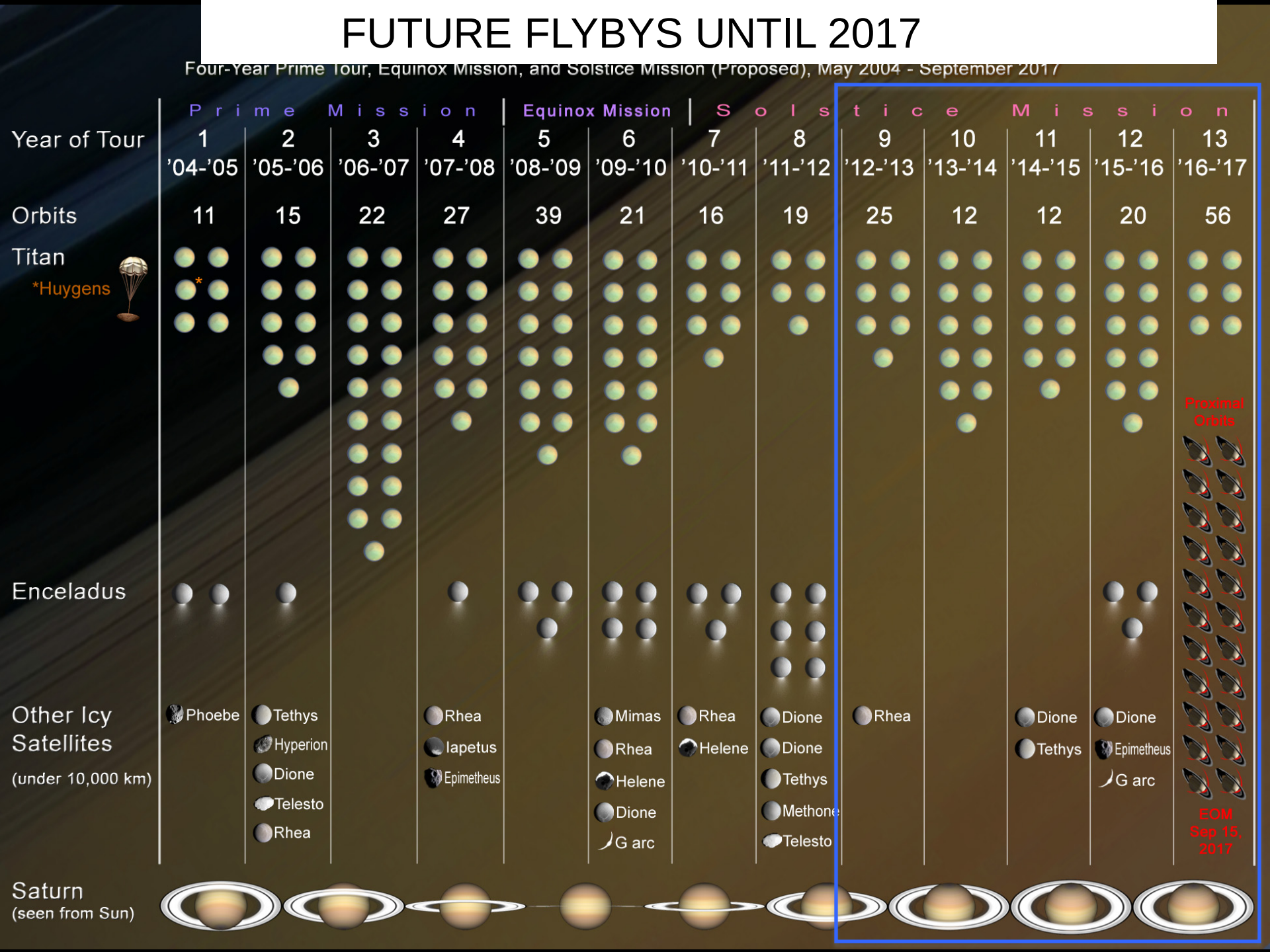


Coates 2008
Ness 1982

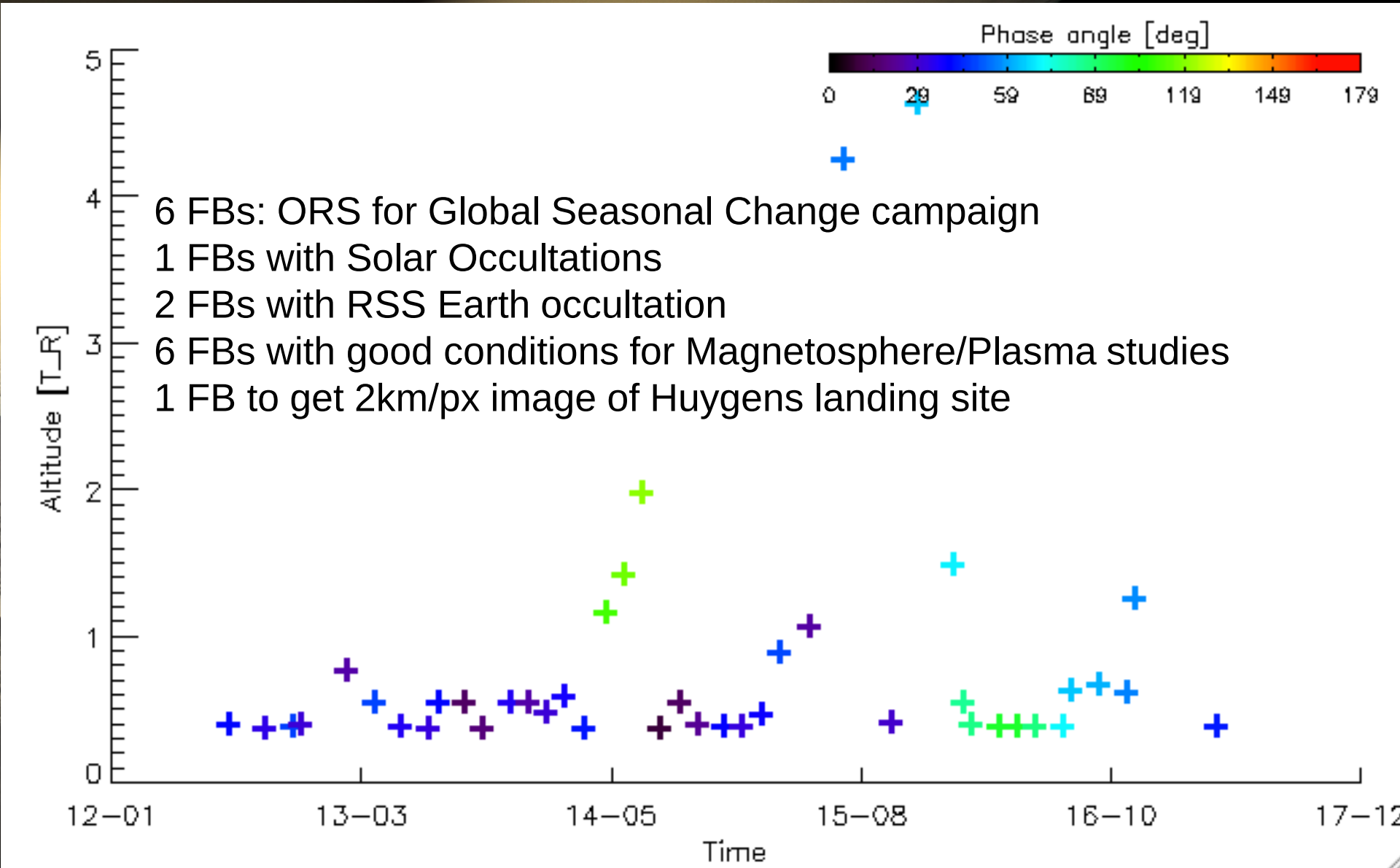
Confirmation of Titan's interior models ?



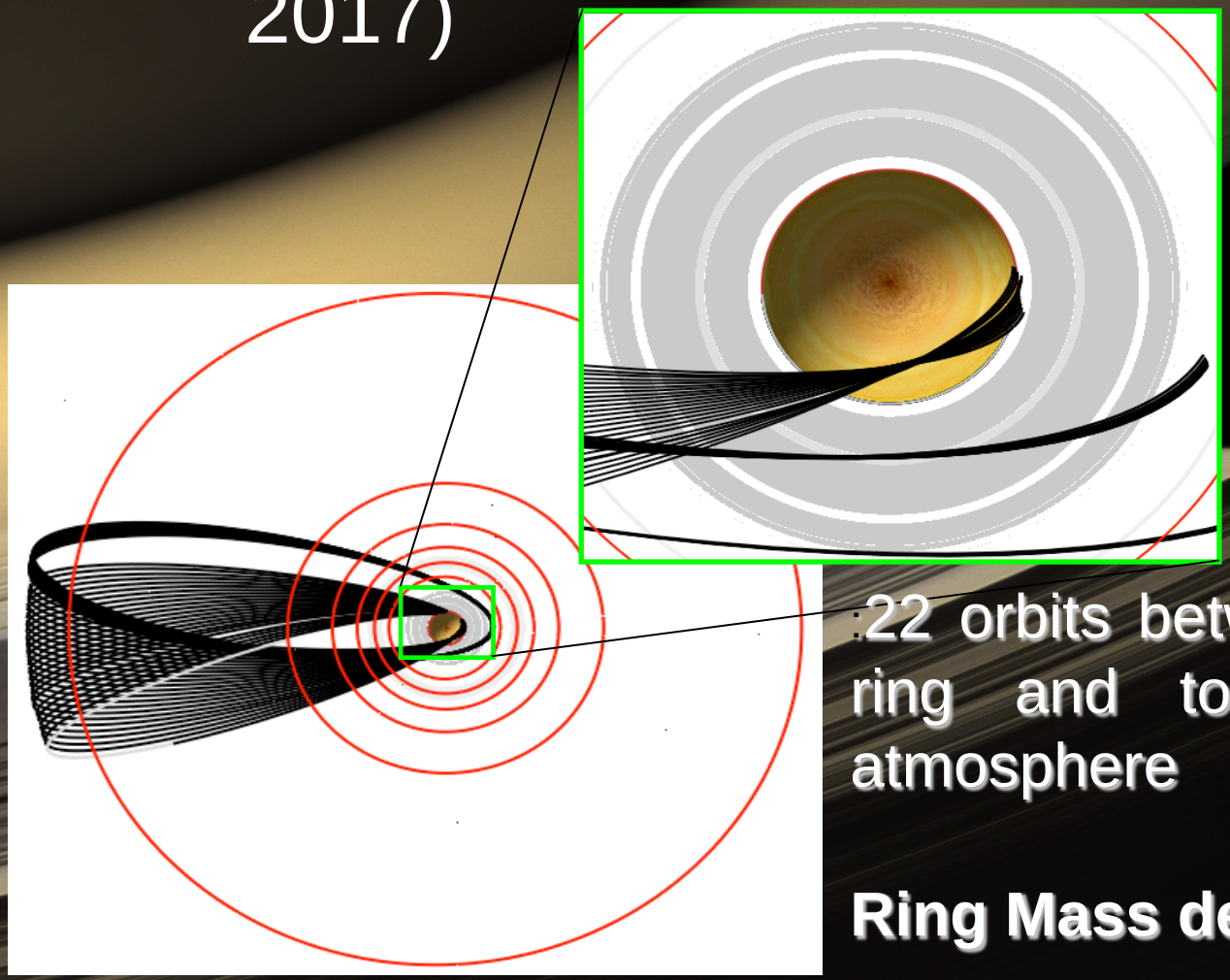
FUTURE FLYBYS UNTIL 2017



Details Titan's flybys until 2017



End of Mission (2016-2017)



:22 orbits between innermost D ring and top of Saturn ' s atmosphere

Ring Mass determination

Probe Saturn interior (synchronized with Juno!)