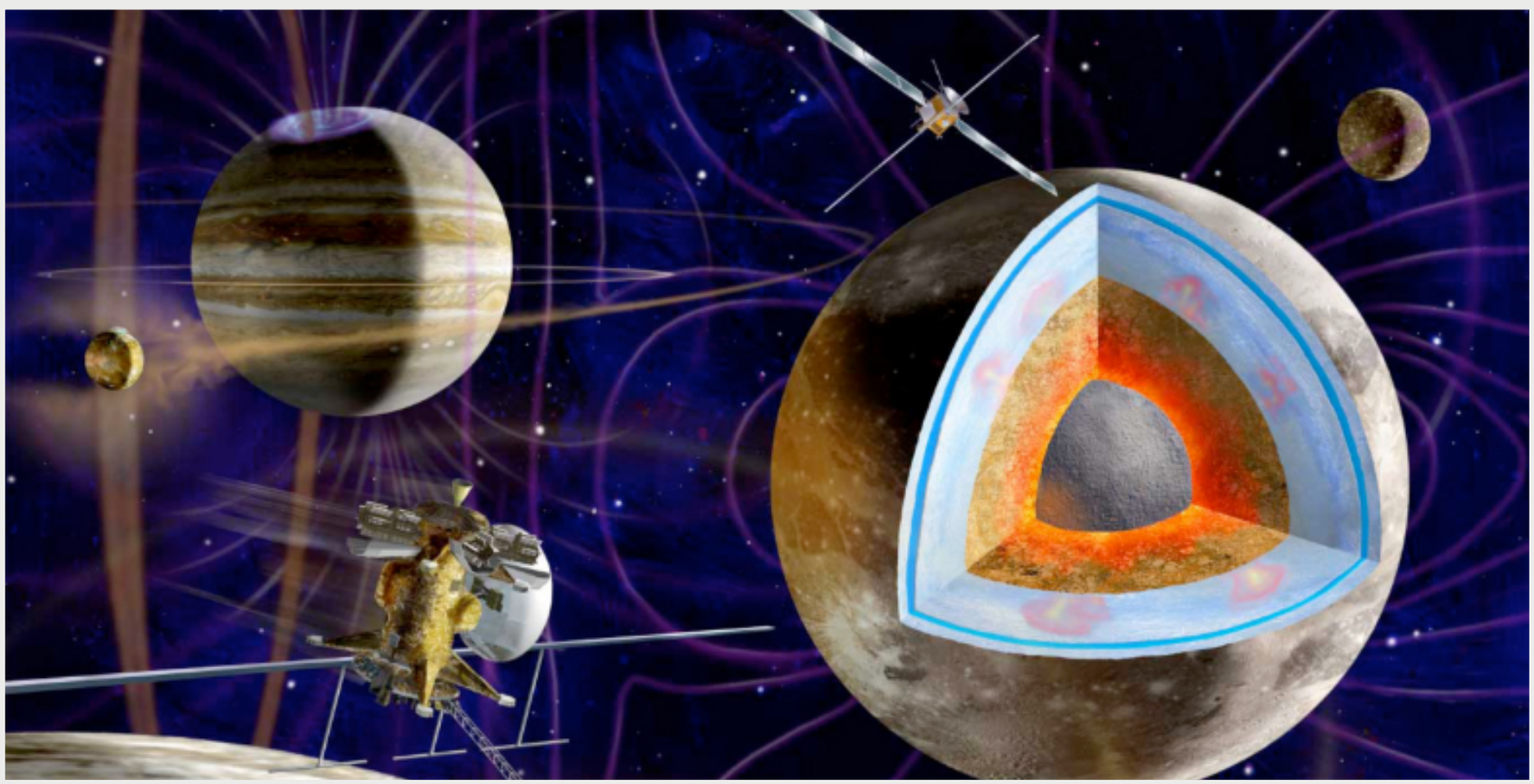
INSTRUMENTATION RPW POUR EJSM

B. Cecconi et l'équipe RPWI menée par J-E Wahlund (Suède)



History of Jovian exploration

Spacecraft	*radio-grade*	*Orbits*	*Radio Instrumentation*	*Maximum frequency*	*Sensors*
Voyager	~	flyby	- total flux, - sign of circular polarization	**40.5Mhz**	Electric: - 2 monopoles (10m)
Ulysses	+	flyby (polar outbound)	**- flux,** **- polarization,** **- direction finding**	940kHz	Electric: - 1 spin-plane dipole (72.5m) - 1 axial monopole (7.5m)
Galileo	~	misc orbits	- projected flux	5.6MHz	Electric: - 1 dipole (6.6m)
Cassini	+	distant flyby >135Rj	**- flux,** **- polarization,** **- direction finding**	16MHz (GP up to 2Mhz)	Electric: - 3 monopoles (10m)
New Horizons	×	distant flyby	*— no Radio & Plasma Waves instrumentation —*		
Juno	~	**polar orbits**	- projected flux	**40MHz**	Electric: - 1 dipole (~2m)
EJSM (JGO, JEO?)	?	***Tour + Satellites***	**- flux,** **- polarization,** **- direction finding**	**45Mhz**	***Electric:*** ***- 3 short dipoles or monopoles (2m)*** ***- 1 long dipole (10m)*** ***Magnetic:*** ***- 1 HF magnetic Loop (option)***

Europa Jupiter System Mission

ESA-NASA mission to Jupiter System

Instrumental AO next year. Final ESA down-selection in 2013.
Launch planned in 2020

2 spacecraft:

- JEO (NASA-led): Jupiter Europa Orbiter
- JGO (ESA-led): Jupiter Ganymede Orbiter

Radio instrumentation only on JGO at this time.
But the last word has not been said for JEO!

possibly 3rd spacecraft:

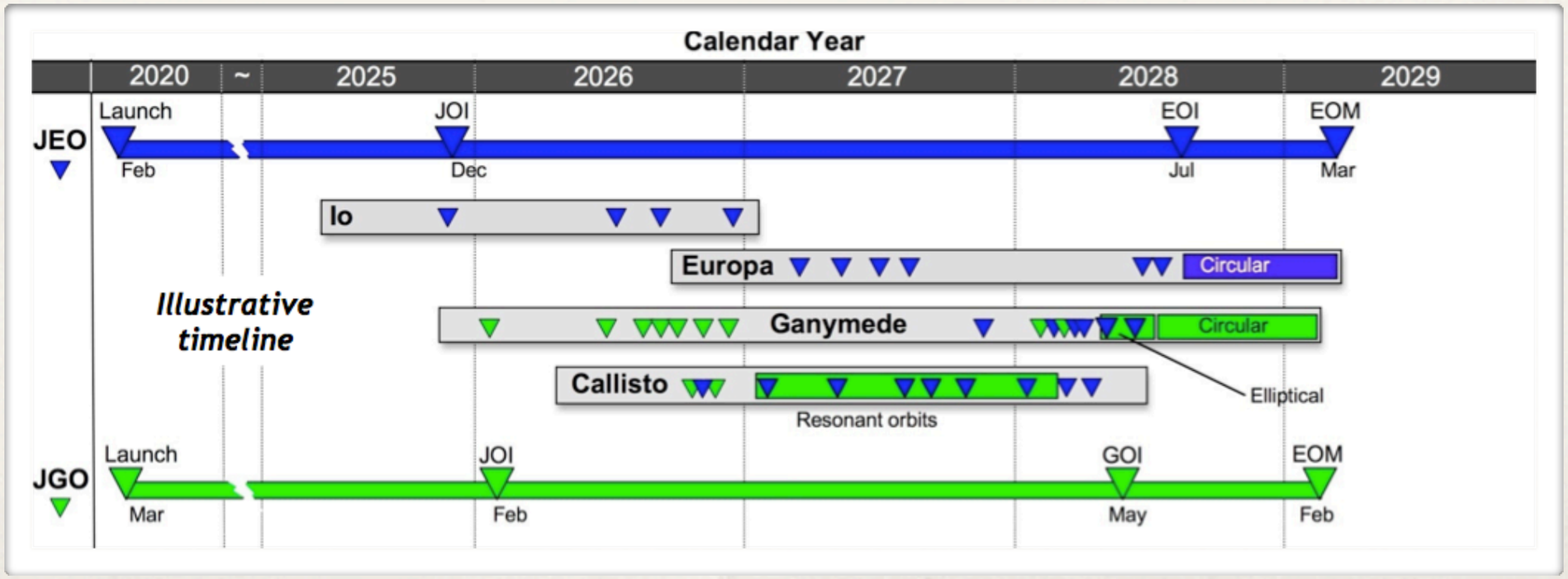
- *JMO (JAXA-led): Jupiter Magnetospheric Orbiter*

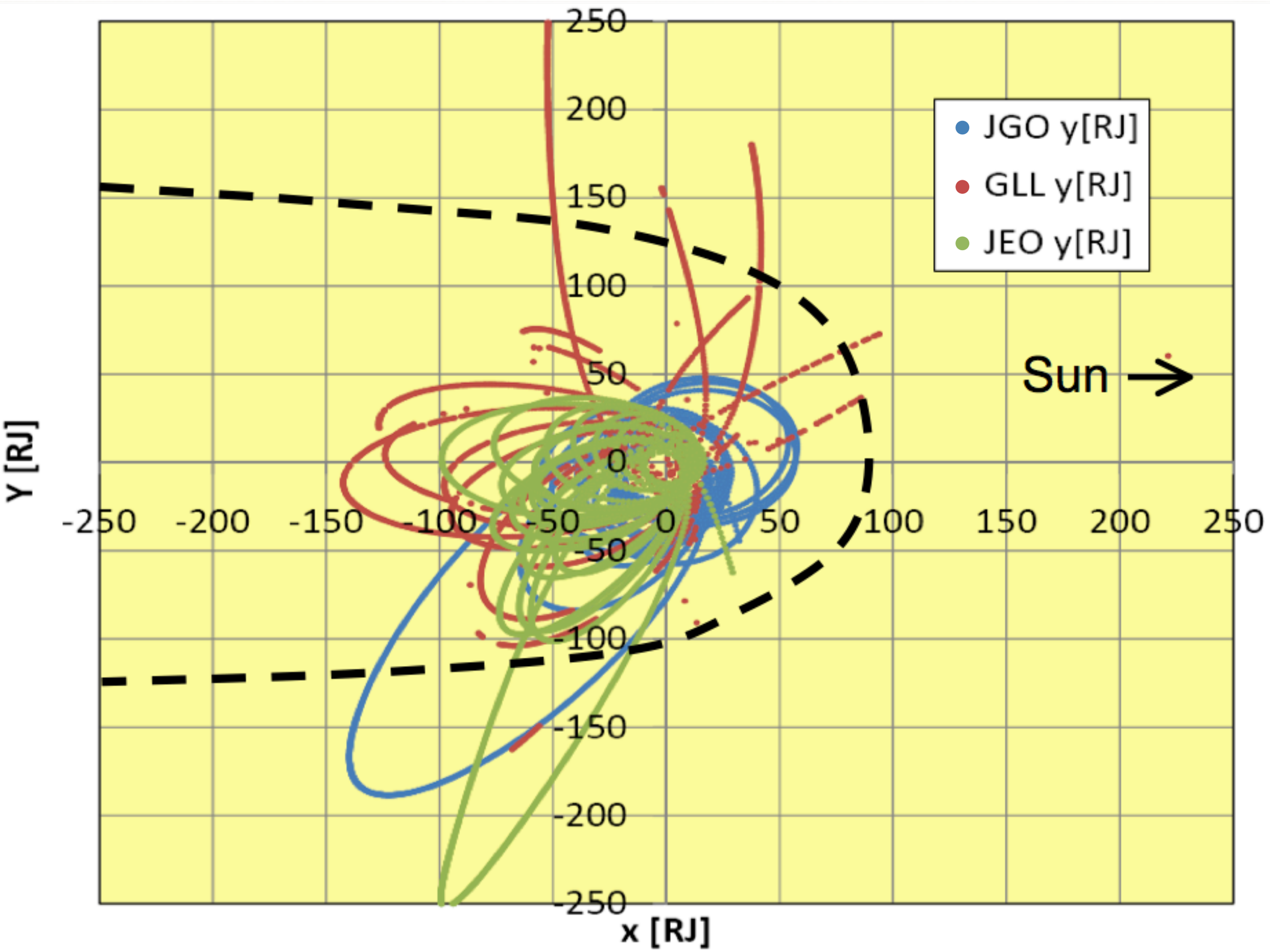
EJSM Stereo Observations

JEO radar instrument could embark small (1 channel) radio receiver.

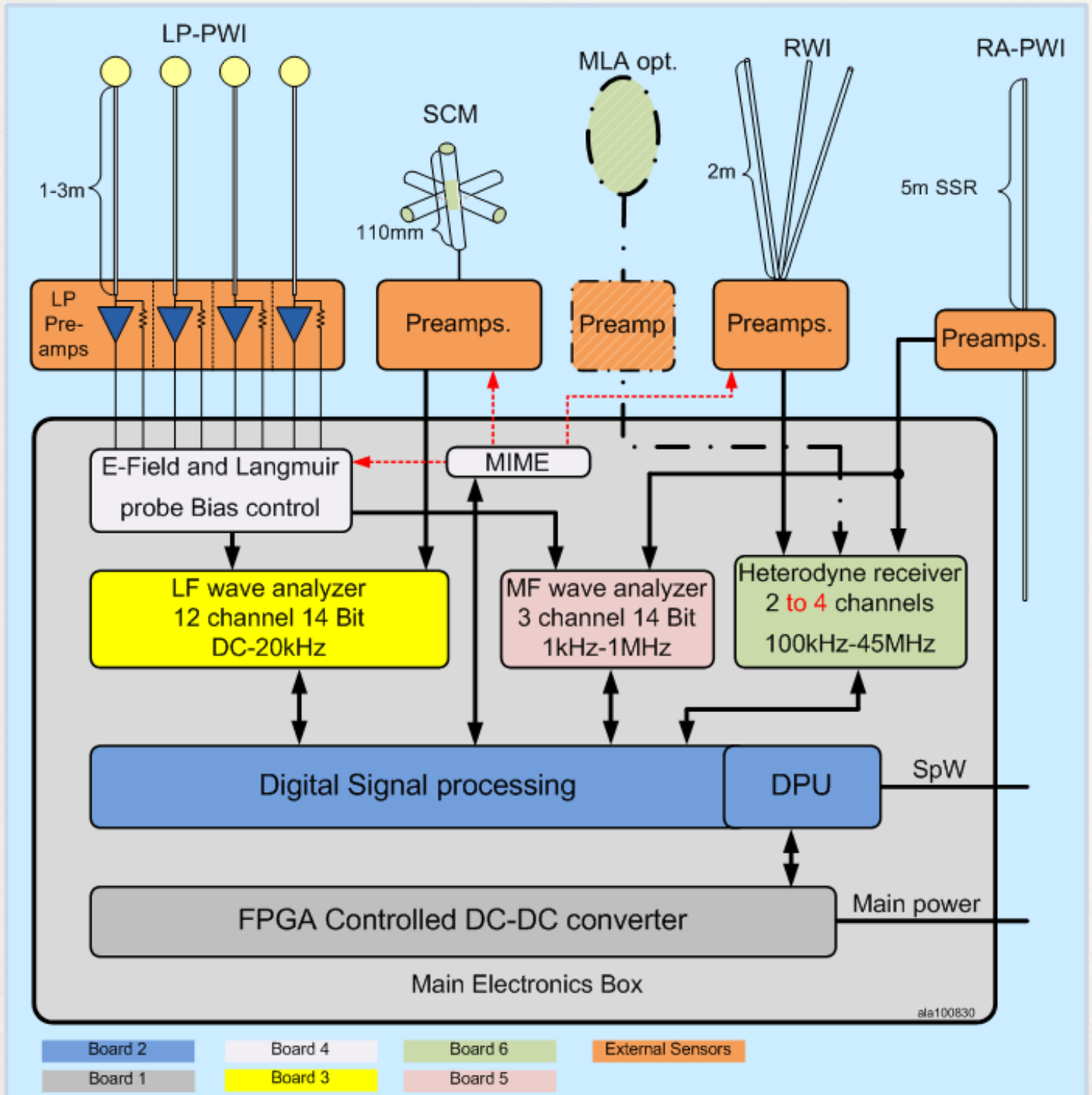
JGO and JEO will be around Jupiter at the same time:
- Stereoscopic radio observation (emission beaming properties)
- Solar-Wind Monitoring or Io Torus Space Weather
- Remote (radio) & In-situ (plasma) simultaneous observations

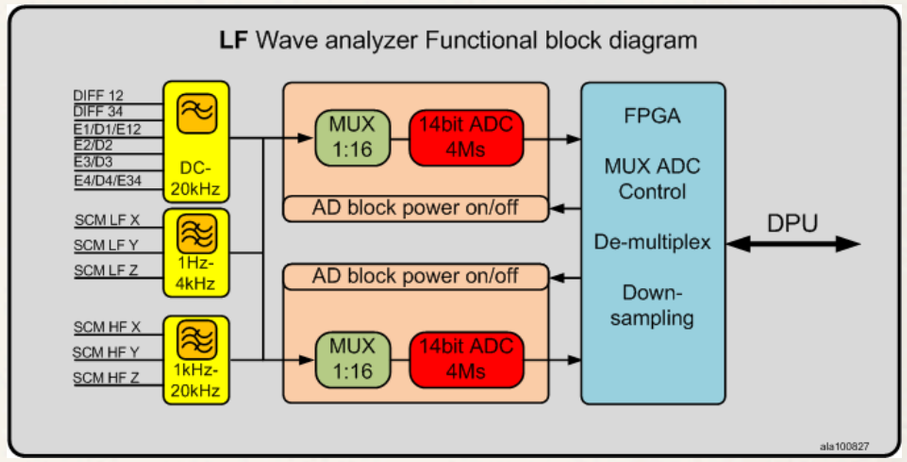
JMO would add a lot !

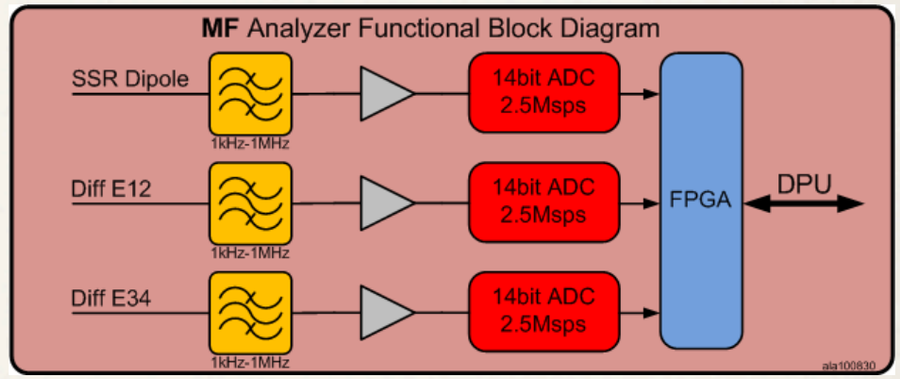


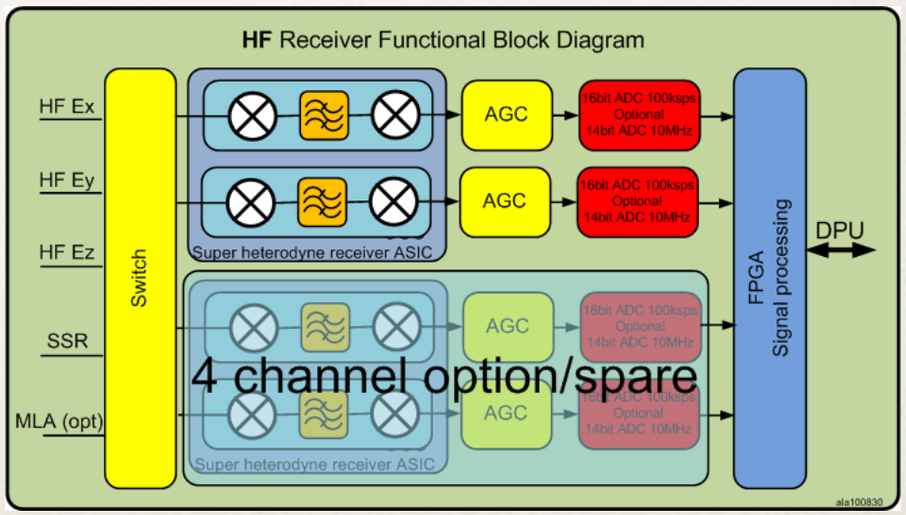

JGO y[RJ]
GLL y[RJ]
JEO y[RJ]
Sun
250
200
150
100
50
0
-50
-100
-150
-200
-250
-250
-200
-150
-100
-50
0
50
100
150
200
250
Y [RJ]
x [RJ]

RPWI block diagram









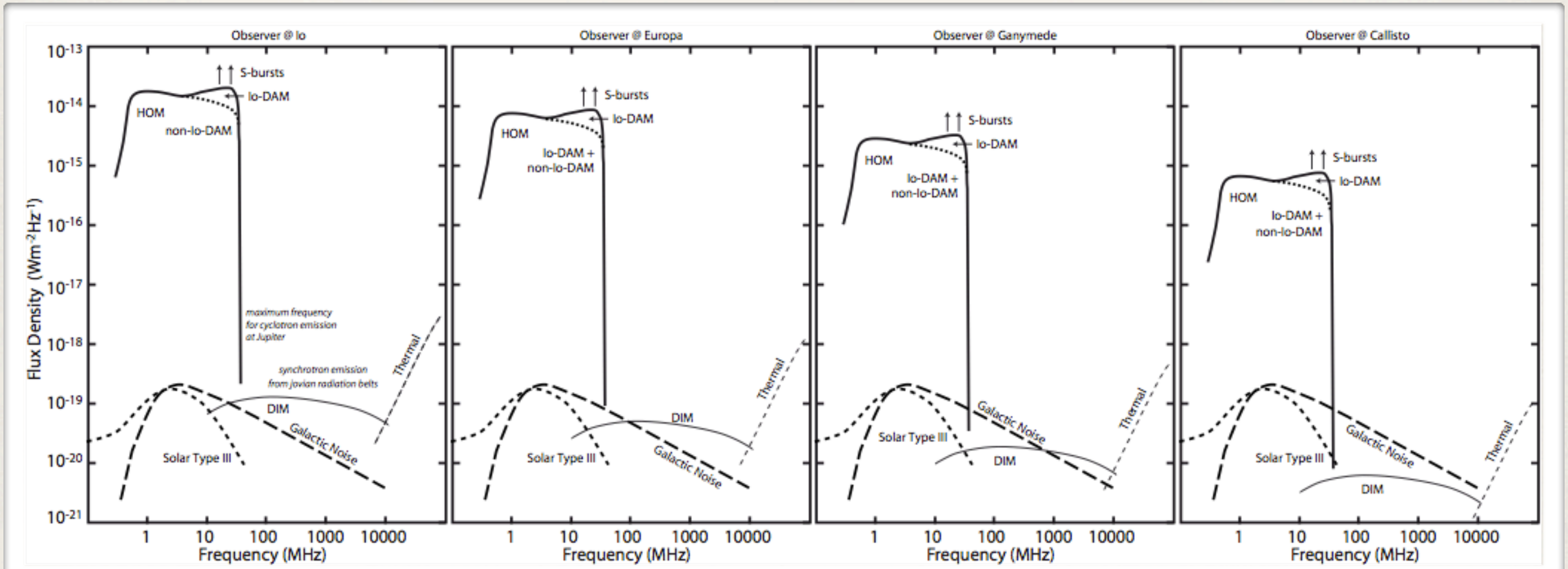
EJSM/JGO/RPWI radio instrumentation

Radio sensors:
- Short Electric Antenna Triad: ~2m, monopoles (on S/C body) or dipoles (on boom)
- Long Electric Dipole: ~10m (using radar dipole)
- Magnetic Loop Antenna (option): 1MHz-45MHz
- Dual Band Search Coil Magnetometers: up to 20 kHz

Other Sensors:
- 4 Langmuir Probes
- Mutual Impedance Instrumentation

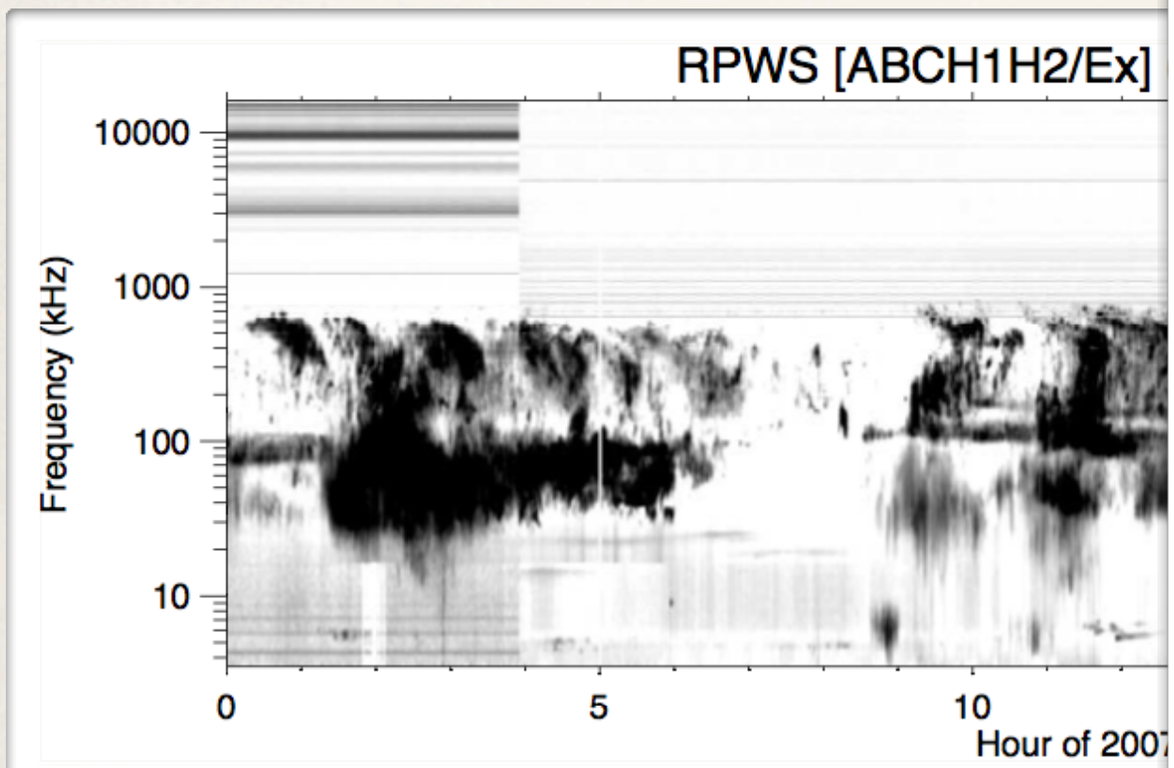
Radio Receiver:
- Dual channel heterodyne sweeping frequency spectrum analyzer with goniopolarimetric capabilities.
- *Optional 3rd channel*
- *Optional wide band heterodyne waveform*

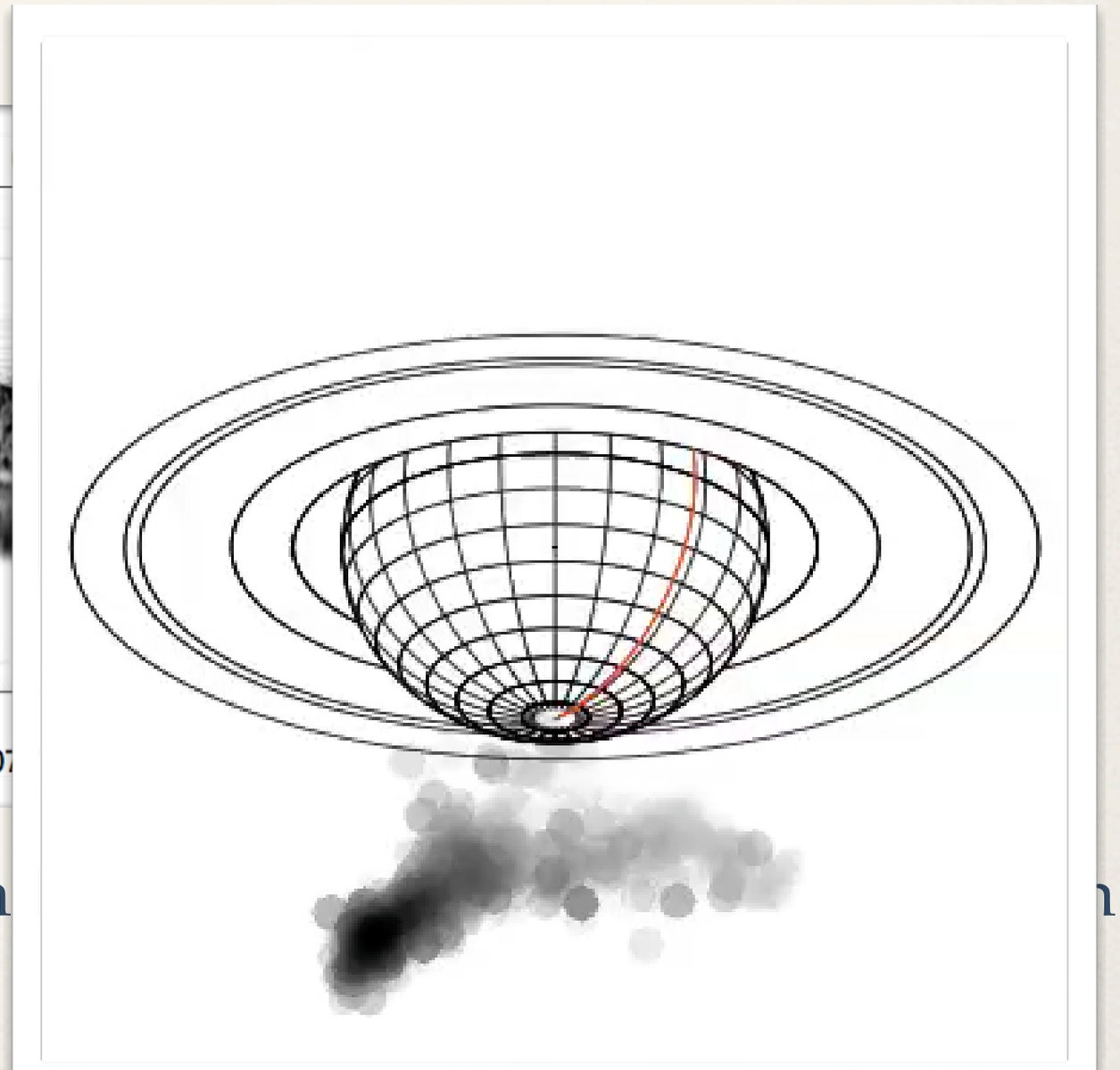
Radio Spectra expected from Galilean Satellites



Goniopolarimetry

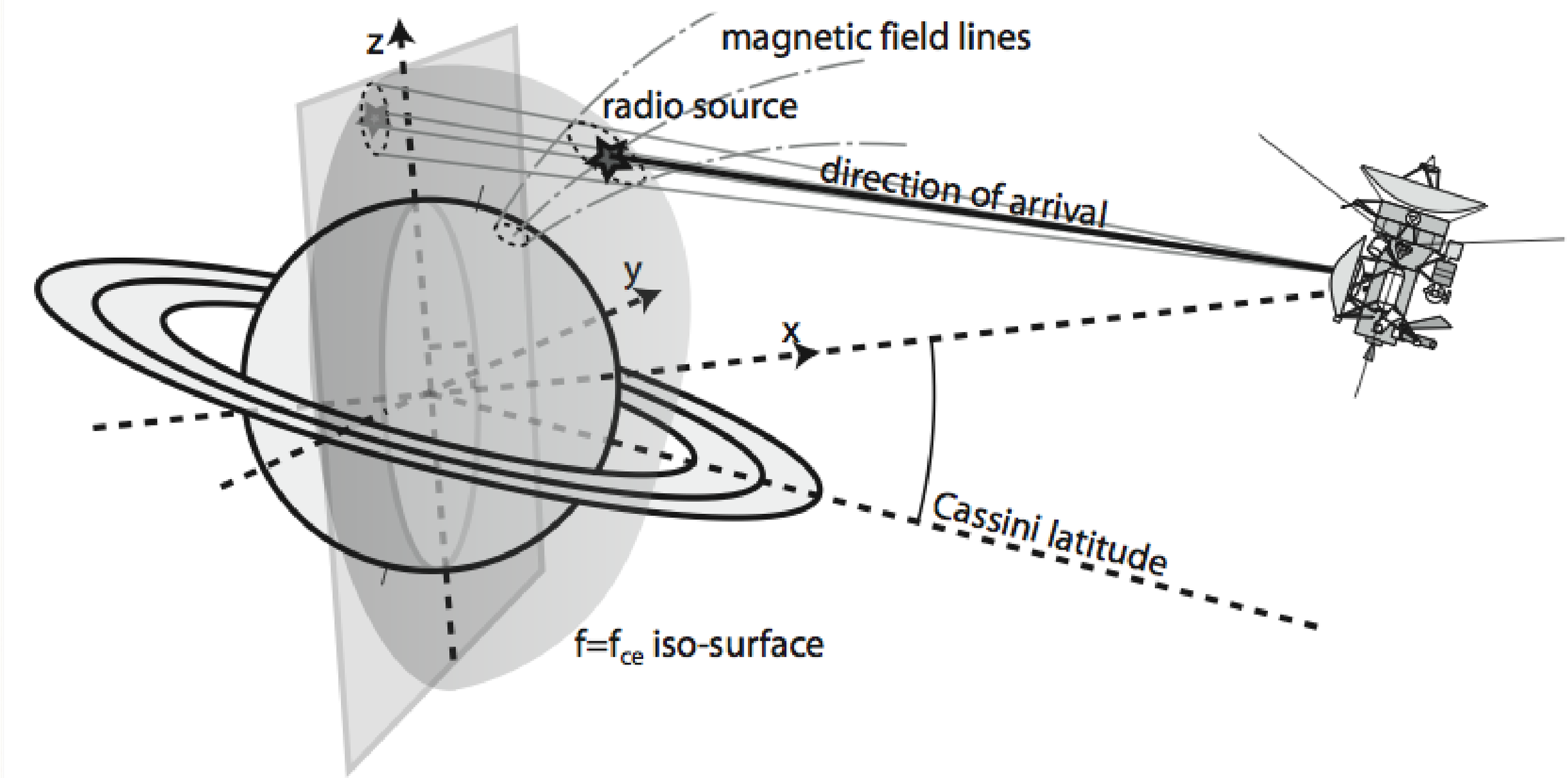
Or how to ‘see’ radio emissions



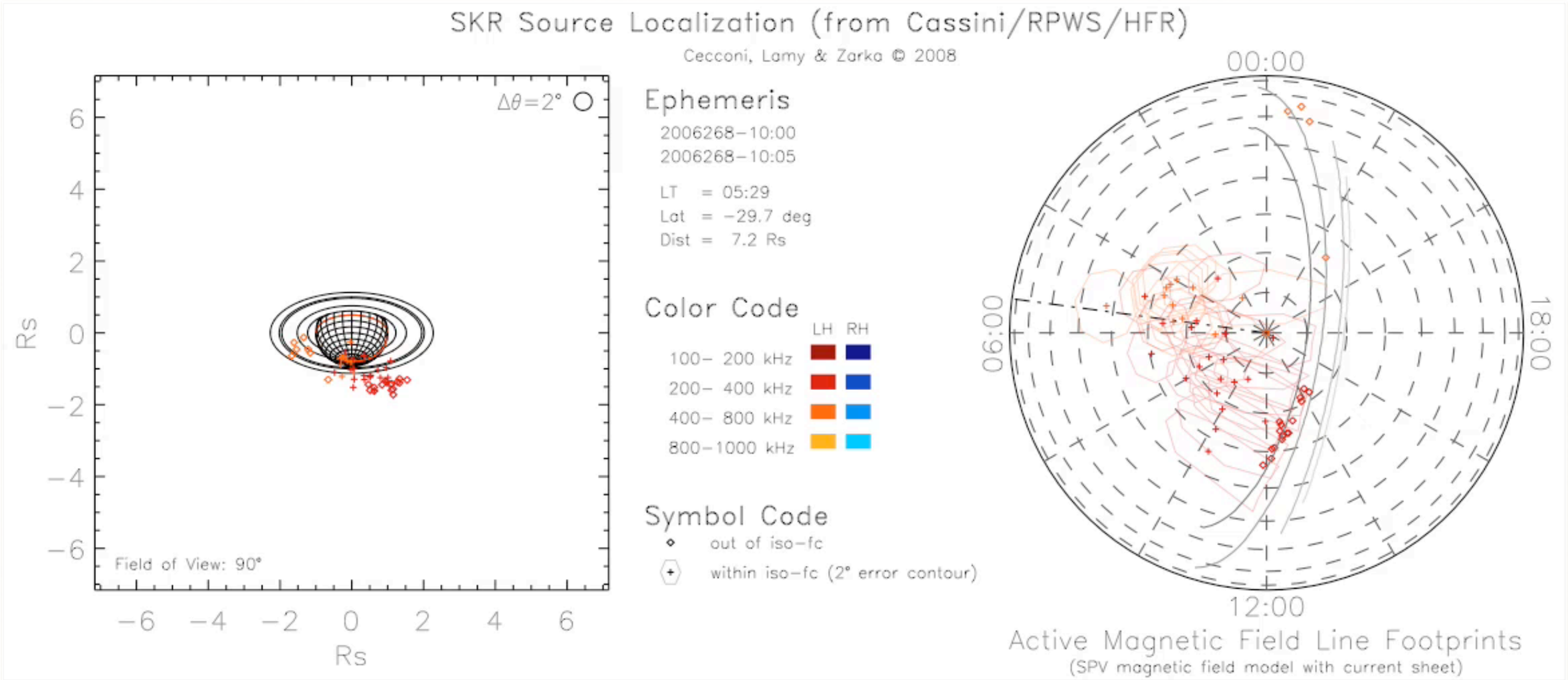


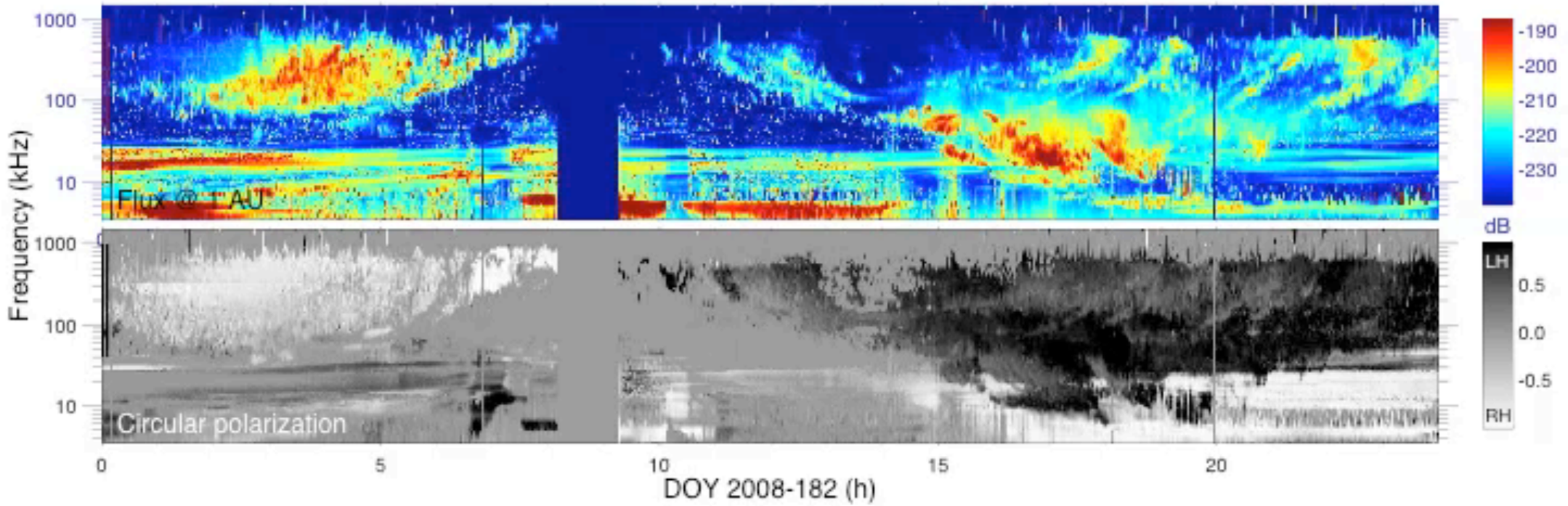
Dynamic spectrum of SKR (Saturn
Cassini/RPWS/HFR.

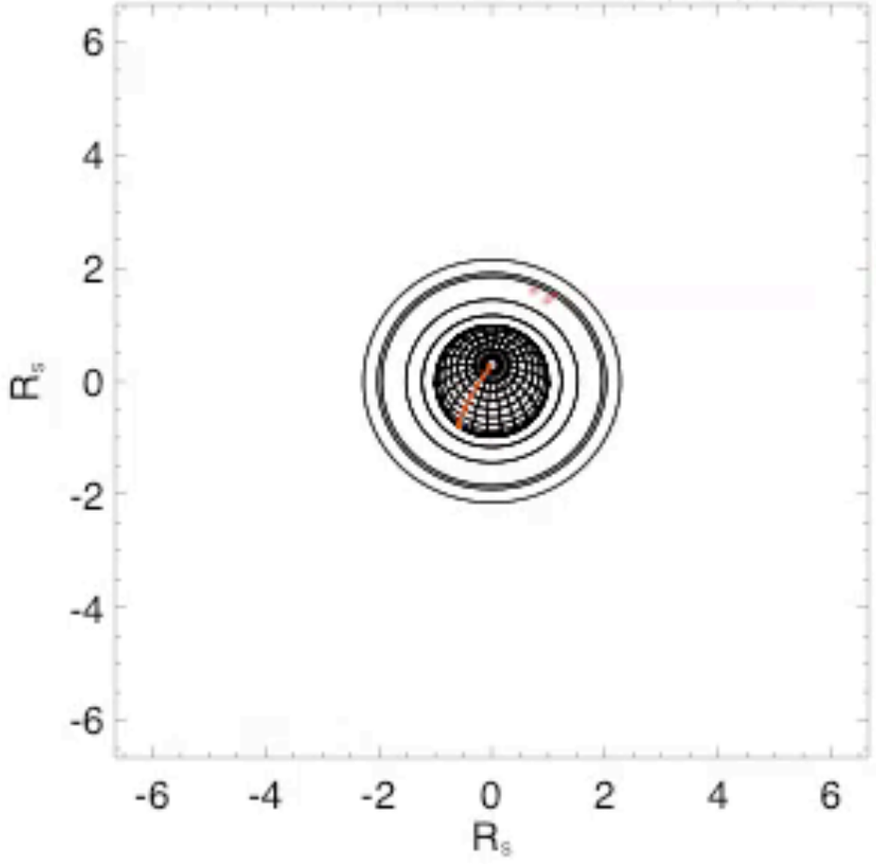
Radio Source Localization



Radio Source Localization







Ephemeris:

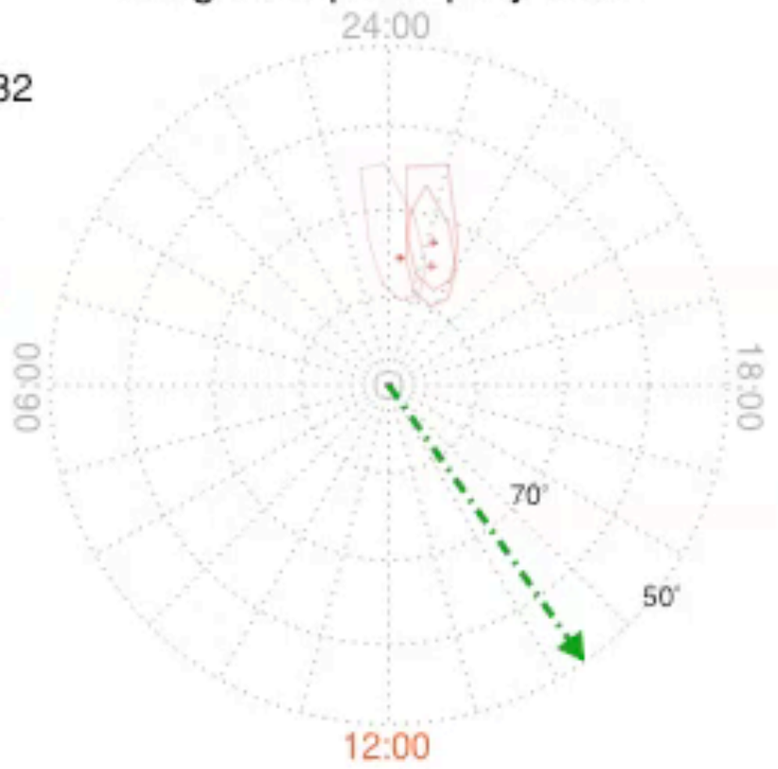
Day : 2008-182

Time : 00:00

$r_{s/c}$ (R_s) = 6.65

$\lambda_{s/c}$ (°) = 71.08

$TL_{s/c}$ = 14:21



Data selection:

δt (min) = 5.0

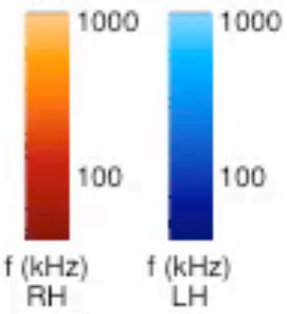
f_{min} (kHz) = 40

f_{max} (kHz) = 1000

V = [0.05,1.10]

$SN_{\lambda,z}$ (dB) ≥ 20

β (°) ≥ 0.



Cassini Goniopolarimetric Results:

a preview of EJSM capabilities

Goniopolarimetry

- wave polarization
- radio source localization
- beaming properties

- better diagnostics for auroral sources: JUNO will provide the ultimate magnetic Jovian magnetic field model.

- possibly improved diagnostic if MLA selected