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Rodos

ERG project: Exploration of the inner magnetosphere

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ERG project group

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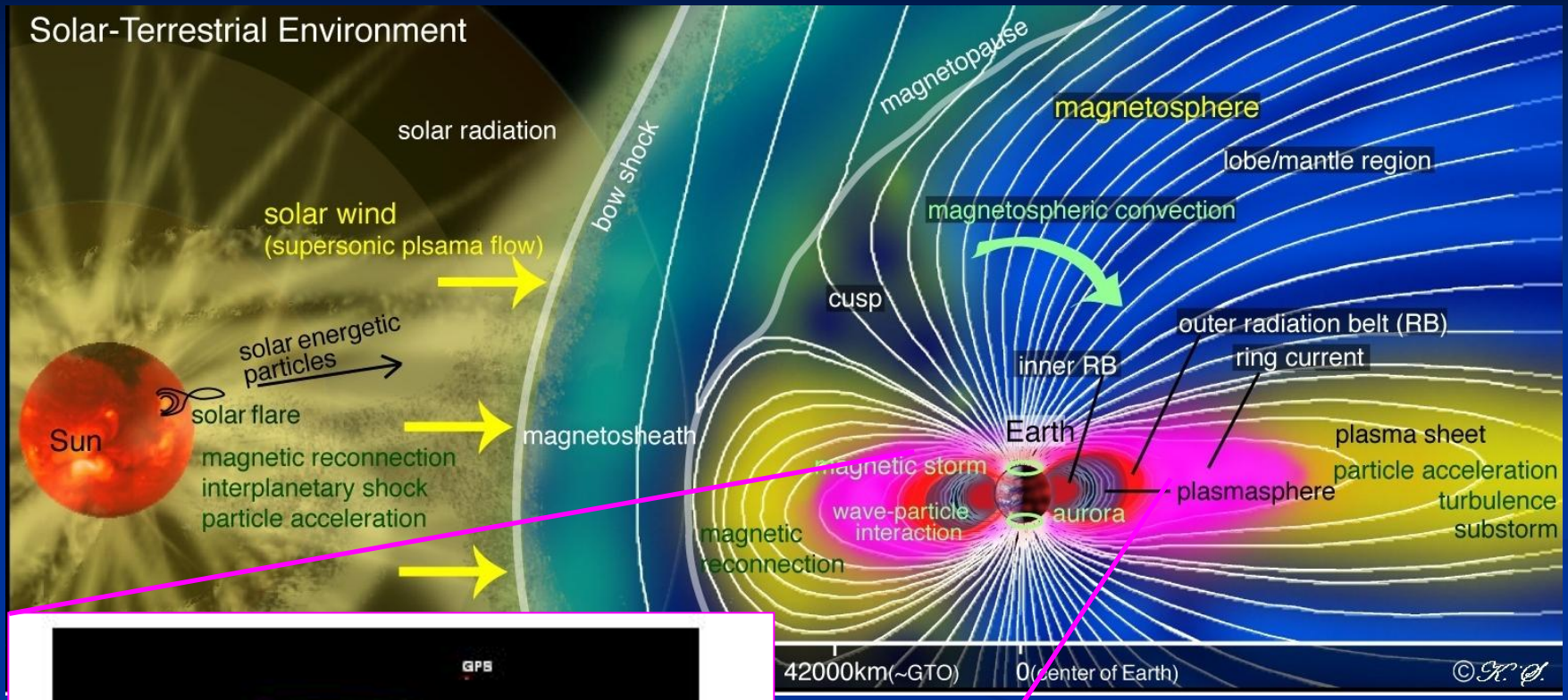
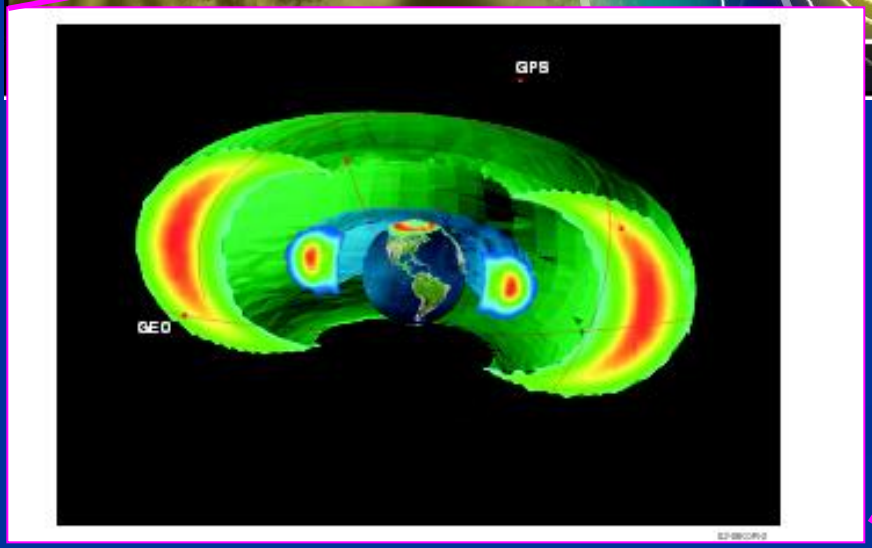
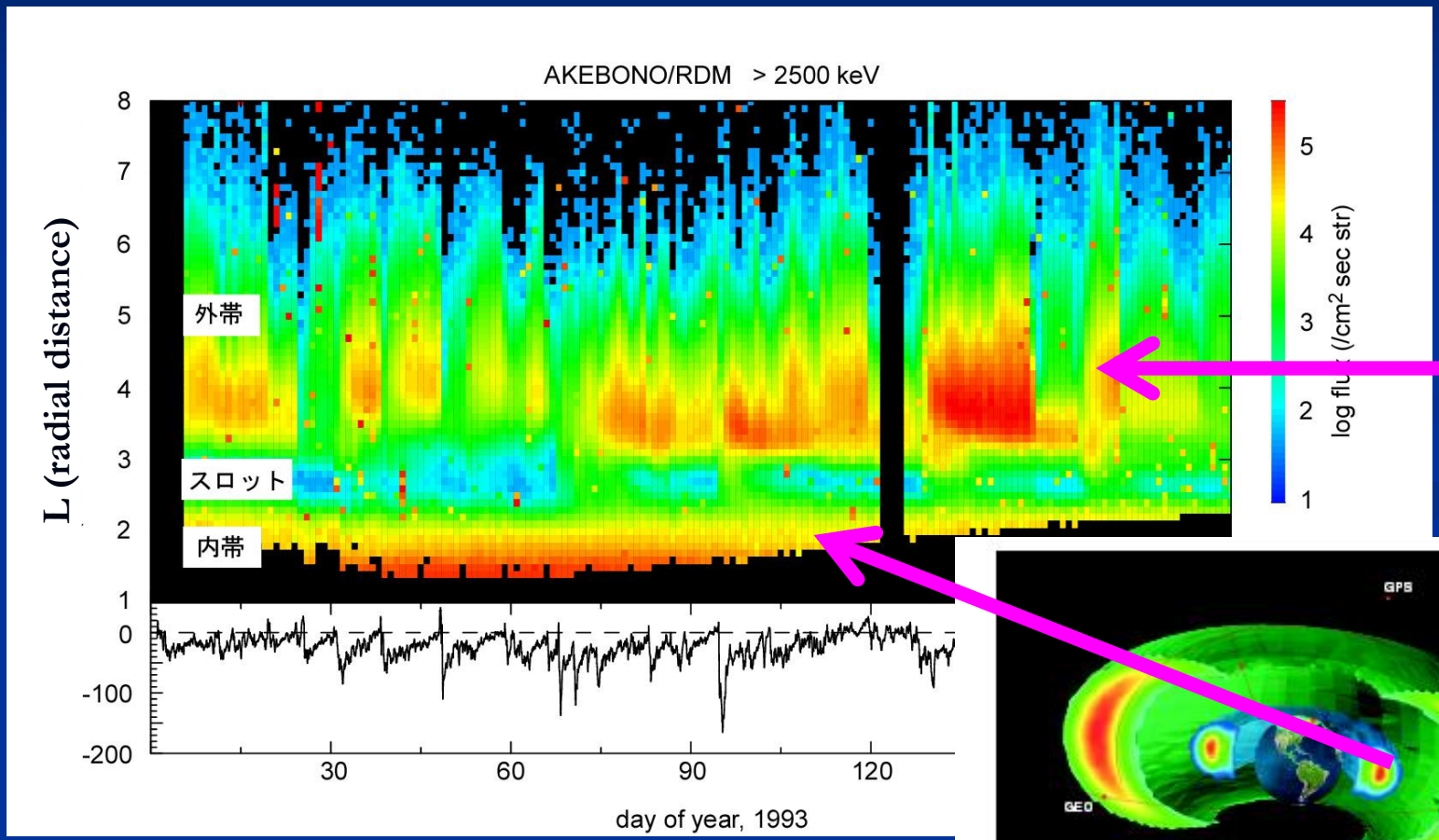
(3) Tohoku University, (4) RISH, Kyoto University

1. Introduction ・・・
Geospace





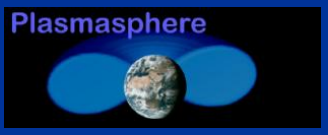
Dynamical evolution of the radiation belts



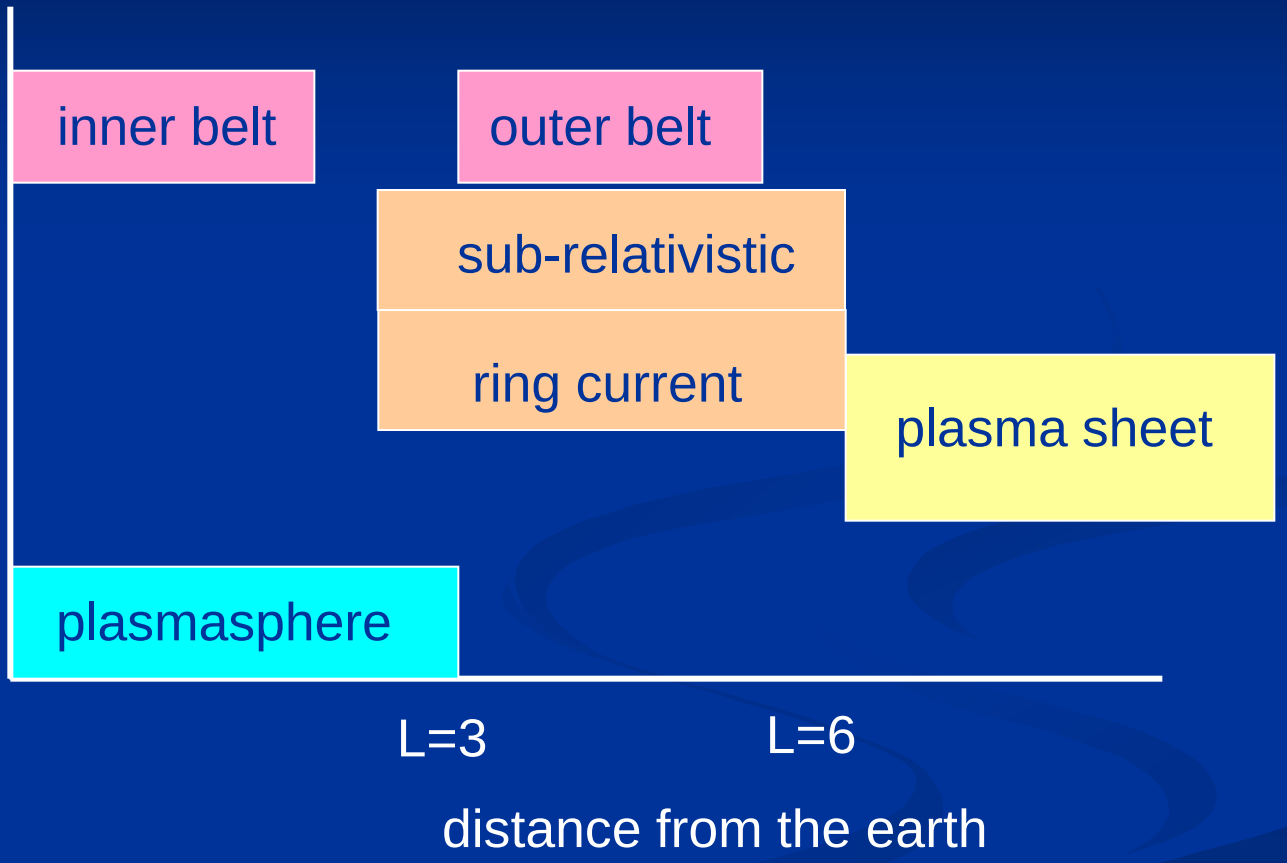
Particles in the inner magnetosphere

relativistic
(～ MeV)

hot
(～ 100 keV)



thermal
(～eV)

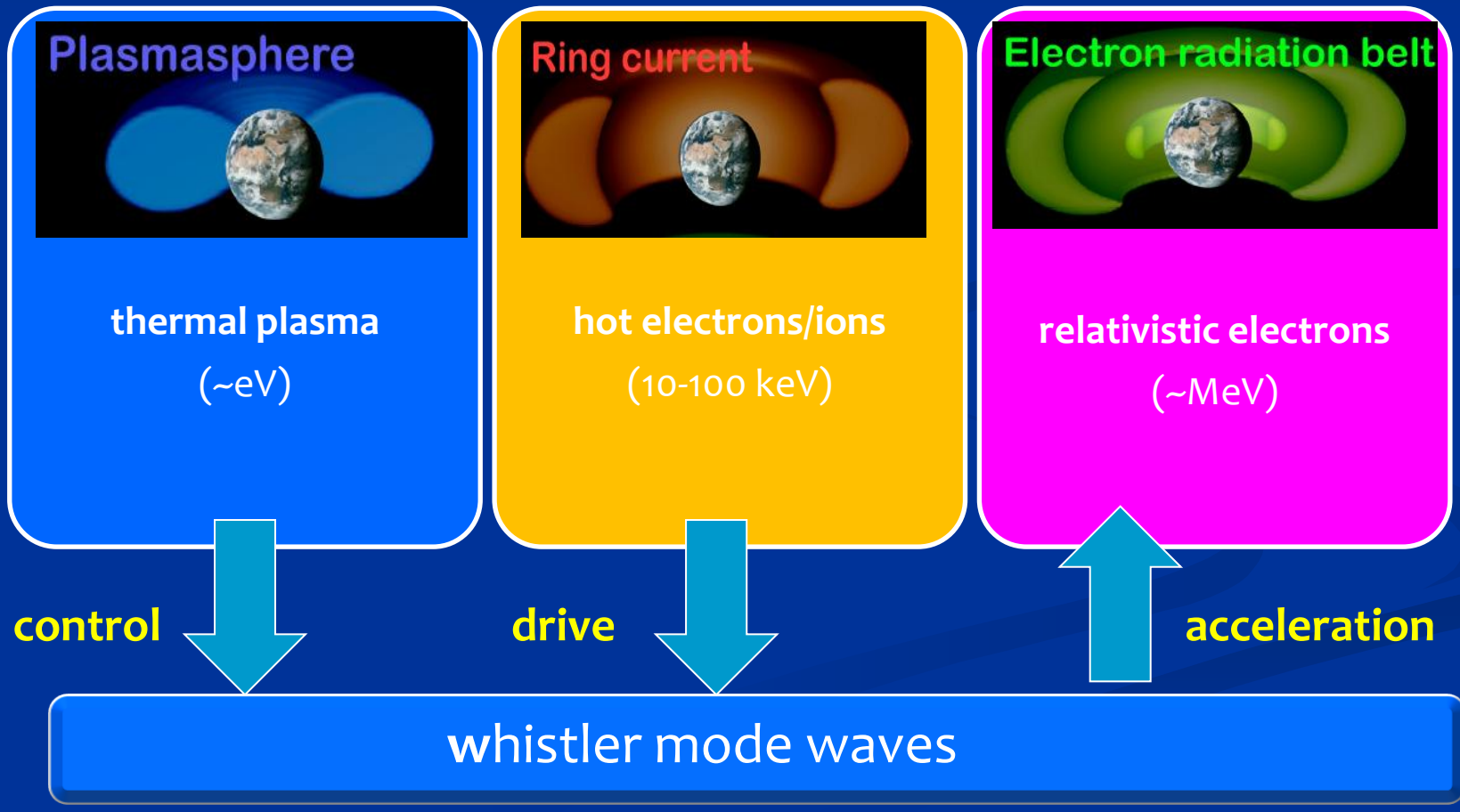


In the inner magnetosphere, widely differing energies over 6 orders coexist same region.

Cross-energy coupling

Interplay of thermal/hot plasma for MeV electron accelerations

- whistler plasma waves act as a mediating agent
  transfer from energy of ring current population to more energetic populations.
- cross-energy coupling via plasma waves is a key concept
  widely different energies from eV to MeV are dynamically coupled via wave-particle interactions



2. The *ERG* project

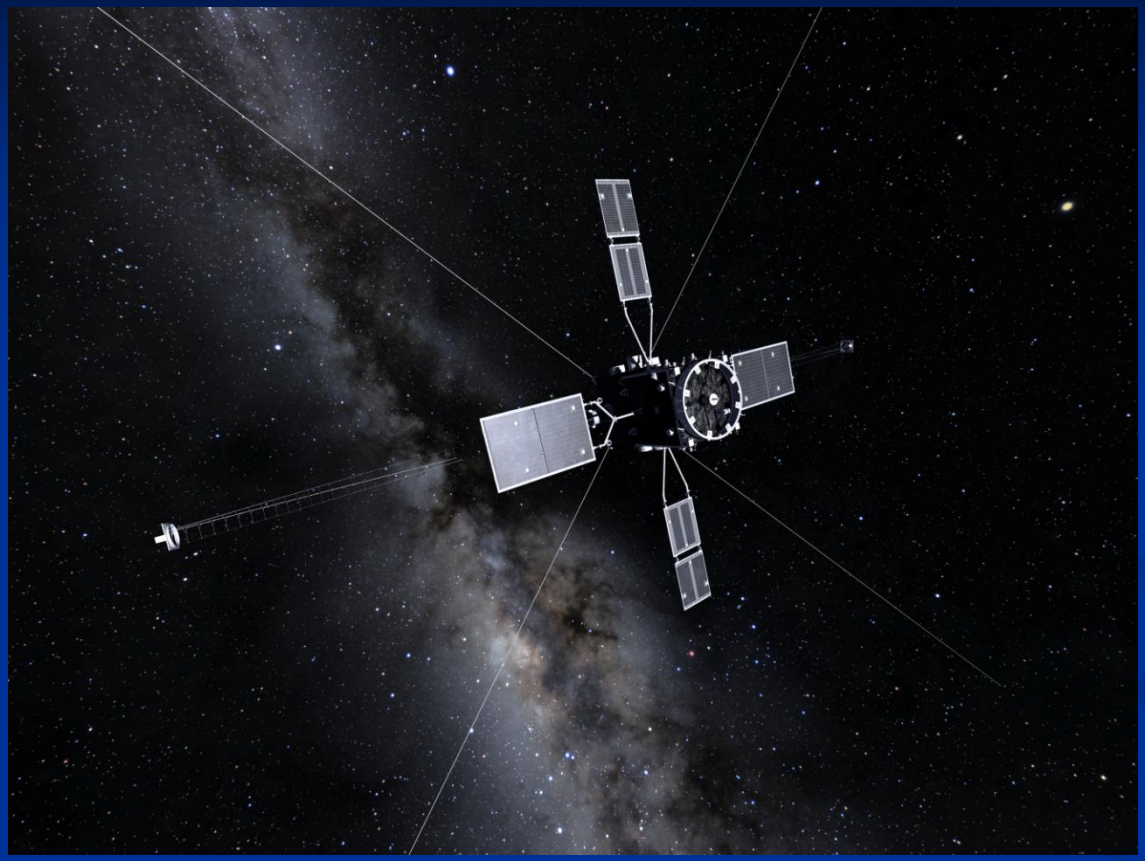
Target 1: Dynamics of the radiation belts
particle acceleration, transportation and loss

Target 2: Dynamics of the geospace storms
ring current and electro-magnetic field variation associated with M-I coupling

Target 3: Dynamics of the plasmasphere

Contribution to understanding of
Space Weahter/Space Radiation Environment

ERG satellite (ISAS/JAXA)

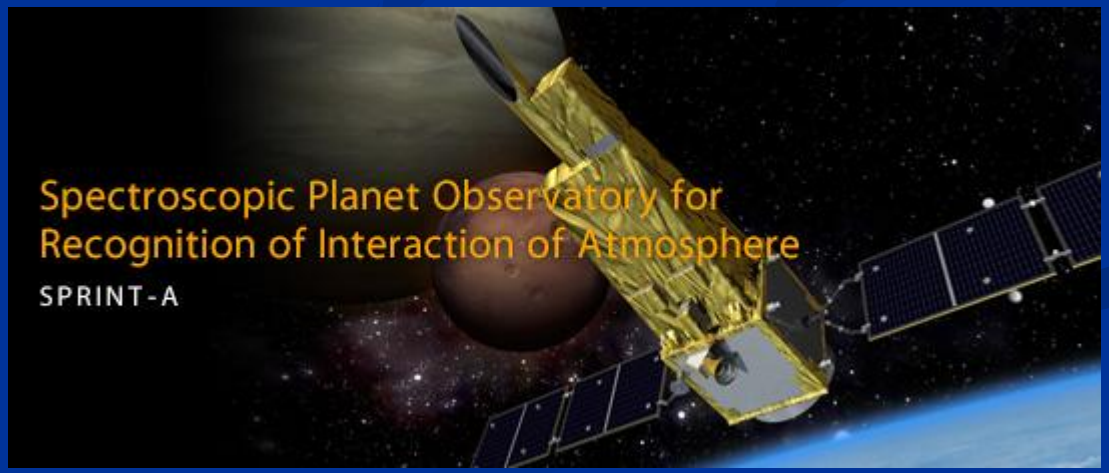


- apogee geocentric distance : 5.5 Re
- perigee altitude: 300 km
- inclination angle: 31 deg (Lmax ~ 9)
- initial apogee MLT: 09:00
- spin period: 8 sec
- planned launch date: FY 2015
- nominal mission life: > 1yr

First launch of the Epsilon launch vehicle on September 13, 2013.

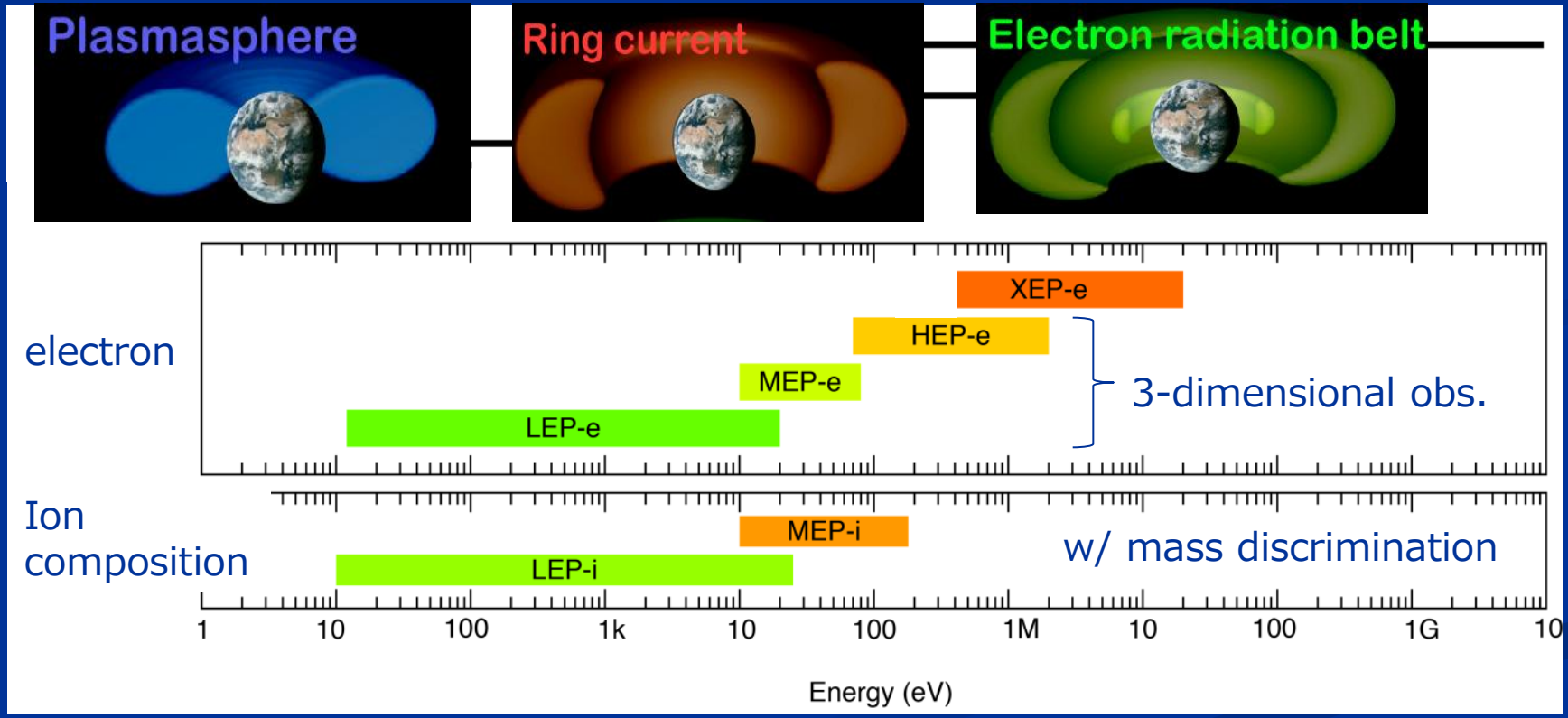
- Hisaki [Spectroscopic Planet Observatory] was successfully launched Epsilon that is newly developed solid rocket on Sep. 13, 2013.

- ERG is the second satellite to be launched by Epsilon.



ERG : plasma & particles

PPE: Plasma and Particle Experiment Suite



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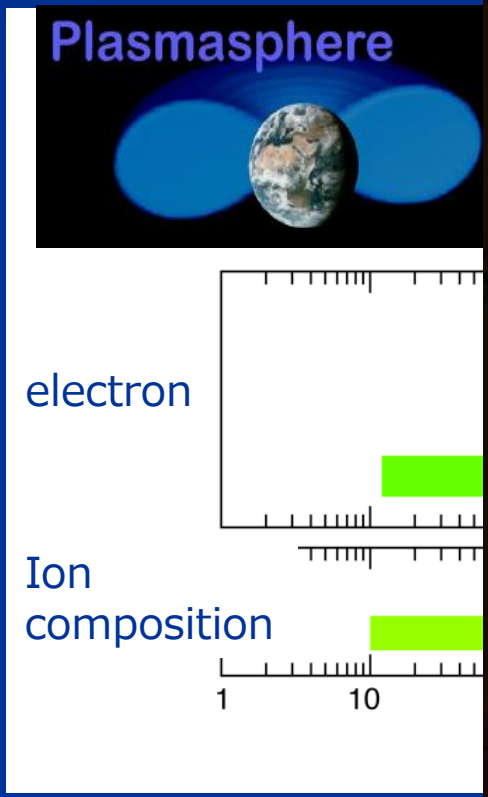
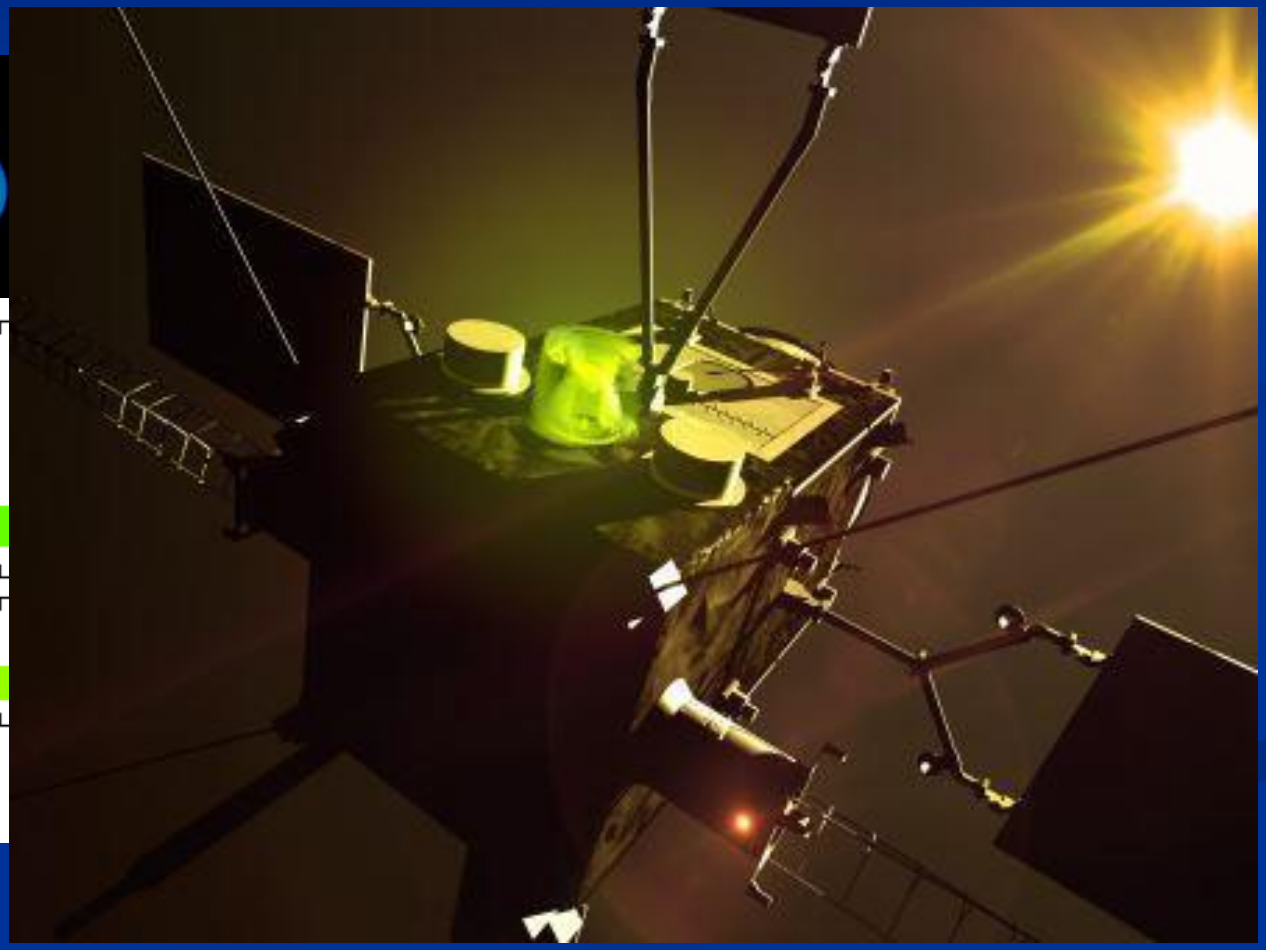
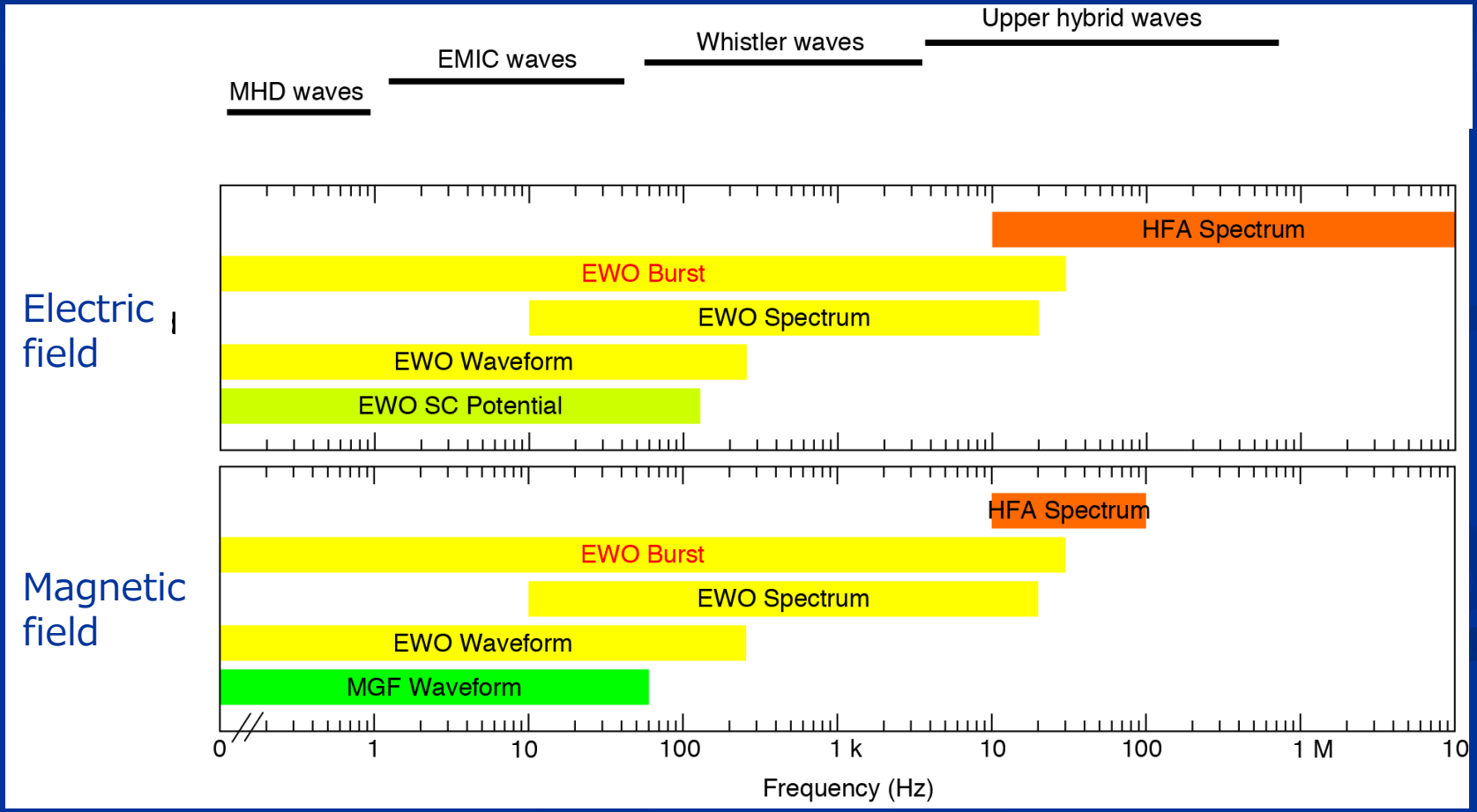




ERG: Field and Waves

PWE: Plasma Wave and Electric Field Experiment
MGF: Magnetic Field measurement



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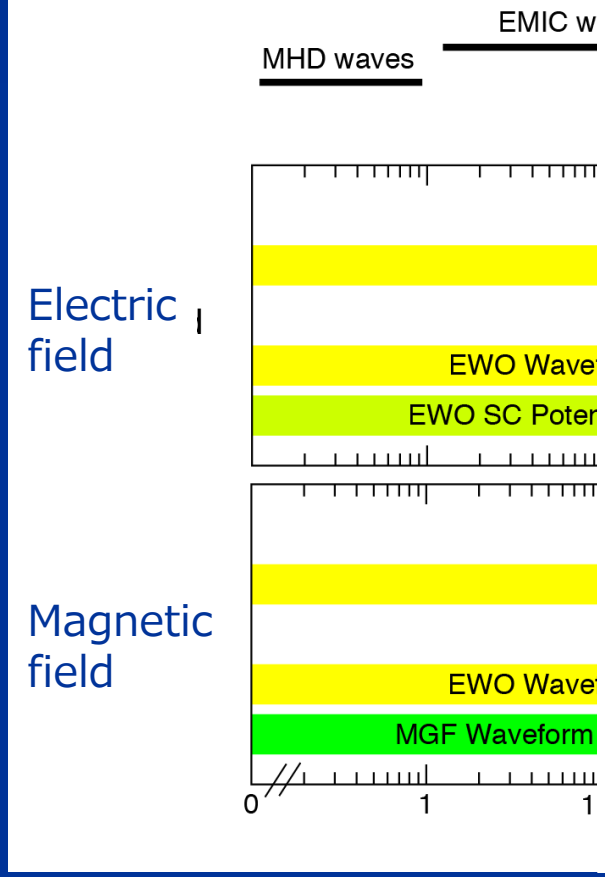
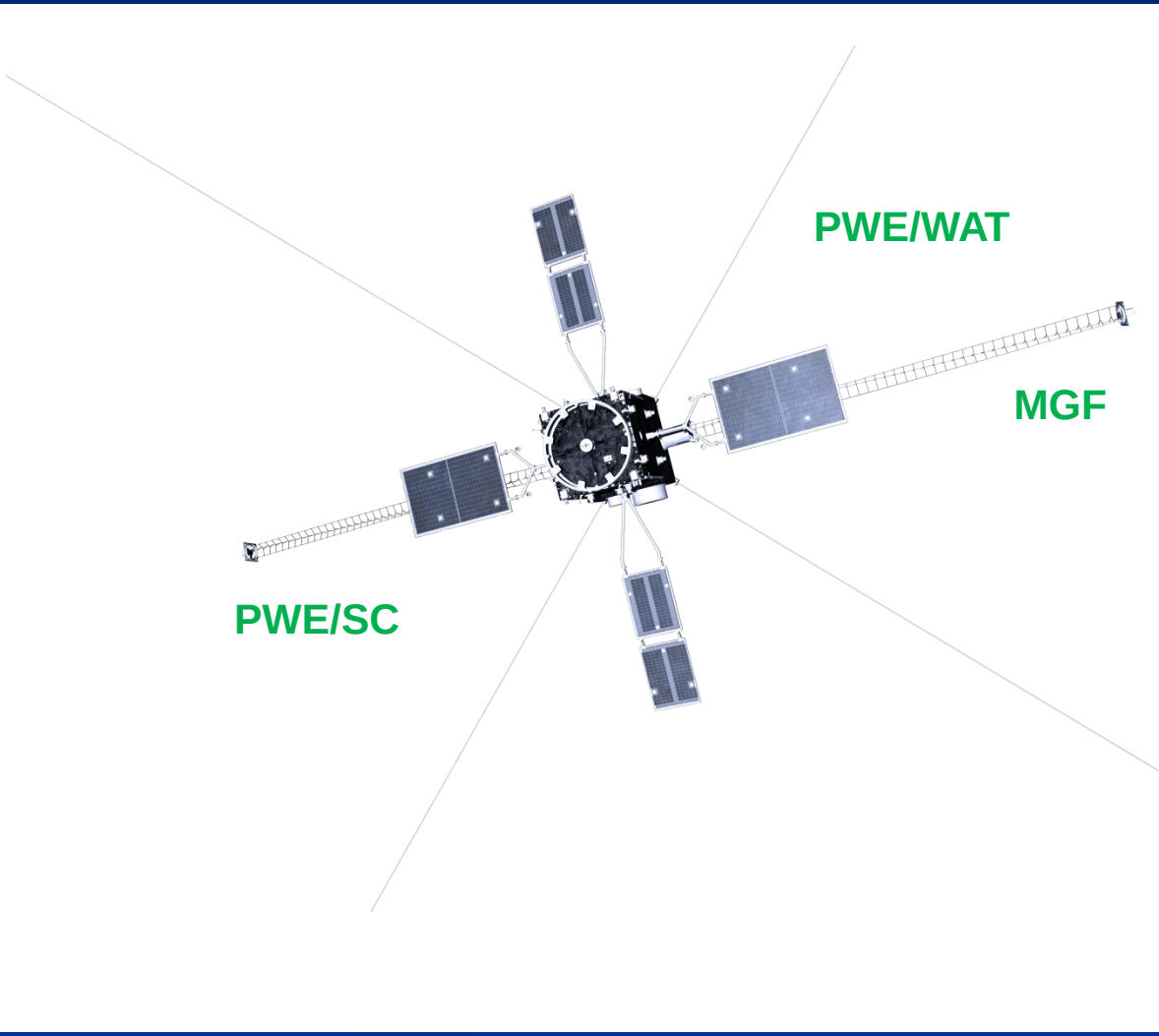
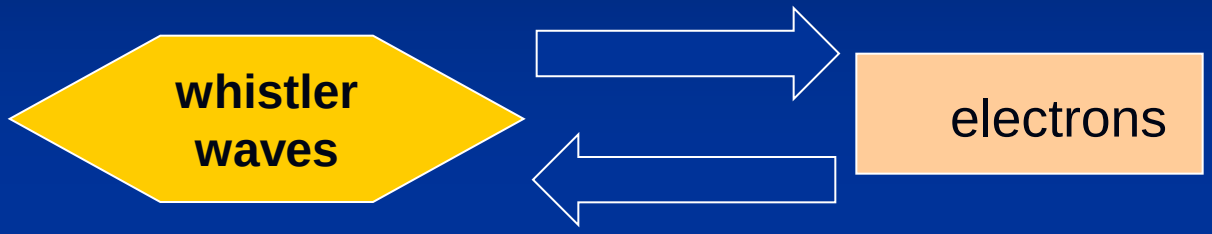




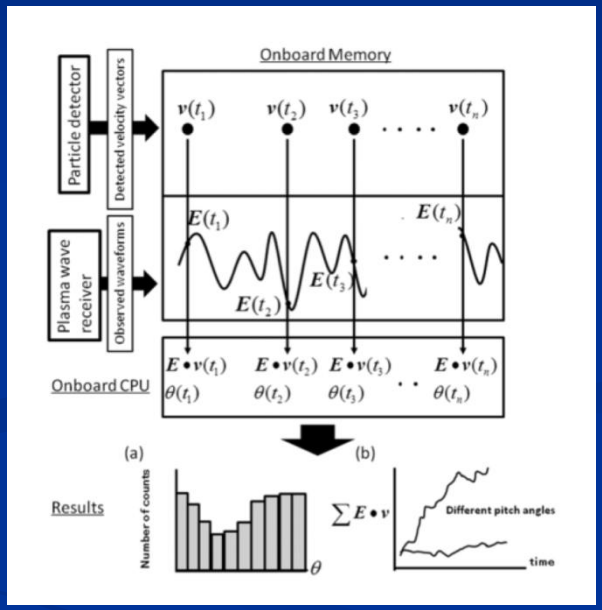
Wave-Particle Interaction Analyzer

S-WPIA: Software-type Wave Particle Interaction Analyzer

Direct measurement of energy transfer between whistler waves and electrons is essential to understand wave-particle interactions.



$$\frac{dK}{dt} = qE \cdot v = |E||v|\sin\theta$$



Phase difference θ determines the direction of energy transfer.
(Electrons generate waves or Waves accelerate electrons)

ERG-satellite will directly measure the energy transfer between whistler waves and electrons in space for the first time.

Attitude determination

For determination of satellite attitude,

- Sun sensor (SSAS)
- Star scanner (SSC)
- Attitude magnetometer (GAS)

will be onboard ERG.

Accuracy of derived satellite attitude is expected to be better than 0.5deg when both SSAS and SSC are available.

Mission Status & Schedule

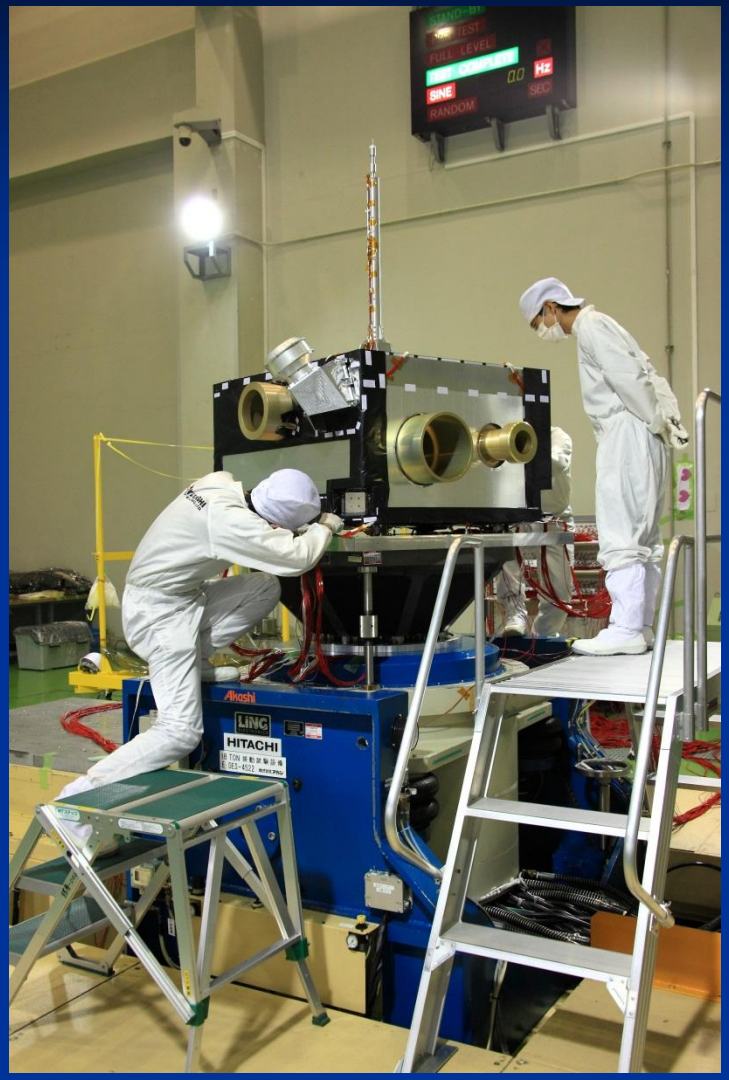
FY 2009 - Mission Definition Review.
System Requirement Review.

FY 2011 - System Definition Review

FY 2012 - Preliminary Design Review

FY 2013 - Critical Design Review

Development of Engineering Model



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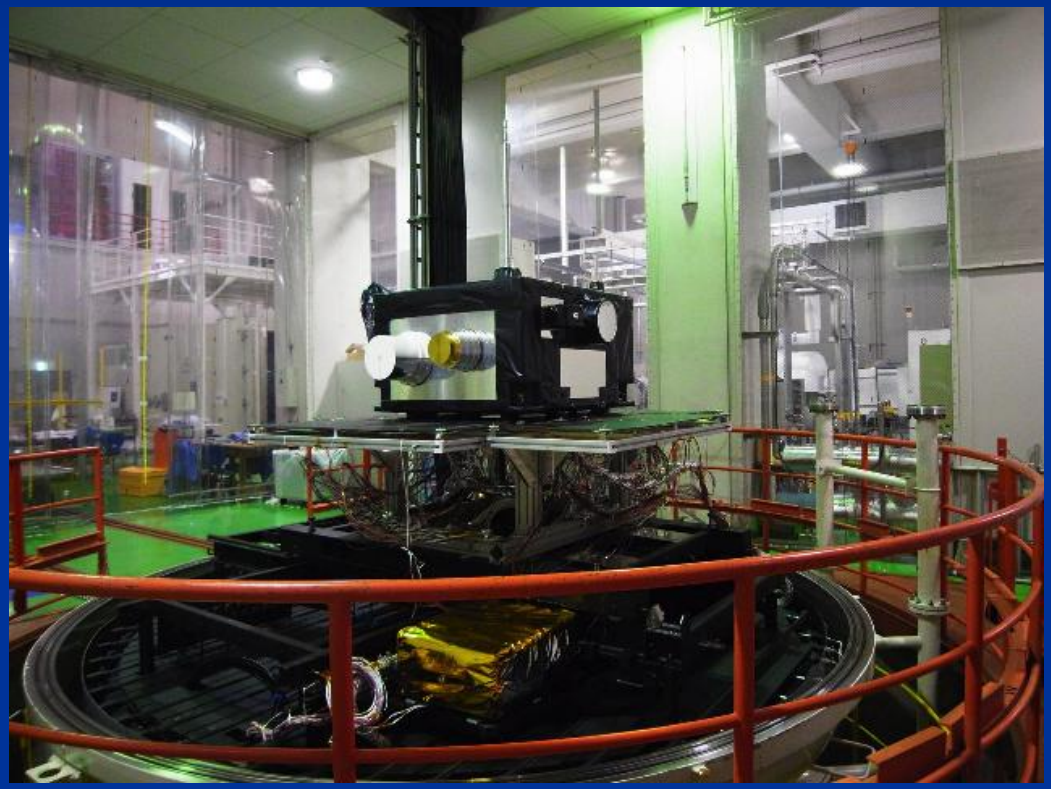

Mission Status & Schedule

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CDR was successfully finished !
Development of the flight model has started.

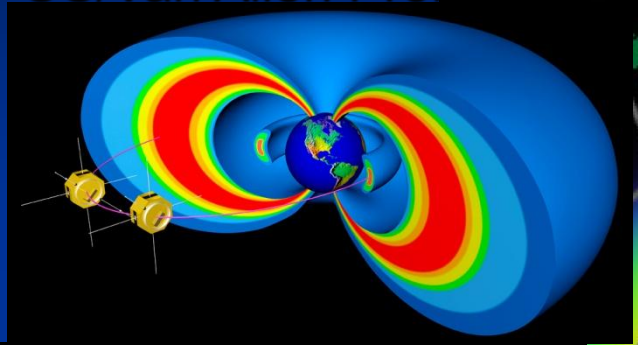
FY 2014-2015 - Development of the flight model

FY 2015 - Launch of the satellite

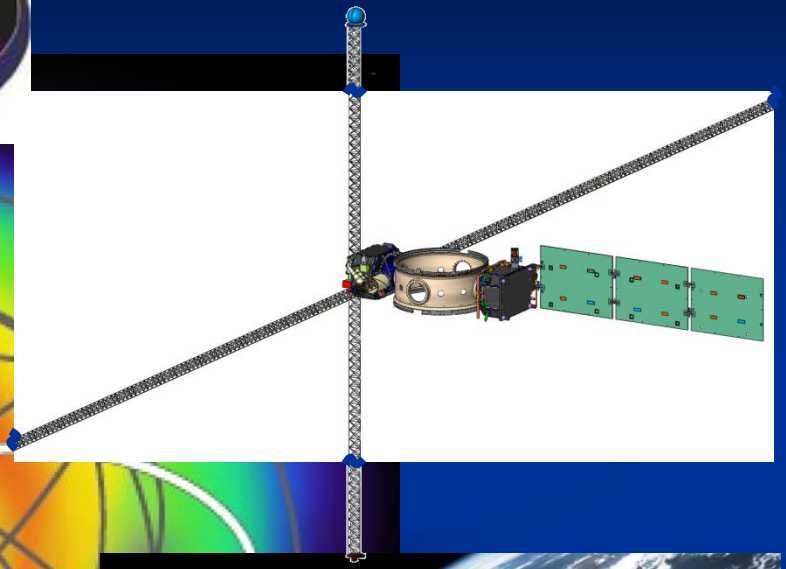
3. International Collaboration: A golden era for geospace

US/THEMIS

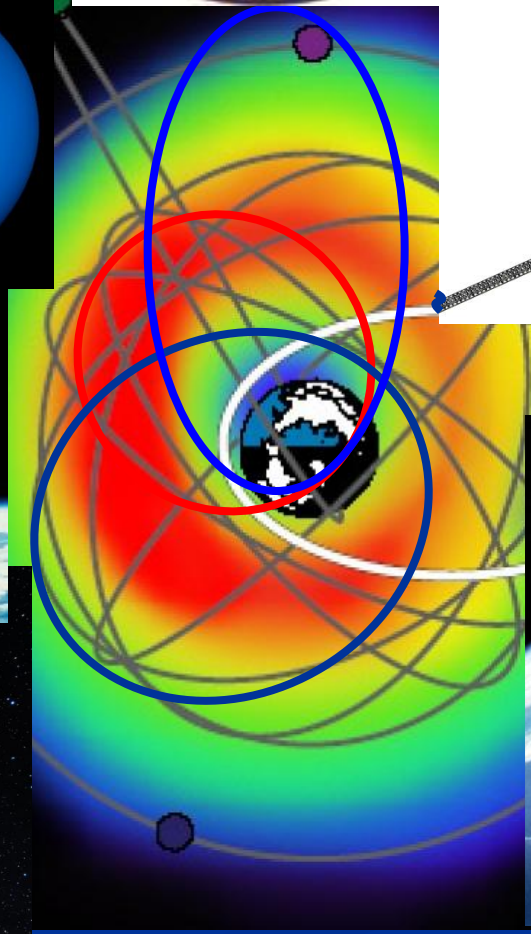
US/Van Allen Probes

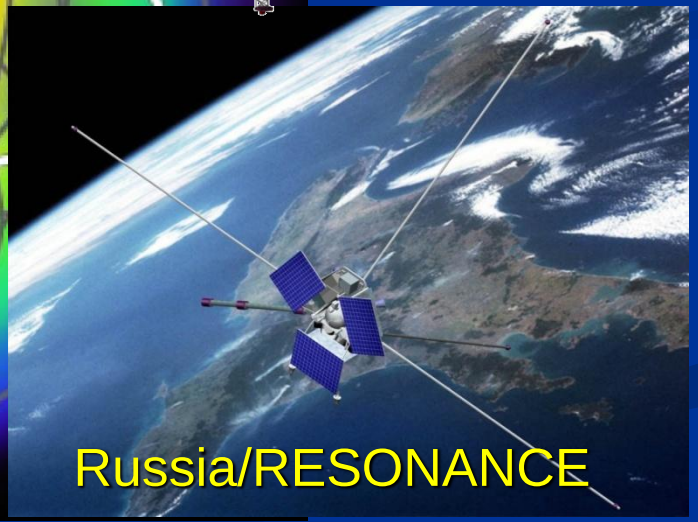


US/DSX



Japan/Geotail





Low-altitude satellites
Ground-based observations

4. Concluding Remarks

- The development of ***ERG*** satellite is now going.
  The planned launch will be FY 2015.
  SSC (star scanner) will be onboard the satellite.

- The ground network observations/integrated studies/science center have started their activity.

- International collaborations ; satellite, ground-based observations, analysis/simulations are very essential during this golden era for geospace studies..

- Real-time data from the satellite are sometimes available, and we would like to know who are interested in.