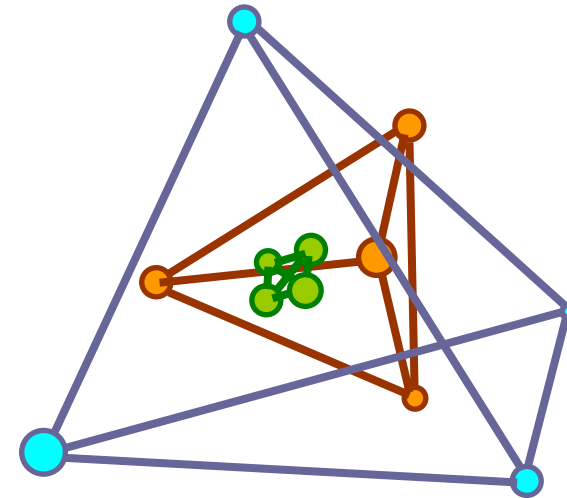


Cross-Scale

the mission formerly known as M³

The Cross-Scale team

- S. Barabash, W. Baumjohann, L. Blomberg, K.-H. Glassmeier, T. Horbury, H. Koskinen, P. Louarn, R. Nakamura, C. Owen, T. Pulkkinen, A. Roux, J-A. Sauvaud, S. Schwartz, K. Svenes, A. Vaivads



Cross-Scale will study

- Multi-scale, 3D plasma dynamics
- Fundamental plasma processes responsible for energy release and particle acceleration throughout the Universe

Plasmas throughout the Universe

Several key plasma phenomena:

- Reconnection
- Shocks
- Turbulence
- Particle acceleration
- Wave-particle interactions

All of these processes are:

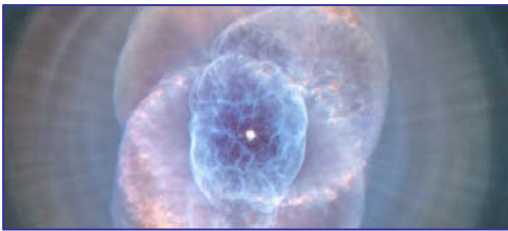
- Variable on several scales
- Fundamentally 3D
- Time-varying
- Poorly understood



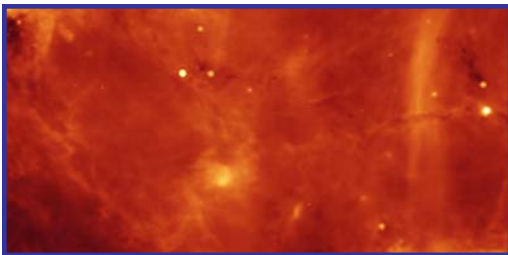
Collisionless plasma physics: key phenomena



- **Reconnection**
 - Steady vs pulsed
 - Time scales



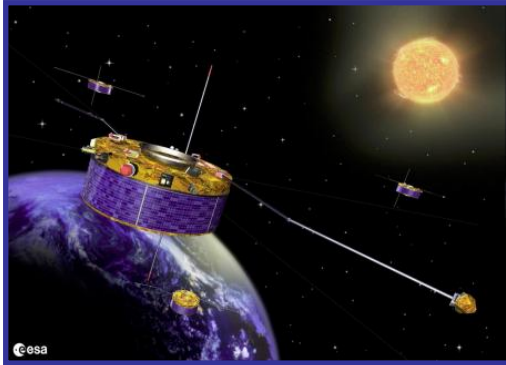
- **Shocks**
 - Particle injection and acceleration
 - Reformation and internal structure



- **Turbulence**
 - Heating
 - Anisotropy and particle transport

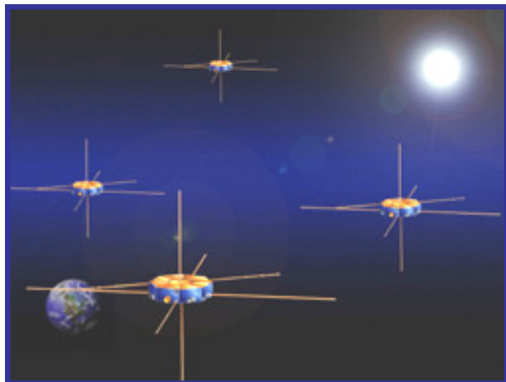
- All of these questions involve **multi-scale, 3D, time-varying** plasmas!

Related missions



Cluster

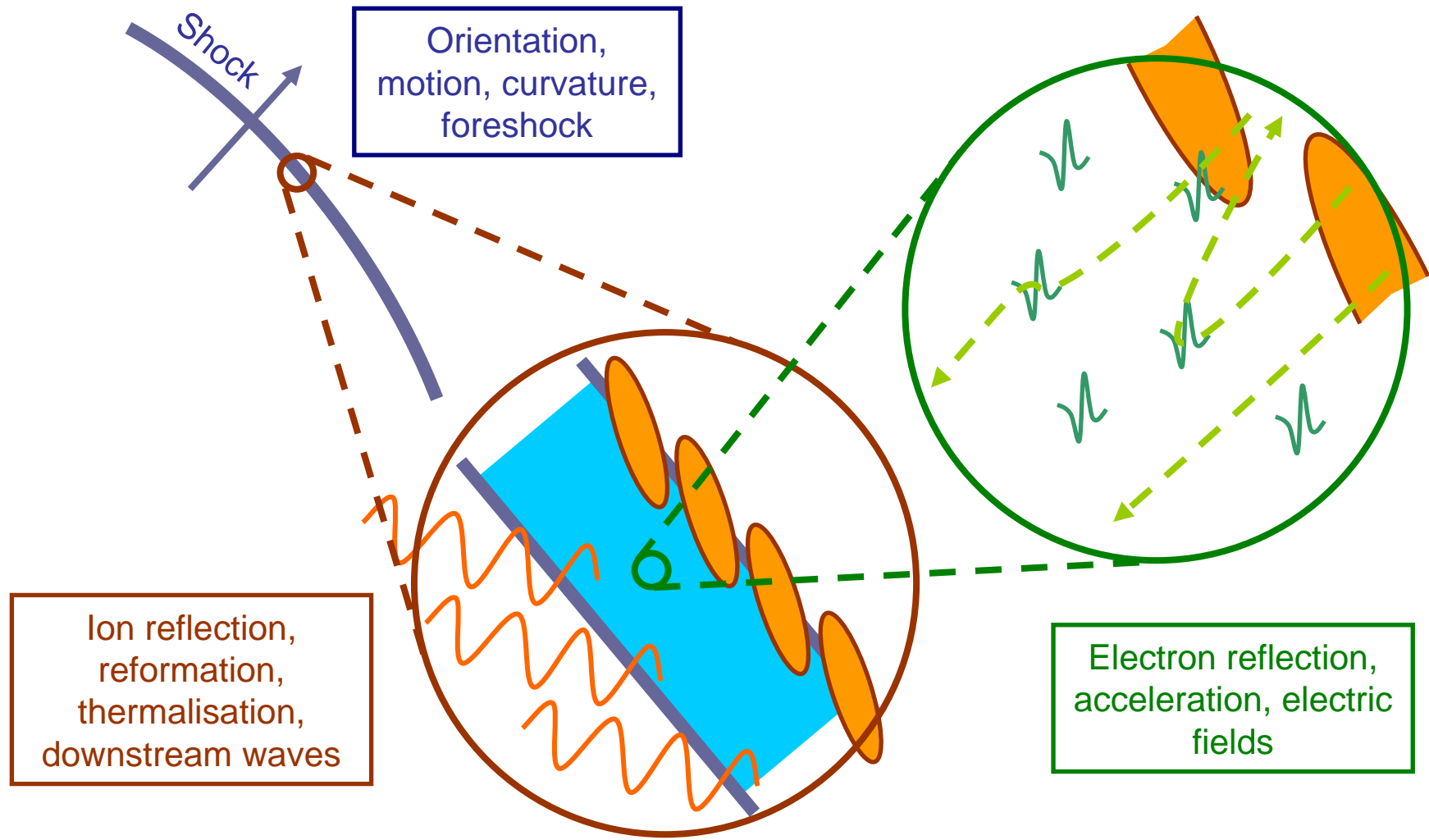
- First 3D plasma measurements
- Multiple scales, but only one scale at a time
- Limited access to electron scales, both time resolution and spatial separation
- Multi-scale extension can't measure in 3D
- Mission end ~2010



MMS

- Access to electron scales in 3D
- Only one scale at a time
- Launch 2013

Three scales of plasmas – shocks as an example



Cross-Scale – the three scales

Electron scale (~10km)

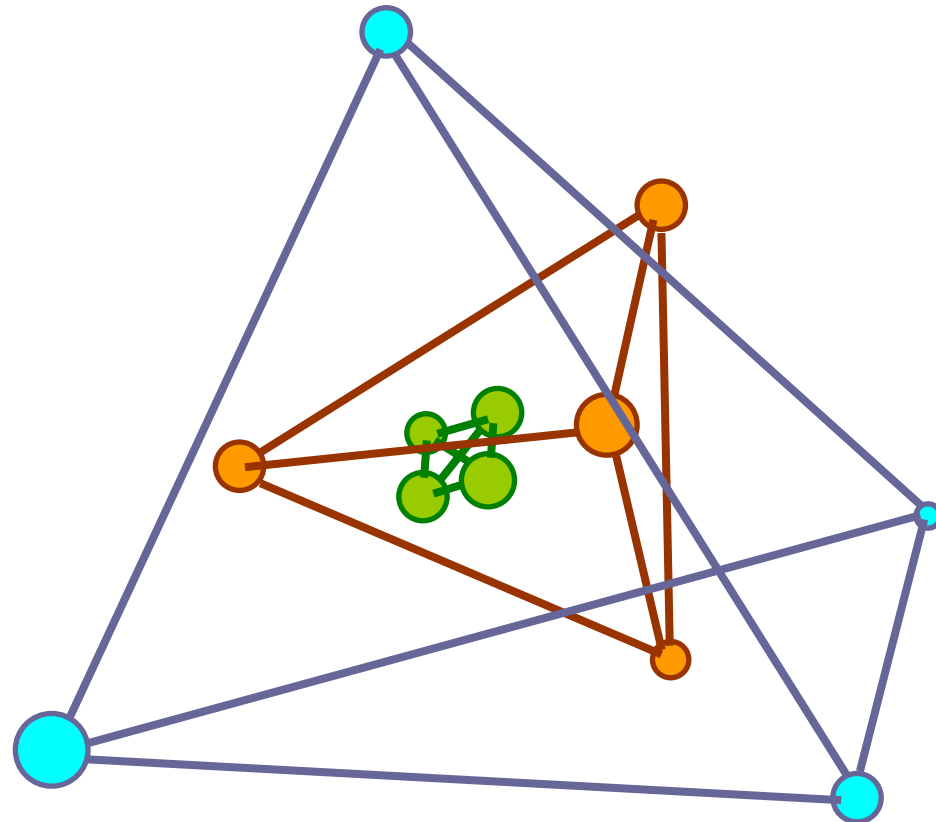
- Fast electron data
- 3D electric field

Ion (~500km)

- Fast ion data
- Composition

Fluid (~2000km)

- Energetic particles
- Composition



The ESA context



- Cosmic Vision 2015-2025
- Relative to other CV mission concepts, Cross-Scale is:
 - **Cheap**: <€300M, baseline of single Soyuz-Fregat launch
 - **Quick**: early in programme - by 2015?
 - **Easy**: no technological show-stoppers
- Potential for international collaboration: JAXA
 - **SCOPE**: 5-s/c mission for cross-scale plasma dynamics
 - Led by M. Fujimoto
 - More information in next talk

Summary

- Compelling science concept
 - Multi-scale plasma dynamics
- Possibility to fly within Cosmic Vision 2015-2025 programme
- Mission has many variables
 - Not fully defined at this stage
 - Compromises will have to be made
- Team is working towards a science requirements document
 - Draft available soon
- Challenge to the community
 - Need to work quickly to define mission
- We welcome all comments and suggestions

