Future European Magnetospheric Missions

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What do we know?

- Space plasma dynamics involves and is different on different scales: global scale, fluid scale, ion scale, electron scale
- Example: magnetotail reconnection involves 4 scales

[Diagram showing global & fluid scale and ion & electron scale]
Where are we?

- Geotail, Polar and others traversed fluid and ion scale
- Cluster tetrahedron measured on fluid and ion scale
- Cluster and Double Star together get glimpse on global scale
What’s next?

- Two NASA missions with large European contributions will probe the two remaining scales
  - THEMIS (launch 2006) will probe global (and fluid) scale
  - MMS (launch 2013) will probe electron (and ion) scale
Anything else?

- Observe other parameter regimes in other magnetospheres
  - VEX (ESA 2005):
    plasma–neutral interaction
  - BC (ESA/JAXA 2012):
    small m’sphere w/o ionosphere
  - JME (ESA? 2018?):
    rotation–dominated m’sphere
- Yes, something important: dynamics on different scales couple
- Example: collisionless shocks involve 3 scales

- Need to observe different scales simultaneously
- Cross-Scale (ESA/JAXA? 2015?) 10+ spacecraft for 3 scales