Proposal Title: NITRO

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The NITRO mission aims at studying the distribution, budget, dynamics and escape rate of nitrogen around the Earth, by monitoring magnetospheric nitrogen ions and exospheric nitrogen and by distinguishing N^+ from O^+ in the inner magnetosphere, polar cap, and just above the ionosphere, in order to analyse the history of the nitrogen abundances of Earth and Mars. The baseline configuration consists of two spacecraft (S/C). One S/C is for in situ plasma measurements in the magnetosphere. The other S/C is for optical measurements of line-of-sight integrated emissions from the magnetospheric plasma and monitoring of plasma and neutral conditions just above the ionosphere and the exosphere.

Since the measurements of the nitrogen budget of the Earth's exosphere and magnetosphere and the determination of the escape rate have not been done so far, apart from some occasional measurements by previous magnetospheric spacecraft, the mission would provide novel data. NITRO should allow for the first time detailed nitrogen atom and ion measurements in the near-Earth environment and could potentially determine the nitrogen escape rate in comparison with that of oxygen and its dependence on solar activity. This would represent a substantial advance of our knowledge of the magnetospheric/ionospheric/exospheric processes and could provide some valuable input into considerations of the evolution of planetary atmospheres.

A main problem for the potential scientific achievements of NITRO is that the proposed two S/C mission cannot be implemented within the M4 constraints. With the one S/C option, i.e. the in-situ spacecraft in an elliptical orbit, the scientific return of the mission is severely reduced. This option would lead to a significant loss of information, in particular with respect to the remote and in-situ sensing of the nitrogen escape from the ionosphere, and the advantage of the simultaneous measurements and in-situ tracing of the ions in the magnetosphere would be missed.

Although NITRO could obtain some interesting results on the exosphere, transport inside the magnetosphere, and nitrogen escape, the wider impact on planetology appears to be low.