# Micro-ARES, the Electric Field Sensor for ExoMars 2016: Atmospheric Interaction Simulations

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## Abstract

Since 2011, LATMOS has been involved in the development of Micro-ARES, an electric field sensor forming part of the DREAMS science payload of the ExoMars 2016 Schiaparelli entry, descent and landing demonstrator module (EDM). Micro-ARES is dedicated to the very first measurement and characterization of Martian atmospheric electricity.

The instrument, a compact version of the ARES instrument for the former ExoMars Humboldt payload [1], is composed of an electronic board, with an amplification line and a real-time data processing Digital Signal Processor. It uses the principle of a relaxation probe [2][3][4] which measures the potential difference between the spherical electrode (located at the top of a 27-cm high antenna) that adjusts itself to the local atmospheric potential, and the lander structure, connected to the ground.

Since the antenna is located roughly in the middle of the aluminium-covered lander structure (Figure 1), the proper data processing and interpretation depends strongly on reliable modeling of the field lines' deformation around the lander and instrument antenna.

To first order, the model is expected to simulate the field lines' deformation to allow accurate potential measurement at the electrode's height in an unperturbed environment.

Those simulations were first performed with the COMSOL AC/DC package, and completed with plasma and particle tracing for charged dust effects simulation. The next step is to simulate the antenna coupling with the atmosphere, as well as the lander-ground coupling with both the soil and atmosphere [2], in order to retrieve the most realistic potential at the electrode's height in an unperturbed environment.

The simulations will include the instrument input electronic circuit to take the input current at the electrode into account, as well as an instrument program mimic in order to properly reproduce the instrument behavior over time.

Once validated, the base model will be run successively with a large set of input parameters such as atmospheric conductivity, electric fields profiles over time, lander position, etc. The final set of results will have to be large enough to enable an optimization of those input parameters over the experimental data, in order to retrieve the key scientific parameters which are the atmospheric

conductivity and electric field.

## Reference


[1] J.J. Berthelier (2000) PSS 48 p. 1193-1200

[2] G. Molina-Cuberos (2012) PSS 58 p. 1945-1952

[3] E. Seran (2013) JGR VOL.118 p. 5358-5368

[4] R. Godard (2010) COMSOL Conference 2010 Boston


## Figures used in the abstract

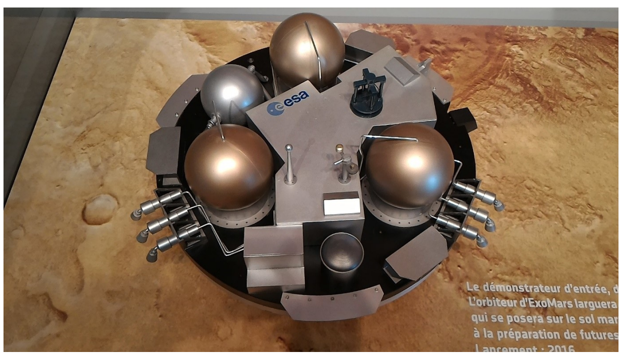

**Figure 1**

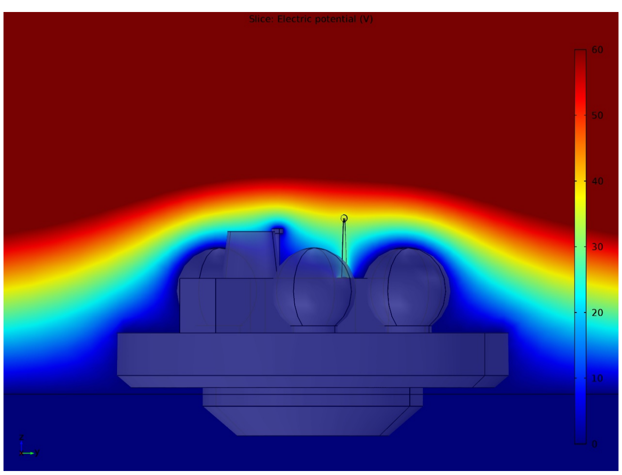


**Figure 2**