The Martian Atmospheric Electrical Environment

Karen Aplin[1]

[1] Space Science and Technology Dept. Rutherford Appleton Lab

Mars is expected to have an electrically active atmosphere, principally due to the presence of dust storms. Similar to Earth, the dust storms are expected to charge triboelectrically, but, unlike Earth, the breakdown potential of the air is low enough for discharges to occur within the dust storms. Away from dust storms, Mars is expected to have a surface air conductivity that is comparable to the terrestrial stratospheric conductivity (˜1pSm-1). The Martian atmosphere is more conductive than the terrestrial atmosphere at the same height, because the atmospheric chemistry permits mobile free electrons to exist. Additionally, there is no ozone layer on Mars, which allows photoionisation throughout the entire atmosphere. Although the Martian near-surface atmospheric electrical environment has been simulated in numerous laboratory experiments and in models, no electrical parameters have yet been measured. Several instruments have already been proposed to measure electric fields, dust charging and air conductivity. It is likely that the first Martian atmospheric electrical measurements will be carried out by the Atmospheric Relaxation and Electric field Sensor (ARES) instrument on the European ExoMars mission to be launched in 2017. In this presentation, background knowledge about Martian atmospheric electricity will be reviewed, recent results summarised, and electrical instrumentation intended for Mars described. The Martian global circuit concept, and the measurements needed to confirm or refute its existence will also be discussed.

Author:
Karen Aplin, Rutherford Appleton Laboratory, UK
Franck Montmessin, LATMOS, France
Jean-Jacques Berthelier, LATMOS, France
Michel Hamelin, LATMOS, France
Neil Bowles, University of Oxford, UK
Simon Calcutt, University of Oxford, UK