



Atmospheric electrification in the Solar System

K.L. Aplin

Space Science and Technology Department, Rutherford Appleton Laboratory
(k.l.aplin@rl.ac.uk)

All Solar System planetary atmospheres are slightly electrified by cosmic ray ionisation, and there is lightning on Earth, Jupiter, Saturn, Uranus and Neptune. Electrical discharges may also occur on Mars, Venus and Titan. A comparative approach will be employed to describe the role of electrification in the atmospheres of other planets and their moons. The conditions necessary for a planetary atmospheric electric circuit similar to Earth's, and the likelihood of meeting these conditions in other planetary atmospheres, will be discussed. Atmospheric electrification could be important throughout the solar system, particularly at the outer planets which receive little solar radiation, increasing the relative significance of electrical forces. For example, nucleation onto atmospheric ions has been predicted to affect the evolution and lifetime of haze layers on Titan, Neptune and Triton. Heating from solar radiation dominates the atmospheric circulations of the terrestrial planets. However, Mars may have a global circuit analogous to the terrestrial model, but based on electrical discharges from dust storms. There is an increasing need for direct measurements of planetary atmospheric electrification, in particular on Mars, to assess the risk for future unmanned and manned missions.