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Studies of the near - Mars space: designing post - Mars Express / MGS missions

S. Barabash

Swedish Institute of Space Physics, Kiruna, stas@irf.se (+46-980-79050)

Currently two missions relevant to studies of the near-Mars space, ESA Mars Express and NASA Mars Global Surveyor (MSG), are in operation at Mars. MGS is orbiting Mars since September 1997 and Mars Express since December 2003. At the time of writing this abstract both missions are healthy and has been extended until 2007 (MGS) and 2008 (Mars Express). The Mars Express scientific data analysis is approaching its culmination but already at this stage the perspectives and scientific objectives for the post - Mars Express / MGS aeronomy and solar wind interaction missions can be identified and possible implementation scenarios worked-out. We review the current most important results in the field of Mars - solar wind interaction focusing on Mars Express and identify the limitation of the present data set. We then formulate the key scientific issues to be addressed by the future missions, namely, (1) determination of the bulk (cold, $<$ 10 eV) plasma escape, (2) response of the Martian plasma environment to the upstream conditions, (3) microphysics of the ion energization, (4) determination of the sputtered atom fluxes. To address these objectives, besides standard plasma and field experiments, the emphasizes in the instrumentation for the future missions should be given to (1) thermal plasma mass spectrometers, (2) wave experiments, (3) UV spectrometers, (4) remote plasma diagnostic technique such as energetic neutral atom imaging and UV/FUV spectrometers/imagers and/or means of the upstream solar wind monitoring, for example, subsatellites. Finally, we outline a possible implementation of a post - Mars Express/MGS plasma mission to Mars.