Geophysical Research Abstracts, Vol. 9, 11239, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-11239

The Mars Escape and Magnetic Orbiter: a Cosmic Vision mission proposal

F. Leblanc, E. Chassefière (1). B. Langlais, C. Sotin (2), S. Barabash (3), A. Coates (4), V. Dehant (5), H. Lammer (6), M. Mandea (7), S. Vennerstrom (8) and the MEMO team

(1) Service d'Aéronomie/ IPSL (CNRS-UPMC-UVSQ), Université P & M Curie, Boite 102, 4 place Jussieu, 75252 Paris Cedex 05, France, (2) Laboratoire de Planétologie et Géodynamique de Nantes, France, (3) Swedish Institute of Space Physics (IRF), Sweden, (4) Mullard Space Science Laboratory, UK, (5) Royal Observatory of Belgium, Belgium, (6) Space Research Institute, Austrian Academy of Sciences, Austria, (7) GeoForschungsZentrum Potsdam, Germany, (8) Danish National Space Center, Denmark.

Recent observations by the ESA spacecraft Mars Express and the two NASA Rovers Opportunity and Spirit have changed our view on the evolution of Mars. The most dramatic result may be the lack of widespread mineralogy related to the action of water on the superficial minerals. This observation is against the previous "wet Mars" idea, and it demonstrates the needs for a better understanding of the water evolution on Mars. Among the different questions that are raised by the results of the Mars Express mission, the escape rate and the effect of the early magnetic field shielding are first order questions that cannot be addressed without new measurements on a dedicated spacecraft. The key questions to be answered are: (i) How much greenhouse gas (carbon dioxide) and water have been removed by escape since the end of the heavy bombardment, at the time when life appeared on Earth? (ii) Was the magnetic shielding strong enough to prevent major atmospheric escape? (iii) What characterize the low, middle and upper atmospheres, and their relations? Mars Escape and Magnetic Orbiter (MEMO) is a low periapsis orbiter of Mars devoted to the measurement of present escape and the characterization of the fossil magnetic field of Mars. The use of a low periapsis altitude orbit (120-150 km) is required to detect and quantify all populations of atoms and molecules involved in escape. It is also required to measure the magnetic field of Mars with an unprecedented spatial resolution that would allow getting a more precise timing of the dynamo and its disappearance. Achieving a full

characterization of atmospheric escape, and extrapolating it back to the past requires: (i) to measure escape fluxes of neutral and ion species, and characterize the dynamics and chemistry of the regions of the atmosphere where escape occurs (thermosphere, ionosphere, exosphere), as well as their responses to solar activity, (ii) to characterize the lateral variations of the magnetic field of lithospheric origin, and by extension, the timing of the Martian dynamo. Of particular interest is the extinction of the dynamo that is thought to have enhanced the atmospheric escape processes still operating today.