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Mars Express science highlights and future plans

Dmitrij Titov (1), Jean-Pierre Bibring (2), Alejandro Cardesin (3), Thomas Duxbury (4), Francois Forget (5), Marco Giuranna (6), Francisco Gonza´lez-Galindo (7), Mats Holmström (8), Ralf Jaumann (9), Anni Määttänen (10), Patrick Martin (3), Franck Montmessin (10), Roberto Orosei (11), Martin Pätzold (12), Jeffrey Plaut (13), and Mex Sgs Team (3)

(1) ESA/ESTEC, SSO, Noordwijk ZH, Netherlands (dmitri.titov@esa.int), (2) IAS-CNRS, Orsay, France, (3) ESA/ESAC, Madrid, Spain, (4) George Mason University, Fairfax, VA, USA, (5) LMD, Paris, France, (6) IAPS-INAF, Rome, Italy, (7) IAA, Granada, Spain, (8) IRF, Kiruna, Sweden, (9) IPF-DLR, Berlin, Germany, (10) LATMOS/IPSL, CNRS, Guyancourt, France, (11) IRA-INAF, Bologna, Italy, (12) RIU-Uni Cologne, Cologne, Germany, (13) JPL, Pasadena, CA, USA

Mars Express remains one of ESA's most scientifically productive missions whose publication record now exceeds 1050 papers. Characterization of the geological processes on a local-to-regional scale by HRSC, OMEGA and partner experiments on NASA spacecraft has allowed constraining land-forming processes in space and time. Recent results suggest episodic geological activity as well as the presence of large bodies of liquid water in several provinces (e.g. Eridania Planum, Terra Chimeria) in the early and middle Amazonian epoch and formation of vast sedimentary plains north of the Hellas basin. New analysis of the subsurface dielectric properties by MARSIS radar sounder indicated that the deposits in Meridiani Planum, previously interpreted as ice-rich, may contain little or no ice at all. Mars Express provided essential contribution to the selection of the Mars-2020 landing sites.
More than a decade-long record of the atmospheric parameters such as temperature, dust loading, water vapor and ozone abundance, water ice and CO_2 clouds distribution, collected by SPICAM, PFS and OMEGA spectrometers as well as subsequent modeling have provided key contributions to our understanding of the martian climate.
More than 10,000 crossings of the bow shock by Mars Express allowed ASPERA-3 to characterize complex behavior of the magnetic boundary topology as function of the solar EUV flux. ASPERA-3 observations of the ion escape during complete solar cycle revealed important dependencies of the atmospheric erosion rate on parameters of the solar wind and EUV flux and established global energy balance between the solar wind and escaping ion flow. This led to important conclusion that the ion escape at Mars is production rather than energy limited.
The structure of the ionosphere sounded by the MARSIS radar and the MaRS radio science experiment was found to be significantly affected by the solar activity, the crustal magnetic field, as well as by the influx of meteorite and cometary dust. MARSIS and ASPERA-3 observations suggest that the sunlit ionosphere over the regions with strong crustal fields is denser and extends to higher altitudes as compared to the regions with no crustal anomalies. Reconnection of solar magnetic field lines carried by the solar wind with field lines of crustal origin opens channels through which the ionospheric plasma escapes to space, producing strong and narrow cavities in the density.
Mars Express has successfully passed the solar eclipse season in 2017 and completed the observation programme. The mission extension till the end of 2020 was approved. The extension plan includes both augmenting the coverage and extending long-time series, as well as new elements and potentially new opportunities for discoveries. It will be boosted by collaboration and synergies with NASA's MAVEN, ESA-Roscosmos Trace Gas Orbiter (TGO) and other missions. In 2018 the mission will be a subject for the bi-annual extension review and will elaborate the science case for new extension till the end of 2022. The talk will give the Mars Express status, review the recent science highlights, and outline future plans focusing on synergistic science with TGO.