EPSC Abstracts
Vol. 9, EPSC2014-528-1, 2014
European Planetary Science Congress 2014

Solar wind interaction with Venus and impact on its atmosphere

Stas Barabash (1), Yoshifumi Futaana (1), Gabriella S. Wieser (1), and Janet G. Luhmann (2)
(1) Swedish Institute of Space Physics, Box 812, Kiruna SE-98128, Sweden, (stas@irf.se); (2) Space Sciences Laboratory, University of California, Berkeley, California, USA.

Abstract

We present a review of the solar wind interaction with Venus and how the interaction affects the Venusian atmosphere.

The Venus Express observations for more than 8 years (2005-present) and quantitatively new simulation codes substantially advanced physical understanding of the plasma processes in the near-Venus space since the Pioneer Venus Orbiter (PVO) mission (1978-1992).

The near-Venus space can be divided into several plasma domains: the magnetotail with the plasmasheet, induced magnetosphere, and magnetosheath. The bow shock separates the undisturbed solar wind from the Venus-affected environment. We review the shapes and positions of the boundaries enveloping the main domains and discuss how they are formed by the current systems and pressure balance. In particular, we discuss the morphology and dynamics of the near-Venus magnetotail that was not accessible by PVO.

Using the unique Venus Express measurements we discuss the ion acceleration processes and their links to the ionosphere. The focus is given to the Venus' atmosphere erosion associated with the solar wind interaction, both through the energy (ion acceleration) and momentum (atmospheric sputtering) transfer. We review the measurements of the escape rates, their variability with the upstream solar wind conditions and the solar cycle. We emphasize the measurements duirng extreme solar wind conditions as an analogue with nominal conditions for the young Sun. The modeling efforts in this area are also reviewed as they provide a quantitatively approach to understand the impact of the solar wind interaction on the atmospheric evolution.

Finally, we compare Venus with other planets of the terrestrial planet group, the Earth and Mars. The Earth, a twin planet of the similar size, is magnetized. Mars, an unmagnetized planet like Venus, possesses by far weaker gravitation to hold its atmospheric gasses. This comparative magnetosphere approach based on the natural solar system laboratory of experiments gives a clearer perspective on physics and processes, which forms the near-Venus space.