

VENUS EXPRESS STUDIES PERTAINING TO THE LOSS OF THE VENUS ATMOSPHERE BY ITS INTERACTION WITH THE SOLAR WIND

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The solar wind can be a source and a sink for planetary atmospheres. This is especially true for unmagnetized planets such as Venus and Mars. We use Venus Express measurements to show that a magnetic barrier effectively excludes the solar wind from the planetary atmosphere but that the solar wind can still erode the planetary atmosphere by interacting with the exosphere above the magnetic barrier and by extracting plasma down the wake. The location of the upper and lower edges of the bow shock have been mapped using the Venus Express magnetometer. Comparisons with models show that the location of the bow shock is consistent with the deflection of the solar wind plasma by the magnetic barrier that in turn shields the atmosphere from the solar wind. While little solar wind can enter the atmosphere, some atmosphere can be picked up by the solar wind. Both in the shocked magnetosheath and in the undisturbed solar wind, proton cyclotron waves are seen by the Venus Express magnetometer that indicate that the hot hydrogen exosphere is being ionized and picked up by the solar wind. Another source of loss is found in the ASPERA plasma data. Here the wake plasma is accelerated down the tail and away from the planet by either a polar-wind type mechanism or via magnetic forces. Thus it is possible that much of the evolution of the Venus atmosphere has been caused through loss to the solar wind.