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Earth and Venus exospheres as seen by SWAN/SOHO and SPICAV/VEX

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Abstract

The Earth's hydrogen exosphere Lyman-α radiation was mapped with the SWAN/SOHO instrument in January 1996, 1997 and 1998 (low solar activity). The use of a hydrogen absorption cell allowed to disentangle the interplanetary emission from the geocoronal one and to assign the absorbed signal almost entirely to the geocorona. The geocorona was found to extend at least up to 100 Earth Radii (R_E) with an intensity of 5 Rayleigh, an unprecedented distance well exceeding the recent results of LAICA imager ($\sim$50 R_E), and encompassing the orbit of the Moon ($\sim$60 R_E). We developed a numerical kinetic model of the hydrogen atoms distribution in the exosphere which includes the solar Lyman-α radiation pressure and the ionization. The radiation pressure compresses the H exosphere on the day side, producing a bulge of H density between 3 and 20 R_E which fits observed intensities very well. The SWAN Lyman-α distribution of intensity was compared both to LAICA (2015) and to OGO-5 (1968) measurements. An onion-peeling technique is used to retrieve hydrogen number density in the exosphere for the three SWAN observations. They show an excess of density versus models at large distances, which is likely due to non-thermal atoms (not in the model).

The SPICAV UV spectrometer was used to measure Lyman-α radiation from 2006 to 2014 in orbit around Venus as part of the Venus Express (VEX) mission. We have performed the analysis of the SPICAV data on observations of the Lyman-α radiation scattered on the "night" side of the Venusian exosphere. We have extended the work [1], where only 4 observations of the "night" side of Venusian hydrogen corona have been considered. In the framework of our study, we have found $\sim$15 "nightside" observations that have never been analyzed before. A qualitative and quantitative analysis of these data was carried out.

We compare both (Earth and Venus) hydrogen exospheres and discuss the main differences/similarities (extension, number density and temperature at the exobase level, existence of the non-thermal component).

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References

[1] Chaufray, J.-Y., Bertaux, J.-L., Quémerais, E., Leblanc, F., Sulis, S.: Observations of the nightside venusian hydrogen corona with SPICAV/VEX, Icarus, Vol. 262, pp. 1-8, 2015.