

## Ablation of Venus' O<sup>+</sup> by unshocked solar wind: Venus Express observations during solar minimum

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### Abstract

Venus, without Earth-like dipole field, has been losing volatiles into the interplanetary space as a consequence of solar wind forcing. Solar wind is shocked near Venus, and the shocked solar wind interacts with upper atmosphere and scavenges particles in various ways [1], as disclosed by spacecrafts' observations over decades [2-4]. Applying the observed loss rate on the history of solar system reveals that planetary atmospheric loss could change the evolution of planetary habitability [5]. In theory the loss rate may be much higher since unshocked solar wind can directly ablate charged particles [6], but this phenomenon has never been observed at Venus though it has been observed to be prevailing at near-Sun comets [7].

We report Venus Express observations of escaping oxygen ions (O<sup>+</sup>) in the unshocked solar wind during a solar minimum. We have found 80 cases during 2006-2010, and found that the appearance of O<sup>+</sup> ions are under control of interplanetary magnetic field. The estimated O<sup>+</sup> loss rate is smaller than but comparable to that driven by shocked solar wind [8]. Our results suggest that the atmospheric loss at Venus might be significantly underestimated by previous studies, and thus the importance of Earth-like dipole field to planetary habitability should be appreciated further.

### References

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