# Ionosphere: A key plasma layer in planetary atmospheres

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All planets and moons, which hold an atmosphere, have it partially ionised under solar illumination and bombardment of energetic particles from the space environment. This forms a conducting layer of plasma, the so-called "ionosphere". It plays a crucial role in terms of space weather at Earth, atmospheric heating at the giant planets, and astrobiology at Titan, the largest moon of Saturn, to cite a few examples. It is also present in the coma, an envelope of gas which develops around a comet when the dusty, icy nucleus is close enough to the Sun to have its surface sublimating. There the ionosphere plays a critical role in the interaction of comets with the interplanetary medium among others.

Over the past decades I have developed comprehensive kinetic and fluid models in order to describe how solar and particle sources deposit their energy in planetary atmospheres and how an ionosphere is formed. This modelling work has been carried out in close interaction with instrument teams from space missions, such as Cassini probing the atmospheres of Saturn and Titan, and Rosetta scrutinising the coma of comet 67P/Churyumov-Gerasimenko. For instance, I have developed original analyses by organising multi-instrument data sets with a physics-based model in order to enhance the science return from space observations.

I propose to first focus on the energy deposition of solar ionising radiation, which extends from soft X-rays to Extreme Ultra-Violet (EUV). I will underline how this solar radiation ionises the upper atmosphere of Titan and initiates a complex, organic factory all the way to its surface. Secondly, I will contrast planetary ionospheres surrounding massive bodies with cometary ionospheres which escape the low-gravity field of the parent nucleus. Thirdly, I will highlight the relevance of auroral emissions, which have not only been fascinating human beings at Earth for centuries, but have also been playing a critical role in space weather. Auroral emissions have been observed throughout the Solar System and have revealed ionospheric species and plasma interactions. Finally, I will conclude by drawing special attention to the relevance of cross-body comparative analysis in order to gain deeper insight into ionospheres encountered in the Solar System and beyond.