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Doubly-charged ions in planetary ionospheres

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Planetary ionosphere models usually consider only singly-charged ions and neglect doubly-charged ions and especially the molecular ones since they were thought to be unstable in ionospheric conditions. Generally speaking, doubly-charged ions are difficult to detect by mass spectrometry because their q/m number is the same as other more abundant ions. Therefore, only O^{++} have already been identified in Earth and Venus' atmospheres. Due to recent and dedicated laboratory experiments on reaction rates and cross sections, specific models of doubly charged ions –atomic and molecular– have been developed for the Earth, Mars, Titan and Venus. In this communication, we shall:
– explain why these ions are of interest;
– review which ions have been detected, and where;
– review the relevant ion-neutral photo-chemistry, the laboratory measurements, and the current models.