

Dayglow and night glow of the Venusian upper atmosphere. Modelling and observations

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Aims. We present the modelling of the production of excited states of O, CO and N₂ in the Venusian upper atmosphere, which allows to compute the nightglow emissions. In the dayside, we also compute several emissions, taking advantage of the small influence of resonant scattering for forbidden transitions.

Methods. We compute the photoionisation and the photodissociation mechanisms, and thus the photoelectron production. We compute electron impact excitation and ionisation through a multi-stream stationary kinetic transport code. Finally, we compute the ion recombination with a stationary chemical model.

Results. We predict altitude density profiles for $O(^1S)$ and $O(^1D)$ states and the emissions corresponding to their different transitions. They are found to be very comparable to the observations without the need for stratospheric emissions. In the nightside, we highlight the role of the $N + O_2^+$ reaction in the creation of the $O(^1S)$ state. This reaction has been suggested by Rees in 1975 (Frederick, 1976). It has been discussed several times afterwhile and in spite of different studies, is still controversial. However, when we take it in consideration in Venus, it is shown to be the cause of almost 90% of the state production. We calculate the production intensities of $O(^3S)$ and $O(^5S)$ states, which are needed for radiative transfer models. For CO we compute the Cameron band and the fourth positive band emissions. For N₂ we compute the LBH, first and second positive bands. All these values are successfully compared to the experiment when data are available.

Conclusions. For the first time, a comprehensive model is proposed to compute day-

glow and nightglow emissions of the Venusian upper atmosphere. It relies on previous works with noticeable improvements, both on the transport and on the chemical aspects. In the near future, a radiative transfer model will be used to compute optically thick lines in the dayglow, and a fluid model will be added to compute ionosphere densities and temperatures. We will present the first observational results from the Pic du Midi telescope in June 2007, in order to compare with our modelling.