Geophysical Research Abstracts
Vol. 14, EGU2012-5408, 2012
EGU General Assembly 2012

The oxygen nightglow emissions of Venus: vertical distribution and role of collisional quenching

J.-C. Gérard (1), L. Soret (1), A. Migliorini (2), G. Piccioni (2), and P. Drossart (3)

(1) LPAP - Université de Liège - Belgium (jc.gerard@ulg.ac.be, 0032 4 366 9711), (2) INAF - Rome, Italy, (3) LESIA, Observatoire de Paris - Meudon, France

Three-body recombination of atomic oxygen produces O_2 molecules excited in different electronic states such as a $^1\Delta_g$, b $^1\sum_g^+$, A $^3\sum_u^+$, c $^1\sum_u$and A' $^3\Delta_u$, each with a specific quantum efficiency. When they radiate, optical transitions are observed in a wide range of wavelengths extending from the ultraviolet to the near infrared. In planetary atmospheres, spontaneous radiative deexcitation compete with collisional quenching with ambient molecules and atoms. As a consequence, the corresponding airglow emission profiles may significantly differ from each other in brightness and altitude of the emitting layer.

We model the volume emission rates and limb profiles of the O_2 Atmospheric Infrared (a $^1\Delta$-X $^3\sum$), Herzberg I (A $^3\sum$-X $^3\sum$), Herzberg II (c $^1\sum$-X $^3\sum$), Chamberlain (A' $^3\Delta$-a $^1\Delta$) bands expected on the Venus night side. The quenching rates are taken from laboratory and observational planetary data and we apply two different methods to determine the oxygen and CO_2 density profiles. One is based on recent analysis of data collected by instruments on board the Venus Express mission. The second one uses a one-dimensional chemical-diffusive model where the free parameters are the strength of turbulent transport and the downward flux of O atoms. Both approaches indicate that the calculated intensities of each transition range over several orders of magnitude and that differences are expected in the altitude of the maximum emission. These predictions will be compared with VIRTIS/Venus Express limb observations, which make it possible to derive the vertical distribution of the O_2 emissions in the visible and infrared. These measurements suggest that no difference is observed between the altitude of the peak of the IR Atmospheric and Herzberg II bands. Conclusions will be drawn about the validity of the current set of quenching coefficients used in the model.