New oxygen nightglow emissions detected in the upper atmosphere of Venus by VIRTIS

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The Venus-Express mission is orbiting around Venus since April 2006, and the VIRTIS instrument (Visible and Infrared Thermal Imaging Spectrometer) on board the spacecraft is providing an extensive valuable dataset of various oxygen airglows. In the spectral region from 1.0 to 1.6 μm, we have detected different nightglow emissions, with the most intense one being the widely studied (0,0) band of the ($a^1\Delta_g$ - $X^3\Sigma^-_g$) O_2 transition. Another oxygen emission, the (0,1), peaking at 1.58 μm is also studied with VIRTIS and reported in recent paper (Piccioni, et al., 2009).
In the present work, we discuss the detection of a new emission at 1.06 μm, which we attribute to the (1,0) transition of oxygen, as predicted by the theory (Goody and Yung, 1989), and another new emission at 1.28 μm which we attribute to the (1-1) O_2 transition.
The intensity of the (1,0) is about 60 kR, with a vertical peak emission at 97 km, as from limb view. The fit of the spectral profile at 1.2-1.3 μm is quite hard to be obtained with the currently available data, as any attempt failed in fitting the spectrum in its full extension range of wavelengths, especially on the longer wavelengths side, by considering the only (0,0) O_2 transition. By means of new synthetic spectra in the region around 1.27 μm, we are now fitting relatively well the full spectral profile when we consider the inclusion of the transition (1,1) of the oxygen, previously never detected.
The detection of these new nightglow emissions provide new hints to better investigate the upper mesosphere of Venus and to shed light on the chemistry and dynamics of our sister planet.