Radiative-transfer model for simulating infrared spectra for the Ceres water exosphere

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The discovery of water vapour around asteroid Ceres from the Herschel telescope observations (Kueppers et al., 2014)[1] gives a new objective to the NASA's Dawn mission reaching the asteroid in 2015 and its infrared spectrometer VIR (De Sanctis et al., 2011) [2].

We have developed a radiative-transfer model to simulate the infrared excitation of H_2O, CO, CO_2 in cometary atmospheres from which we are able to derive synthetic spectra of infrared bands in different observation geometries.

This model is applied to Ceres in order to make estimations of the detectability of the water 2.7-µm band from the Dawn spacecraft. This model computes the populations of the different ro-vibrational levels in the exosphere of Ceres. The density, temperature, and velocity structure of the exosphere is obtained from DSMC simulations which consider water outgassing from an 80 km-sized active spot at the subsolar point. This exospheric model was used to interpret the Herschel observations (Kueppers et al., 2014) [1].

We present results of simulations for different levels of activity and outgassing distributions on the Ceres surface. The detectability of water vapour from the VIR instrument on Dawn is discussed. This radiative-transfer model will be used to analyse the future Dawn measurements.

References: [1] Kueppers et al., 2014, Nature, 505, 525. [2] De Sanctis et al., 2011, SSRv, 163, 329.