Determination of an upper limit for the water outgassing rate of the main-belt comet P/2012 T1 (PanSTARRS)

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A new main-belt comet (MBC) P/2012 T1 (PANSTARRS) was discovered on 2012 October 6, approximately one month after its perihelion, by the Pan-STARRS1 survey based in Hawaii (Wainscoat et al. 2012). It displayed cometary activity upon its discovery with one hypothesis being that the activity was driven by sublimation of ices; as a result, we searched for emission assumed to be driven by the sublimation of subsurface ices. Our search was of the H_2O $1_{10} - 1_{01}$ ground-state rotational line at 557 GHz from P/2012 T1 (PANSTARRS) with the Heterodyne Instrument for the Far Infrared (HIFI; de Graauw et al. 2010) onboard the Herschel Space Observatory (Pilbratt et al. 2010) on 2013 January 16, when the object was at a heliocentric distance of 2.504 au and a distance from Herschel of 2.059 au. Perihelion was in early September 2012 at a heliocentric distance of 2.411 au. To analyze the data, we used a molecular excitation model equivalent to that utilized to analyze both Herschel and ground-based cometary observations (Hartogh et al. 2010, 2011; de Val-Borro et al. 2010, 2012ab). While no H_2O line emission was detected in our observations, we were able to derive sensitive 3–σ upper limits for the water production rate and column density of $< 7.63 \times 10^{25}$ molecules s^{-1} and of $< 1.61 \times 10^{11}$ cm^{-2}, respectively. An observation taken on 2013 January 15 using the Very Large Telescope found the MBC to be active during the Herschel observation, suggesting that any ongoing sublimation due to subsurface ice was lower than our upper limit.

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