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Molecular abundances in comet 103P/Hartley 2 observed with the Arizona Radio Observatory

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Abstract

Comet 103P/Hartley 2 passed perihelion on October 28, 2010 at a close distance of only ∼0.12 AU from Earth. 103P/Hartley 2 has orbit characteristics of a Jupiter-family comet with an orbital period of 6.5 years and small eccentricity. On November 4, 2010 NASA's EPOXI mission made a close approach to the comet (A'Hearn M. F., et al. 2011). An observational campaign with *Herschel* and ground based instrumentation was coordinated during the EPOXI flyby to monitor the comet activity (Meech et al. 2011; Biver et al. 2011). Comet 103P/Hartley 2 was observed with the three instruments onboard *Herschel* (Pilbratt et al. 2010) in the sub-millimetre and far-infrared domain within the framework of the guaranteed time key project "Water and related chemistry in the Solar System" (Hartogh et al. 2009). We have observed this object in the mm and sub-millimeter ranges with the Arizona Radio Observatory (ARO) 12 Meter and Heinrich Hertz Submillimeter Telescopes (HHSMT) to detect the parent volatiles HCN, CS and CH_3OH and complement almost simultaneous *Herschel* H_2O and HDO observations (Hartogh et al. 2011). The close approach to Earth provided a unique opportunity to study the molecular composition in the inner coma and the production rate variability due to the rotation of the nucleus in a Jupiter-family comet.

1. Observations

We have observed comet 103P/Hartley 2 at five different times from October 27 to November 8, 2010, to support the monitoring by *Herschel*. Simultaneous observations are crucial in view of the already known short-term variability of the production rate with a period ~ 0.8 h (Biver et al. 2011; Drahus et al. 2011; Dello Russo et al. 2011). Because of technical constraints the comet could not be observed by *Herschel*/HIFI before November 17. We have observed the time variation of the HCN, CS and CH_3OH emission and report an upper limit on the H_2CO abundance.

Production rates are derived for each species using a spherically symmetric Monte Carlo radiative transfer numerical code to compute the populations of the rotational levels as function of distance from the nucleus (Hartogh et al. 2010; de Val-Borro et al. 2010). A constant gas temperature of $T = 50$ K is assumed (Biver et al. 2011). The scaling factor of the electron density profile is $x_{n_e} = 0.2$ and the ortho-to-para ratio is assumed to be 3. We will compare the results with derived production rates from other ground-based submillimeter observations.

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