

**COMPOSITION AND OUTBURST FOLLOW-UP OBSERVATIONS OF COMET 17P/HOLMES AT THE NANÇAY, IRAM AND CSO RADIO OBSERVATORIES.** Nicolas Biver<sup>1</sup>, Dominique Bockelée-Morvan<sup>1</sup>, Helmut Wiesemeyer<sup>2</sup>, Jacques Crovisier<sup>1</sup>, Ruisheng Peng<sup>3</sup>, Darek Lis<sup>4</sup>, Tom Phillips<sup>4</sup>, Jérémie Boissier<sup>5</sup>, Pierre Colom<sup>1</sup>, Emmanuel Lellouch<sup>1</sup>, Raphaël Moreno<sup>1</sup>, <sup>1</sup>LESIA, Observatoire de Paris, 5 place Jules Janssen, F-92190 Meudon, France (Nicolas.biver@obspm.fr), <sup>2</sup>IRAM, Granada, Spain, <sup>3</sup>CSO, Hilo, Hawaii, USA, <sup>4</sup>Caltech, Pasadena, California, USA, <sup>5</sup>IRAM, Grenoble, France.

The Jupiter-family comet 17P/Holmes underwent a major outburst on 24.0 October 2007 UT, 5 months after its perihelion at 2.05 AU from the Sun. The 18-cm lines of OH were monitored with the Nançay radio telescope starting on the day when its brightness increased by about 14 magnitudes [1]. Using the CSO 10.4-m, IRAM 30-m and Plateau-de-Bure [2] telescopes we observed the outgassing of several other molecules. The comet was shortly picked up on 25.9 Oct. at IRAM around its peak of outgassing. We estimate that the total outgassing rate might have been close to 200 tons per second on that day. Then the outgassing steeply decreased by a factor 3 per day before slowing down on the 28<sup>th</sup>. A small secondary outburst was observed on the 30<sup>th</sup> UT. The comet was ultimately detected at the end of December (HCN, CH<sub>3</sub>OH), by which time the outgassing could be sustained by the nucleus itself and not requiring the large active area of a cloud of sublimating icy particles. The total amount of material lost by the nucleus during this outburst was estimated to be close to 1% of its total mass.

The gas temperature and outgassing velocity were also precisely monitored thanks to high S/N lines. The expansion velocity was found to decrease from 0.78 to 0.35 km/s. Differences in line shapes were observed for CS and HNC, showing some higher velocity components.

Eleven molecules – OH, CO, CH<sub>3</sub>OH, H<sub>2</sub>CO, HCN, CH<sub>3</sub>CN, HC<sub>3</sub>N, H<sub>2</sub>S, SO, HNC and CS – were detected. Significant upper limits on the abundances of HNCO, HCOOH, SO<sub>2</sub> and OCS were also obtained. On 28 October we also searched for isotopologues of HCN, CS and H<sub>2</sub>S. The <sup>13</sup>C/<sup>12</sup>C and <sup>34</sup>S/<sup>32</sup>S ratios in HCN and CS were found to be close to terrestrial, while the <sup>15</sup>N/<sup>14</sup>N ratio in HCN is enriched by a factor 2 [3] as has been found in CN for 17P and other comets [3,4,5]. Upper limits on the D/H ratio in HCN and H<sub>2</sub>S have also been obtained.

The comparison of the molecular abundances of comet 17P to other comets [6,7,8] shows that it has a classical composition, not especially rich in the most volatile species CO and H<sub>2</sub>S (figure).

#### References:

[1] Crovisier, J., Colom, P., Biver, N. and Bockelée-Morvan, D. (2008). *This conference*.

[2] Boissier, J., Bockelée-Morvan, D., Biver, N., et al., (2008). *This conference*.

[3] Bockelée-Morvan, D., Biver, N., Jehin, E., et al. (2008). *ApJ Letters*, in press

[4] Hutsemékers, D., Manfroid, J., Jehin, E., et al. (2005). *A&A*, 440, L21–L24.

[5] Jehin, E., et al. (2008). *This conference*.

[6] Biver, N., Bockelée-Morvan, D., Crovisier, J., et al. (2002). *Earth, Moon & Planets*, 90, 323–333.

[7] Biver, N., Bockelée-Morvan, D., Crovisier, J., et al. (2006). *A&A*, 449, 1255–1270.

[8] Biver, N., Bockelée-Morvan, D., Boissier, J., et al. (2007), *Icarus*, 187, 253–271.

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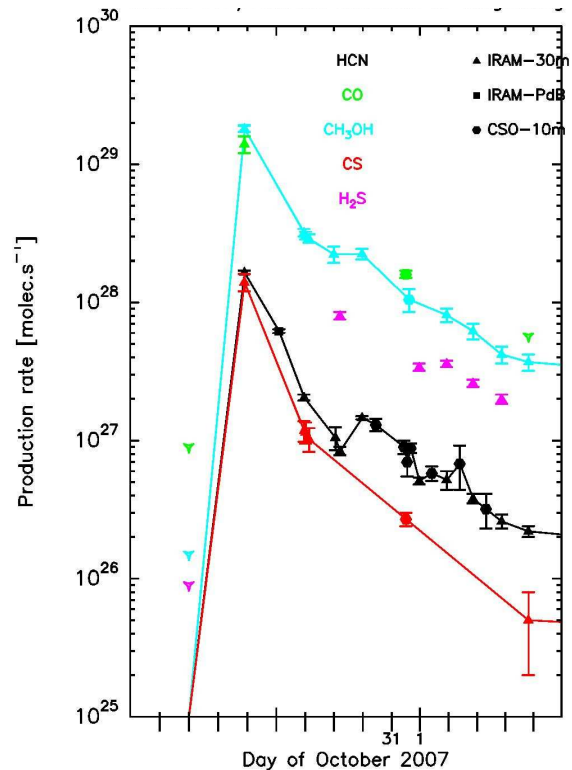


Figure: Time evolution of the HCN, CS, CH<sub>3</sub>OH, CO and H<sub>2</sub>S production rates in comet 17P/Holmes.