IN-DEPTH INVESTIGATION OF THE FRAGMENTING COMET 73P/SCHWASSMANN-WACHMANN 3 AT RADIO WAVELENGTHS WITH THE NANÇAY, IRAM, CSO, APEX AND ODIN RADIO TELESCOPES. N. Biver[1], D. Bockelée-Morvan[1], J. Crovisier[1], A. Lecacheux[1], D.C. Lis[2], J. Boissier[1,3], P. Colom[1], N. Dello-Russo[4], H-G. Florén[5], U. Frisk[6], Å. Hjalmarson[7], S. Kwok[8], K. Menten[9], R. Moreno[1], M. Olberg[7], B. Parise[9], G. Paubert[10], Aa. Sandqvist[5], R. J. Vervack[4], H. A. Weaver[4], A. Winnberg[7], [1]LESIA, Observatoire de Paris, 5 place Jules Janssen, 92190 Meudon, France (Nicolas.biver@obspm.fr), [2]Caltech, Pasadena, California, [3]IRAM, Grenoble, France, [4]APL, Johns Hopkins University, Maryland, USA, [5]Stockholm Observatory, Sweden, [6]Swedish Space Corporation, Solna, Sweden, [7]Onsala Space Observatory, Sweden, [8]Dept. of Physics and Astronomy, University of Calgary, Canada & Inst. of Astron. & Astrophys., Academia Sinica, Taipei, Taiwan, [9]MPIfR, Bonn, Germany, [10]IRAM, Granada, Spain.

73P/Schwassmann-Wachmann 3 is a Jupiter-family comet which showed multiple fragmentations at its three last passages. The 2006 passage was peculiarly spectacular due to the close approach to Earth of the comet (0.08 AU in mid-May). We monitored the outgassing of the two main components (73P-B and 73P-C) of the comet using radio spectroscopy. The 18-cm lines of OH were monitored with the Nançay radio telescope [1] from Mars to July. Water was observed through its 557 GHz line in May with the Odin satellite. Using the CSO 10-m, IRAM 30-m and APEX 12-m telescopes we observed the outgassing of several other molecules in the two main fragments.

Seven molecules – CH_3OH, H_2CO, HNCO, HCN, CH_3CN, H_2S and CS – were detected in both fragments. The comparison of their abundances relative to water (Fig. 1) shows compositional similarities of the two fragments (e.g. depletion of CH_3OH, enrichment in HCN,..) as was found for other molecules seen in the infrared [2]. 73P-C is thought to be the main remnant of the nucleus which broke up in 1995. On the other hand, 73P-B is a smaller piece that was undergoing continuous fragmentation during the observations and exposing possibly less processed comet material to the open space: its composition remained the same following its 8 May outburst suggesting that 73P is homogeneous in composition and that we measured its original bulk composition.

Several other molecules were searched for. $H_2{}^{18}O$ (fig. 2) was detected in fragment 73P-C with Odin and a preliminary analysis suggests that the $^{18}O/^{16}O$ ratio is terrestrial or slightly higher. This is the first measurement of this ratio in a Jupiter-family comet. It was found to be close to the terrestrial value (1/499) in other comets [3]. A sensitive search for HNC undertaken in fragment B shows that this comet is especially depleted in this molecule [4].

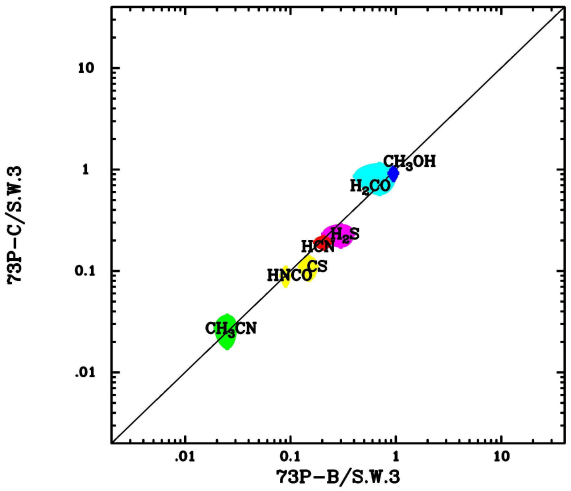

Figure 1: Molecular abundances relative to water (in %) in fragment 73P-C vs fragment 73P-B.

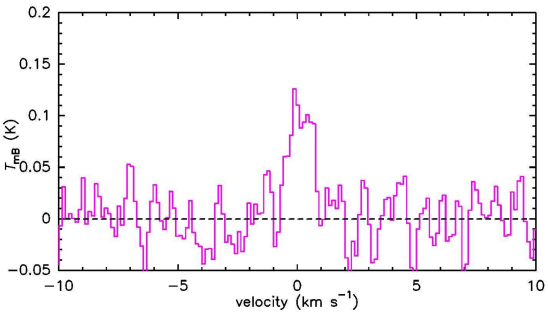

Figure 2: Detection of the $H_2{}^{18}O$ line at 548 GHz in fragment 73P-C with Odin. Average of observations done between 6.0 and 22.5 May 2006 UT.

References:

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