

Observations of the 18-cm lines of OH in comets with the Nançay radio telescope

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We present a progress report on the observations of comets with the Nançay radio telescope.

The lines of OH at 18-cm wavelength have been systematically observed in comets at Nançay since 1973 [1]. These observations allow us to evaluate the cometary water production rate and its evolution with time, and to study several physical processes such as the excitation mechanisms of the OH radio lines, the expansion of cometary atmospheres, their anisotropy in relation with non-gravitational forces, the Zeeman effect in relation to the cometary magnetic field. Between 1973 and 1999, 52 comets have been successfully observed at Nançay. The radio telescope has been upgraded in 2000, and observations are now made with a sensitivity increased by about a factor of two. As of mid 2011, the returns of 53 comets were observed at Nançay with the refurbished instrument. The most recent ones are listed in Table 1.

The observations, which are organized in a database, are made progressively publicly available ([1]; <http://www.lesia.obspm.fr/planeto/cometes/basecom/>). New analyses of this database have been performed of the OH line shapes in terms of coma expansion velocity [2] and of the correlation between visual magnitudes and OH production rates [3].

The observations of three comets (C/2002 X5 (Kudo-Fujikawa), C//2002 V1 (NEAT) and C/2006 P1 (McNaught)) that passed at close distances to the Sun, in relation with IRAM observations, were recently analysed [4].

The recent observations at Nançay were especially targeted to support the *Herschel* programme of cometary observations [5].

C/2006 W3 (Christensen) was observed pre-perihelion. The OH production rate was found to be larger than the water production upper limit observed post-perihelion by *Herschel*, suggesting a seasonal effect [6].

The two Jupiter-family comets 81P/Wild 2 (previous target of the *Stardust* mission) and 10P/Tempel 2

were detected at Nançay two months before perihelion, but could not be detected at the time of their *Herschel* observations because of the small inversion of the OH maser at that moment [7] [8].

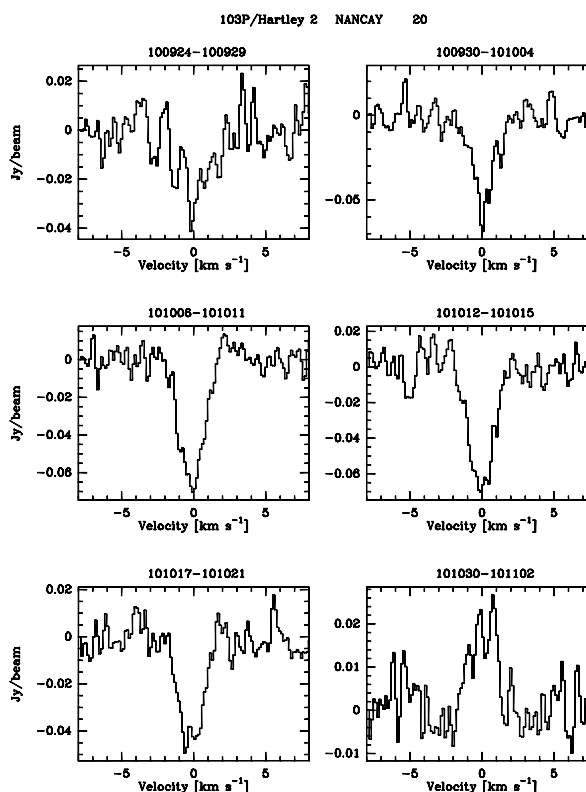


Figure 1: A sample of the spectra of comet 103P/Hartley 2 observed with the Nançay radio telescope.

A special effort was made for the Jupiter-family comet 103P/Hartley 2, in support to both *Herschel* and the *EPOXI* mission [9]; this comet made a close approach to Earth at $\Delta = 0.12$ AU on 21 October 2010, just before its perihelion at $q = 1.059$ AU on 28 October and the *EPOXI* flyby on 4 November. It was monitored at Nançay from August 2010 to January 2011

Table 1: Comets observed at Nançay since 2008.

comet	perihelion [yymmdd]	q [AU]	range of observations [yymmdd]	r_h range a) [AU]	N	
					b)	c)
8P/Tuttle	080127.02	1.027	071203–080128	1.03–1.31	49	H
46P/Wirtanen	080202.50	1.057	080103–080121	1.07–1.13	16	J
C/2007 W1 (Boattini)	080624.89	0.850	080401–010831	0.85–1.67	119	L
6P/d'Arrest	080814.96	1.353	080614–080806	1.36–1.53	36	J
C/2008 A1 (McNaught)	080929.13	1.073	080911–081031	1.07–1.20	22	L
C/2007 N3 (Lulin)	090110.73	1.212	080902–090405	1.22–2.24	105	L
144P/Kushida	090126.87	1.439	081115–090104	1.46–1.65	38	J
22P/Kopff	090525.39	1.578	090226–090915	1.60–1.93	86	J
C/2008 T2 (Cardinal)	090614.35	1.209	090202–090809	1.21–2.25	69	L
C/2006 W3 (Christensen)	090706.49	3.127	090102–090419	3.20–3.60	36	L
C/2007 Q3 (Siding Spring)	091007.33	2.251	090620–102602	2.34–2.76	73	L
88P/Howell	091012.47	1.363	090801–100214	1.37–1.88	87	J
81P/Wild 2	100222.73	1.598	091116–100214	1.60–1.86	63	J
C/2009 O2 (Catalina)	100324.20	0.694	100115–100324	0.70–1.45	48	L
C/2009 K5 (McNaught)	100430.03	1.422	100401–100414	1.44–1.48	7	L
C/2009 R1 (McNaught)	100702.16	0.401	100401–100831	0.41–1.92	60	L
10P/Tempel 2	100704.86	1.424	100422–100730	1.42–1.61	54	J
103P/Hartley 2	101028.50	1.059	100803–110131	1.06–1.63	113	J

- a) lowest and highest heliocentric distance of the observations;
b) number of observations in the data base (one 1-hour observation per day);
c) L: long-period comet; H: Halley-family comet; J: Jupiter-family comet;

and was detected from the end of September to mid-December 2010 (Fig. 1).

Several comets were additionally observed at Nançay in preparation to the *Herschel* programme, but were not observed by this space observatory because of the launch delay or of scheduling issues. These are 22P/Kopff, 88P/Howell, 144P/Kushida and C/2007 Q3 (Siding Spring).

Comets 88P/Howell, C/2009 K5 (McNaught) and 103P/Hartley2 were also observed in connexion with observations of the 557 GHz water line with the Odin satellite, pursuing a programme initiated 10 years ago [10].

References

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