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Observations of the rotational lines of OH in comets with the *Herschel Space Observatory*

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The hydroxyl radical OH, as a photodissociation product of water, is an important constituent of cometary atmospheres. OH is easily and extensively observed in comets through its electronic bands in the near UV and its radio lines at 18 cm wavelength [1]. The rotational lines of OH, which fall in the far-infrared domain, are much more difficult to observe. Up to now, only one observation has been reported, that of the $^2\Pi_{3/2}(5/2)$–$^2\Pi_{3/2}(3/2)$ lines at 119 μm in comet 1P/Halley with the *Kuiper Airborne Observatory* [2].

The *Herschel Space Observatory* [3], with its Photodetector Array Camera and Spectrometer (PACS) [4], is well suited to start again the search for these lines.

One of the main goals of the "Water and related chemistry in the Solar System" guaranteed time key programme for *Herschel* [5] is the observation of water in comets. No dedicated searches for the OH lines were scheduled, but as part of these observations, full range (51–220 μm) spectra were obtained with PACS on 10P/Tempel 2 (on 6 July 2010, at 1.42 AU from the Sun and 0.75 AU from *Herschel*) [6] and 103P/Hartley 2 (on 11 November 2010, at 1.09 AU from the Sun and 0.14 AU from *Herschel*) [7].

We present here a search for the OH rotational lines in these spectral scans. In comet 103P/Hartley 2, the $^2\Pi_{3/2}(5/2)$–$^2\Pi_{3/2}(3/2)$ lines at 119 μm and $^2\Pi_{1/2}(5/2)$–$^2\Pi_{1/2}(3/2)$ lines at 99 μm are detected. Other lines may be marginally present.

Two mechanisms concur to the emission of the OH rotational lines: fluorescence due to solar excitation of the electronic states of OH [8] and prompt emission following the photodissociation of water, which produces the OH radical in electronic, vibrational and rotational excited states [9, 10]. We will compare the observed line intensities with those expected from these mechanisms, using the comet water productions determined from *Herschel* [6, 7], in order to better constrain the excitation of cometary OH.

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