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Letter to the Editor

Herschel observations of the hydroxyl radical (OH) in young stellar objects [*,**]

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Abstract

Aims. “Water In Star-forming regions with *Herschel*” (WISH) is a *Herschel* key program investigating the water chemistry in young stellar objects (YSOs) during protostellar evolution. Hydroxyl (OH) is one of the reactants in the chemical network most closely linked

to the formation and destruction of H_2O. High-temperature (T 250 K) chemistry

connects OH and H_2O through the OH + H_2 H_2O + H reactions. Formation of H_2O from OH is efficient in the high-temperature regime found in shocks and the innermost part of protostellar envelopes. Moreover, in the presence of UV photons, OH can be produced from

the photo-dissociation of H_2O through $H_2O + \gamma_{UV}$ OH + H.

Methods. High-resolution spectroscopy of the 163.12 μm triplet of OH towards HH 46 and NGC 1333 IRAS 2A was carried out with the Heterodyne Instrument for the Far Infrared (HIFI) on board the *Herschel* Space Observatory. The low- and intermediate-mass protostars HH 46, TMR 1, IRAS 15398-3359, DK Cha, NGC 7129 FIRS 2, and NGC 1333 IRAS 2A were observed with the Photodetector Array Camera and Spectrometer (PACS) on *Herschel* in four transitions of OH and two [O i] lines.

Results. The OH transitions at 79, 84, 119, and 163 μm and [O i] emission at 63 and 145μm were detected with PACS towards the class I low-mass YSOs as well as the intermediate-mass and class I Herbig Ae sources. No OH emission was detected from the class 0 YSO NGC 1333 IRAS 2A, though the 119 μm was detected in absorption. With HIFI, the 163.12 μm was not detected from HH 46 and only tentatively detected from NGC 1333 IRAS 2A. The combination of the PACS and HIFI results for HH 46 constrains

the line width (*FWHM* 11 km s^{-1}) and indicates that the OH emission likely originates from shocked gas. This scenario is supported by trends of the OH flux increasing with the [O i] flux and the bolometric luminosity, as found in our sample. Similar OH line ratios for most sources suggest that OH has comparable excitation temperatures despite the different physical properties of the sources.

Key words: astrochemistry / stars: formation / ISM: molecules / ISM: jets and outflows / ISM: individual objects: HH 46

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Herschel is an ESA space observatory with science instruments provided by European-led Principal Investigator consortia and with important participation from NASA.

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Appendices (page 6) are only available in electronic form at http://www.aanda.org

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