H_2O in Herschel high-z galaxies, a new diagnosis of their dense cores

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As confirmed by Herschel, submillimeter lines of H_2O are, just after CO, among the strongest submillimeter molecular lines in local and high-z ultra-luminous infrared galaxies (ULIRGs). They provide a completely different diagnosis than CO of their dense, warm cores because of the large electric dipole of H_2O, the high water abundance and their sensitivity to infrared excitation.

I will report on the progress of high-z H_2O line studies in strongly lensed high-z Herschel galaxies from the H-ATLAS survey. High-z H_2O detections with IRAM/PdBI will be presented in 15 objects and compared with Herschel detections in local ULIRGs. We have shown that H_2O is easily detectable at all redshifts. The H_2O line luminosity increases as $L_{IR}^{\sim 1.2}$, and high-excitation lines ($E_{up}/k \sim 300K$) remain strong in the majority of the sources. H_2O lines provide thus an important diagnosis in extreme starbust (and possibly AGN) conditions of warm, dense cores/clumps of these galaxies which are often more extreme than local equivalents and are abundant at $z \sim 2$-4. Modeling H_2O rotational excitation allows us to constrain physical parameters there such as warm dust opacity and temperature and H_2O abundance. Extensions to observations of related molecular lines such as H_2O^+ will be also presented.