H_2O in interstellar and circumstellar clouds : What we know and what could be expected from FIRST

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I will review the ISO observations of water vapor emission/absorption lines in molecular clouds and circumstellar envelopes in terms of the physical parameters that can be derived from them. H_2O can be an efficient cooler of the regions where its emission is produced and probably plays an important role in the chemistry and dynamical evolution of the warmest zones of molecular clouds. I will discuss the limitations of the data available so far, due to several observational constraints, and the current interpretations of this available information, focusing in particular on Orion, SgrB2 and Sgr A. The role of dust in the excitation of H_2O will be discussed and detailed modeling will be presented (see also the contribution by González-Alfonso).
FIRST will provide much more sensitive observations than ISO and SWAS. The study of interstellar and circumstellar clouds with HIFI using the emission/absorption water lines should allow to resolve the velocity structure and to derive the physical conditions of the innermost zones of massive star forming regions such as Orion. The same applies to the shocked regions produced by the outflows of newly formed low mass stars. PACS and SPIRE will provide simultaneous multi-line intensity information of H_2O in these regions. Although the velocity resolution will be much lower than that provided by HIFI, covering all H_2O lines up to wavenumbers of 150 cm^{-1} ($\lambda \simeq 63$ μm) will permit to study in detail the role of H_2O in the cooling processes of star forming regions and of evolved stars.
The predictions of H_2O line intensities as they could be seen with FIRST detectors towards several molecular clouds and evolved stars will be presented and discussed. In a separate contribution, González-Alfonso will present the radiative transfer models that we have developed in the framework of H_2O studies with FIRST.