Water line emission from the envelopes surrounding solar type protostars

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Water lines have been predicted to be the gas major coolants of the inner regions of the envelopes surrounding solar type protostars (Ceccarelli, Hollenbach & Tielens 1996; Doty & Neufeld 1997). Observations carried out with the Long Wavelength Spectrometer (LWS) on board the Infrared Space Observatory (ISO) satellite revealed strong water emission in several solar type protostars, confirming these early predictions (Ceccarelli et al. 1999). Indeed the analysis of the water lines from the solar type protostar IRAS16293-2422 allowed to reconstruct the physical structure of its envelope and to estimate the mass of the central forming star and its mass accretion rate (Ceccarelli et al. 2000). Yet, given the relatively low sensitivity, large spatial resolution and low spectral resolution, the ISO observations had some obvious limitations, which will be certainly surmounted by FIRST. With its higher sensitivity, spatial and spectral resolutions, FIRST will be able:

a) to increase the sample of solar type protostars where the study of water line emission is possible
b) to disentangle the water emission associated with the infalling gas against the emission due to shocked material of the outflowing gas
c) to resolve spectrally the line emission making possible kinematical studies: note that since high lying water lines originate in the innermost regions, where the infall velocity is the highest, they can be resolved by the HIFI spectrometer and used to probe the infall.

FIRST is the only instrument able to observe efficently and routinely water lines from solar type protostars in many years to come. In this contribution we will show how the water lines observable with FIRST can be used to derive some key parameters: e.g. the water abundance both in the outer cold regions of the envelopes and the hot core like regions where grain mantles evaporate; the mass of the central forming stars and their accretion rates. The knowledge of these parameters in a large statistical sample of solar type protostars is unvaluable to understand the process of the formation of these objects.