Model predictions for H_2O emission/absorption in molecular clouds and circumstellar envelopes

E. González-Alfonso
CSIC, IEM, Dpt Molecular Physics, C/Serrano 121, E-28006 Madrid, Spain
&
Universidad de Alcalá de Henares, Departamento de Física, Campus Universitario,
E-28871 Alcalá de Henares, Spain
gonzalez@isis.iem.csic.es

ISO/SWS observations of H_2O lines have provided valuable information about the water abundance in molecular shocks and envelopes sorrounding oxygen-rich evolved stars. Since H_2O is an important coolant in both type of sources, the physical conditions will be mostly determined by the excitation mechanism of this species. This will be the main subject of my contribution.

The excitation mechanism of H_2O levels depends on the excitation energy of the considered level, on the molecular hydrogen density, and on the radiation field, i.e., the dust emission. However, the relative importance of collisions and radiation in pumping of H_2O excited levels may strongly vary from source to source. On the other hand, it is now well stablished that the lowest-lying lines are observed in absorption toward some sources (i.e., SgrB2) and in emission toward others (i.e., OMC-1). Furthermore, in OMC-1 the far-infrared H_2O lines are in emission whilst lines with $\lambda < 60$ μm are in absorption (see the contribution by J. Cernicharo).

The problems outlined above will be discussed and related to future FIRST observations. Models for H_2O excitation will be presented and predictions for FIRST will be emphasized. The sensitivity and frequency resolution of FIRST will allow to determine much more precisely the physical and chemical conditions that can be derived from H_2O observations, and simultaneously to constrain much better our models of H_2O excitation.