ISO–SWS Observations of Interstellar CO_2 Ice

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Infrared absorption features near 4.3 & 15.2 μm associated with the fundamental vibrational modes of the carbon dioxide molecule (CO_2) have been observed toward 13 sources (which include 3 toward the Galactic Center and 10 embedded protostars) using the Short-Wavelength Spectrometer (SWS) aboard the Infrared Space Observatory (ISO). CO_2 has long been predicted to exist in the interstellar medium in the results of computational models and laboratory experiments involving solid H_2O and CO, but is unobservable from the ground (or even high-altitude observatories) due to the strength of its atmospheric absorptions. The column densities derived from the observed spectra indicate that CO_2 makes up 10 - 20 % of the H_2O abundance and from 0.8 - 5 times the CO abundance in each of these lines of sight. The shapes and positions of the bending mode at 15.2 μm and the stretching mode of $^{13}CO_2$ at 4.38 μm are quite sensitive to the ice environment, and their profiles are compared to laboratory data in order to determine the nature of the CO_2 ice and the molecules with which it resides.

Acknowledgments:
Based on observations with ISO, an ESA project with instruments funded by ESA Member States (especially the PI countries: France, Germany, and the United Kingdom) and with the participation of ISAS and NASA.