METHANOL IN TRANSLUCENT INTERSTELLAR MOLECULAR CLOUDS

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We have detected several low-J lines of E- and A-type methanol in 17 translucent interstellar clouds whose physical conditions and chemistry have recently been well studied. The mean fractional abundance is 1(-8), similar to the abundance of 3(-9) found in cold dark clouds. Gas-phase formation occurs via $CH_3^+ + H_2O \rightarrow CH_3OH_2^+ + h\nu$. We have verified the predictions of this simple process by using the full Standard Model of interstellar chemistry (over 3000 reactions). While most interstellar molecules are formed by gas-phase processes, these models predict CH_3OH abundances 4 orders of magnitude less than the observed abundances. We have examined grain surface chemistry in which accreted CO hydrogenates to CH_3OH on the surface under the action of UV or cosmic rays, then desorbs principally by photodesorption. These processes can easily explain the observed CH_3OH abundances, and in fact imply lower desorption efficiencies than usually adopted.