WHAT IS THE NATURE OF THE DOUBLETS IN THE E-METHANOL LAMB-DIP SPECTRA?

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A large number of methanol lines have been measured with a Lamb-dip technique in the frequency range 75-510 GHz. A few series of doublets for the transitions with selection rules ΔJ = 0, ΔK = $\pm$ 1, $\pm$ 3, $\pm$ 5, $E_1 \leftrightarrow E_2$ and ΔJ = $\pm$ 1, ΔK = $\pm$ 1 between the torsional-rotational levels of E-methanol in the ν_t = 0 state have been observed. These doublets were not predicted and were not observed earlier. In a traditional approach to the methanol molecule (as a nearly prolate asymmetric top with an internal rotation) these doublets may only originate from the magnetic hyperfine structure of the E-methanol torsional-rotational levels. However, there are some signs in spectra indicating that the doublets are sensitive to the parity selections rules. If so, the origin of the doublets is an inversion splitting of the $E(+)$ and $E(-)$ energy levels. This exciting interpretation seems to be feasible. The results of the experimental measurements will be presented and the possibility of a new type of the inversion motion in the CH_3OH molecule due to the proton tunneling in the H-O-C-H plane will be discussed .