AN ELECTRONIC SPECTROSCOPIC STUDY OF A MOLECULAR BEAM SAMPLE OF YbOH[a]

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Ytterbium monofluoride, YbF, has long been used as a venue in attempts to measure the electron electric dipole moment (eEDM)[bc] . In addition to the molecular EDM resulting from the eEDM contribution, the ^{173}Yb(16.1%, I=5/2) isotopic form of Yb-containing molecules are also expected to have an EDM caused by an interaction of a nuclear magnetic quadrupole moment (NMQM)[d] with the electrons. As pointed out by Kozyryev and Hutzler[e], certain energy levels of Yb-polyatomic molecules (e.g. YbOH, YbCCH, $YbCH_3$, and $YbOCH_3$) are expected to exhibit enhanced sensitivity for EDM measurements, relative to YbF, largely due to their ease of polarization. The properties of such molecules are poorly characterized. Here we report on our initial molecular beam studies of the known[f] $A^2\Pi_{1/2}(000)$ - $X^2\Sigma^+(000)$ transition of YbOH. The high-resolution (30 MHz) laser induced fluorescence (LIF) spectrum in the 17320 cm^{-1} to 17326 cm^{-1} range was recorded both field-free and in the presence of a static electric field. Stark spectra were analyzed to determine the molecular frame permanent electric dipole moments, μ_{el}, for the $A^2\Pi_{1/2}$ and $X^2\Sigma^+$ states. The dispersed fluorescence resulting from the excitation of rotationally resolved branch features has been analyzed to produce fluorescence branching ratios. Implications for planned EDM measurements will be presented.

[a]Funded by a grant from the Heising-Simons Foundation.

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