The ethyl radical has been isolated and spectroscopically characterized in $^4$He nanodroplets. The five fundamental CH stretch bands are observed near 3 $\mu$m and have band origins shifted $< 1$ cm$^{-1}$ from those reported for the gas phase species.$^{a,b}$ The symmetric CH$_2$ stretching band ($\nu_1$) is rotationally resolved, revealing nuclear spin statistical weights predicted by $G_{12}$ permutation-inversion group theory. A permanent electric dipole moment of 0.28 (2) D is obtained via the Stark spectrum of the $\nu_1$ band. The four other CH stretch fundamental bands are broadened in helium droplets and lack rotational fine structure. The approximately 1-2 cm$^{-1}$ line widths for these bands are attributed to the homogeneous broadening associated with solvent-mediated rovibrational relaxation dynamics. In addition to these five fundamentals, three $A'_2$ overtone/combination bands are observed and have resolved rotational substructure. These are assigned to the $2\nu_{12}$, $\nu_4+\nu_6$, and $2\nu_6$ bands through comparisons to anharmonic frequency computations at the CCSD(T)/cc-pVTZ level of theory.

\footnotesize

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