The molecular ion CH$_3^+$ is of special theoretical interest because it is both quasi-linear and exhibits a strong Renner-Teller interaction between its ground and first-excited electronic states. At linearity, the ground state is a $^2\Pi_u$ state that splits into $^3\Sigma_u^+$ and $^3\Pi_u^-$ states as the molecule bends. The $^3\Sigma_u^+$ state is linear, while the $^3\Pi_u^-$ is quasi-linear with a barrier to linearity of only 1089 cm$^{-1}$. Thus, only the ground vibrational state is bound by the barrier to linearity.

The spectrum of CH$_3^+$ in the region 11,000–13,000 cm$^{-1}$ has been recorded with our Ti:sapphire laser spectrometer. This spectrometer couples velocity modulation with heterodyne detection for near shot-noise-limited sensitivity. Since our initial letter on this spectrum, we have selectively rescanned portions of this spectrum with improved signal-to-noise. As a result, we have been able to assign the $^3\Sigma_u^+ (0, 3, 0)^3 \leftarrow ^3\Pi_u^- (0, 0, 0)^3$ band and detect the $^3\Pi_u^- (0, 9, 0)^3 \leftarrow ^3\Pi_u^- (0, 0, 0)^3$ band, whose assignment is in progress. A more detailed analysis of the entire spectrum, including spin splitting, is underway.

\footnote{J. L. Gottfried and T. Oka, J. Chem. Phys. 121, 11527 (2004).}