THE $\tilde{A}(0,9,0)^2 \leftarrow \tilde{X}(0,0,0)^3$ AND $\tilde{A}(0,9,0)^4 \leftarrow \tilde{X}(0,0,0)^3$ BANDS OF CH_2^+

CHRISTOPHER F. NEESE, CHRISTOPHER P. MORONG, JENNIFER L. GOTTFRIED, and TAKESHI OKA, *Department of Chemistry, Department of Astronomy & Astrophysics, and the Enrico Fermi Institute, The University of Chicago, Chicago IL, 60637, USA*.

The methylene ion, CH_2^+, 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 $\tilde{X}^2A_1$ and $\tilde{A}^2B_1$ states as the molecule bends. The $\tilde{A}$ state is linear, while the $\tilde{X}$ state is quasi-linear with a barrier to linearity of only 1089 cm^{-1}.
Since 2002 we have been studying the spectrum of CH_2^+ with our Ti:sapphire laser spectrometer. This spectrometer couples velocity modulation with heterodyne detection for near shot-noise-limited sensitivity. Since last year's symposium we have assigned the $\tilde{A}(0,9,0)^2 \leftarrow \tilde{X}(0,0,0)^3$ and $\tilde{A}(0,9,0)^4 \leftarrow \tilde{X}(0,0,0)^3$ bands.[a] These bands are the first high-resolution detection of $K_a = 3$ levels for the ground state. In addition, the $\tilde{A}(0,9,0)^2 \leftarrow \tilde{X}(0,0,0)^3$ can be combined with the previously studied $\tilde{A}(0,9,0)^2 \leftarrow \tilde{X}(0,0,0)^1$ band[b] to produce $K_a = 3-1$ combination differences for the ground state. The current analysis of the complete near-infrared spectrum will be discussed.

[a] The $\tilde{X}$ state is labeled using bent notation and the $\tilde{A}$ state is labeled using linear notation.
[b] J. L. Gottfried and T. Oka, *J. Chem. Phys.* **121**, 11527 (2004).