

## STRONG VIBRONIC COUPLING IN THE VISIBLE SPECTRUM OF ZIRCONIUM METHYLIDYNE

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Zirconium methylidyne, ZrCH, can be prepared by the reaction of methane (8% in helium) with laser-ablated zirconium atoms. At least 50 vibrational bands have been observed in the 565 – 665 nm region for each of ZrCH and ZrCD using laser-induced fluorescence. Dispersed emission spectra have allowed the assignment of numerous excited vibrational levels in the  $\tilde{X}^2\Sigma^+$  ground state (17 for ZrCH, 22 for ZrCD and 9 for Zr-<sup>13</sup>CH). The ground state bond lengths, as determined from high-resolution spectra of ZrCH and ZrCD, are  $r_0(\text{Zr}-\text{C}) = 1.83067(13) \text{ \AA}$  and  $r_0(\text{C}-\text{H}) = 1.0866(9) \text{ \AA}$ .  $P'$  values derived from rotational analyses of 20 subbands in the electronic spectrum (9 of ZrCH and 11 of ZrCD) reveal a very complicated level structure. Preliminary vibrational assignment suggests the presence of two interacting excited states,  $^2\Pi$  and  $^2\Delta$ , about  $250 \text{ cm}^{-1}$  apart. Many vibronically-induced bands consequently appear with unusual properties such as anomalous branch intensity patterns or upper levels with very large electrostatic (Renner-Teller) splittings between their angular momentum components.

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