In the high resolution spectrum of nitromethane near 1584 cm$^{-1}$ each of the zeroth order transitions of the lowest internal rotor state is split into a clump of 4 or 5 rovibrational transitions. Individual perturbing (dark) states are followed as a function of the $J$, $K_r$, and $K_z$ rotational quantum numbers. Four stages of vibration-torsion-rotation coupling are identified: (i) sub-picosecond $c$-axis Coriolis coupling to a torsionally excited state dark vibration ($\nu_7 + \nu_{10}$ or $\nu_8$), (ii) $a$-axis Coriolis coupling between $A_1'$ and $A_2'$ torsional states of the dark vibration, (iii) $c$-axis Coriolis coupling of the dark vibration back to dark rotational states of the asymmetric N-O stretch, and (iv) at $J=8$ and higher a strong coupling to a second torsionally excited dark vibration.

$^a$deceased