# STRONG THERMAL NONEQUILIBRIUM IN HYPERSONIC CO AND $CH_4$ PROBED BY CRDS

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A new experimental set-up coupling a High Enthalpy Source (HES) reaching 2000 K to a cw Cavity Ring-Down Spectrometer has been developed to investigate rotationnally cold hot bands of polyatomic molecules in the $[1.5, 1.7]$ $\mu$m region. The rotational and vibrational molecular degrees of freedom are strongly decoupled in the hypersonic expansion produced by the HES and probed by Cavity Ring-Down Spectroscopy. Carbon monoxide has been used as a first test molecule to validate the experimental approach. Its expansion in argon led to rotational and vibrational temperatures of $6.7 \pm 0.8$ K and $2006 \pm 476$ K, respectively. The Tetradecad polyad of methane ($1.67$ $\mu$m) was investigated under similar conditions leading to rotational and vibrational temperatures of $13 \pm 5$ K and $750 \pm 100$ K, respectively. The rotationally cold structure of the spectra reveals many hot bands involving highly excited vibrational states of methane.