

MID-INFRARED DOPPLER-FREE SATURATION ABSORPTION SPECTROSCOPY OF THE Q BRANCH OF CH₄
 $\nu_3=1$ BAND USING A RAPID-SCANNING CONTINUOUS-WAVE OPTICAL PARAMETRIC OSCILLATOR

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We have developed a mid-infrared Doppler-free saturation absorption spectroscopy apparatus using a continuous-wave optical parametric oscillator (CW-OPO). Here we report a comprehensive spectral scan of the Q branch transitions of the $\nu_3=1$ band of methane (CH₄) with an average linewidth (FWHM) of 4.5 MHz. The absolute frequency calibration was achieved using previously reported transition frequencies determined using optical frequency combs, while an etalon was used for relative frequency calibration. We report 12 transitions with improved accuracies of 3 MHz. These measurements are then used to lock to a single transition, which then can be used to access the higher polyads with a second photon via a transition that is measured through CW-CRDS.