Supporting Information B

High-resolution absorption cross sections of formaldehyde in the 30285 – 32890 cm$^{-1}$ (304 – 330 nm) spectral region

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Figure SB.1 Spectral region 32700 – 32750 cm$^{-1}$ from the $2^64^1_0$ vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with state origin increased by +0.545 cm$^{-1}$ and optimized transition dipole moment of 0.024 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.2 Spectral region 32750 – 32800 cm\(^{-1}\) from the \(v_{41}\) vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with state origin increased by +0.545 cm\(^{-1}\) and optimized transition dipole moment of 0.024 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.3 Spectral region 32800 – 32850 cm$^{-1}$ from the $2^4\Sigma^+_g$ vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with state origin increased by +0.545 cm$^{-1}$ and
optimized transition dipole moment of 0.024 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.

**Figure SB.4** Spectral region 32850 – 32890 cm\(^{-1}\) from the \(2^3\Delta_1\) vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with state origin increased by +0.545 cm\(^{-1}\) and
optimized transition dipole moment of 0.024 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.5 Spectral region 32100 – 32150 cm\(^{-1}\) from the \(^{21}\Sigma_g^+\) vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with optimized transition dipole moment of 0.015 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.6 Spectral region 32150 – 32200 cm\(^{-1}\) from the \(2_1^1\) vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with optimized transition dipole moment of 0.015 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.7 Spectral region 32200 – 32250 cm\(^{-1}\) from the \(2^{1}S_{0}\) vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with optimized transition dipole moment of 0.015 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.8 Spectral region 32250 – 32300 cm\(^{-1}\) from the \(2_{1}^{2}5_{0}^{1}\) vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with optimized transition dipole moment of 0.015 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.9 Spectral region 32300 – 32350 cm$^{-1}$ from the $^2_1^1S^1$ vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with optimized transition dipole moment of 0.015 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.10 Spectral region 32350 – 32400 cm\(^{-1}\) from the \(\nu_{10}^{\text{2l}}\) vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with optimized transition dipole moment of 0.015 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.11 Spectral region 32400 – 32440 cm\(^{-1}\) from the \(2^1 \Sigma^+_{\Pi} \rightarrow 2^1 \Sigma^+_\Pi\) vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with optimized transition dipole moment of 0.015 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.12 Spectral region 31600 – 31650 cm\(^{-1}\) from the \(\tilde{2}^3 \tilde{A}^1\) vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with state origin increased by +0.315 cm\(^{-1}\) and optimized transition dipole moment of 0.0245 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.13 Spectral region 31650 – 31700 cm\(^{-1}\) from the \(2_{20}^34_{10}\) vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with state origin increased by +0.315 cm\(^{-1}\) and optimized transition dipole moment of 0.0245 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.14 Spectral region 31700 – 31750 cm$^{-1}$ from the $2^3\Sigma_{u}^+ - 4^1\Sigma_{g}^+$ vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with state origin increased by +0.315 cm$^{-1}$ and optimized transition dipole moment of 0.0245 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.15 Spectral region 31750 – 31800 cm$^{-1}$ from the $^{23}_{00}^{4}$ vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with state origin increased by +0.315 cm$^{-1}$ and optimized transition dipole moment of 0.0245 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.16 Spectral region 31800 – 31850 cm$^{-1}$ from the $2^3a_1^1$ vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with state origin increased by +0.315 cm$^{-1}$ and optimized transition dipole moment of 0.0245 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.17 Spectral region 31850 – 31900 cm$^{-1}$ from the $2^2 \Pi_{1/2}$ $4^1 \Pi_{1/2}$ vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with state origin increased by +0.315 cm$^{-1}$ and optimized transition dipole moment of 0.0245 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.18 Spectral region 31300 – 31350 cm\(^{-1}\) from the \(2^2_0^4_0^3\) vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with state origin increased by +1 cm\(^{-1}\) and optimized transition dipole moment of 0.021 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.19 Spectral region 31350 – 31400 cm$^{-1}$ from the $^2\Pi_{1/2}^3 \rightarrow ^4\Pi_{1/2}^3$ vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with state origin increased by +1 cm$^{-1}$ and optimized transition dipole moment of 0.021 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.20 Spectral region 31400 – 31450 cm$^{-1}$ from the $2^2_0$-$4^3_0$ vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with state origin increased by +1 cm$^{-1}$ and optimized transition dipole moment of 0.021 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.21 Spectral region 31450 – 31500 cm\(^{-1}\) from the \(\tilde{2}^2 4_\Pi^3\) vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with state origin increased by +1 cm\(^{-1}\) and optimized transition dipole moment of 0.021 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.22 Spectral region 31500 – 31550 cm$^{-1}$ from the $^2\tilde{g}_u^2 \tilde{g}_u^3$ vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with state origin increased by +1 cm$^{-1}$ and optimized transition dipole moment of 0.021 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.23 Spectral region 31550 – 31590 cm$^{-1}$ from the $2^3_{00} + ^3_{44}$ vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with state origin increased by +1 cm$^{-1}$ and optimized transition dipole moment of 0.021 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale. This region was used to adjust the state origin.
Figure SB.24 Spectral region 30450 – 30500 cm$^{-1}$ from the $2^2_{0^0} 4^1_{0^0}$ vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with optimized transition dipole moment of 0.026 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.25 Spectral region 30500 – 30550 cm$^{-1}$ from the $2^2_0^0$ $4^1_0$ vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with optimized transition dipole moment of 0.026 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.26 Spectral region 30550 – 30600 cm$^{-1}$ from the $^{2}_{0}0^{1}_{0}$ vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with optimized transition dipole moment of 0.026 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.27 Spectral region 30600 – 30650 cm$^{-1}$ from the $2^2 \Pi_{1}^1 - 4^2 \Pi_0^0$ vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with optimized transition dipole moment of 0.026 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.28 Spectral region 30650 – 30700 cm\(^{-1}\) from the \(^{2}_{0} ^{4}_{1}\) vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with optimized transition dipole moment of 0.026 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.29 Spectral region 30700 – 30750 cm\(^{-1}\) from the \(^{2}A^\prime_A^{1}\) vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with optimized transition dipole moment of 0.026 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.30 Spectral region 30280 – 30330 cm$^{-1}$ from the $^{2}A_{u}^{1/2}$ vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with optimized transition dipole moment of 0.020 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.31 Spectral region 30330 – 30380 cm$^{-1}$ from the $2^1 I_0^3$ vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with optimized transition dipole moment of 0.020 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.
Figure SB.32 Spectral region 30380 – 30420 cm$^{-1}$ from the $2^14^3$ vibronic band. Top: comparison between measured absorption cross section and PGOPHER simulation (inverted) with optimized transition dipole moment of 0.020 D. Bottom: difference between the experimental and simulated spectra, plotted on the same vertical scale.