

練習実験報告

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May 25, 2024

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Contents

Galvano Sepctrum

REMPI scan

- Selected peaks

- Radius and angular distributions

- Peak assignments

- Speed correction

Contents

Galvano Sepctrum

REMPI scan

- Selected peaks

- Radius and angular distributions

- Peak assignments

- Speed correction

Galvano Sepctrum



Fig. 1: Wavelen. correction

Galvano Sepctrum

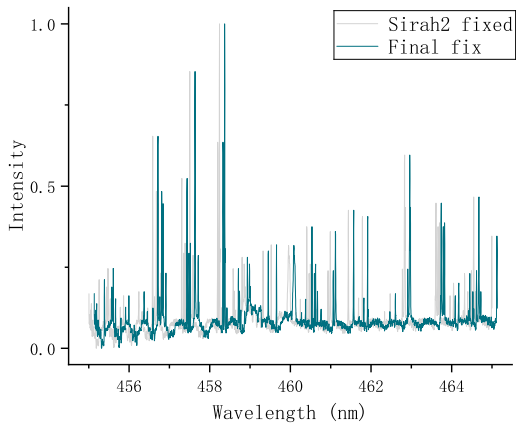


Fig. 1: Wavelen. correction

Galvano Sepctrum

Correction

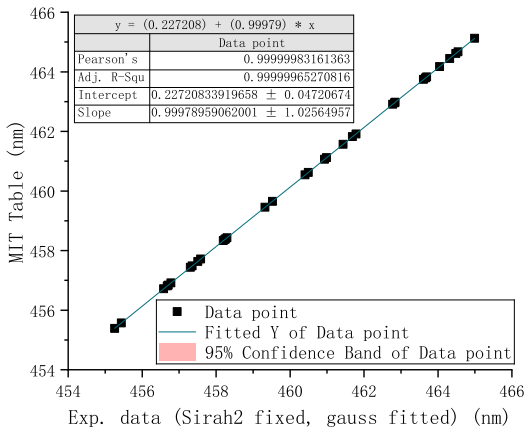


Fig. 2: Correction function

Contents

Galvano Sepctrum

REMPI scan

- Selected peaks

- Radius and angular distributions

- Peak assignments

- Speed correction

Contents

Galvano Sepctrum

REMPI scan

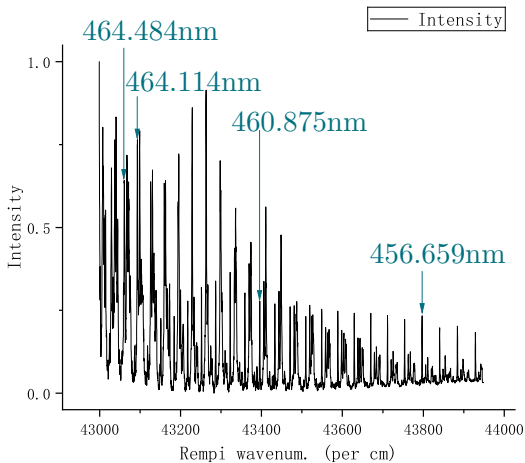
- Selected peaks

- Radius and angular distributions

- Peak assignments

- Speed correction

Selected peaks



Contents

Galvano Sepctrum

REMPI scan

- Selected peaks

- Radius and angular distributions

- Peak assignments

- Speed correction

Contents

Galvano Sepctrum

REMPI scan

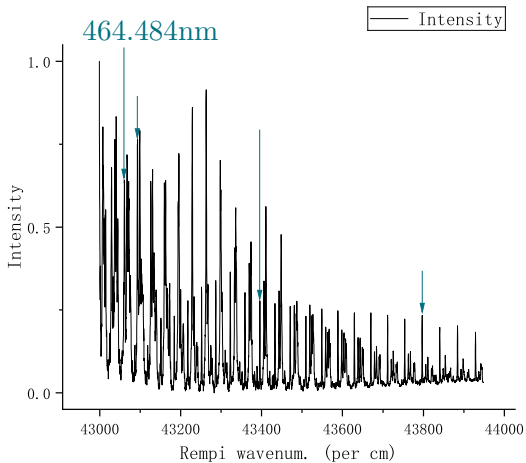
Selected peaks

Radius and angular distributions

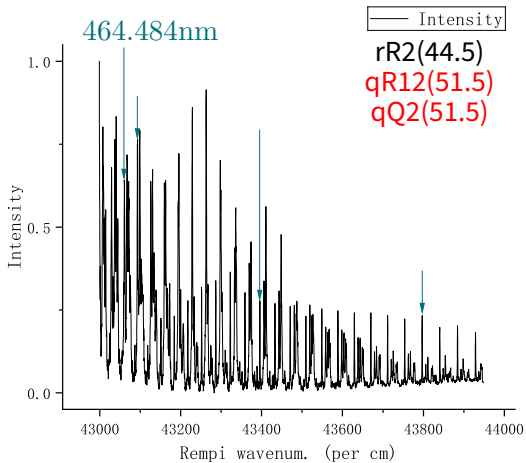
Peak assignments

Speed correction

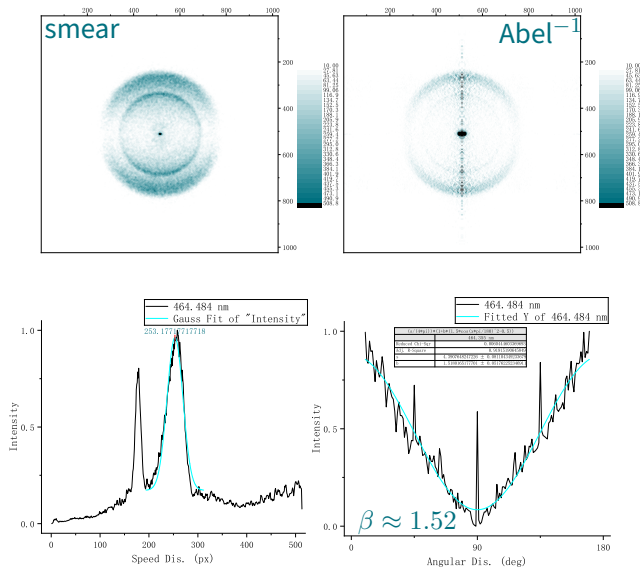
Peak 1



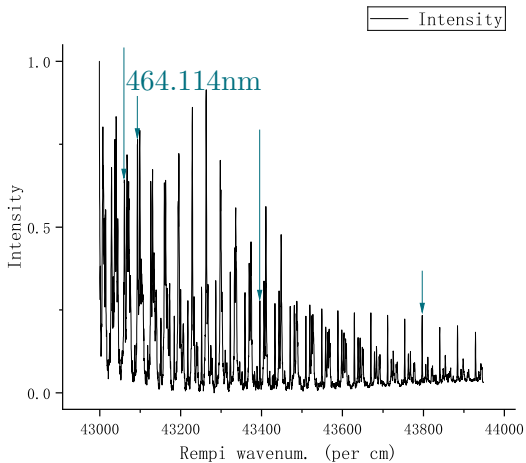
Peak 1



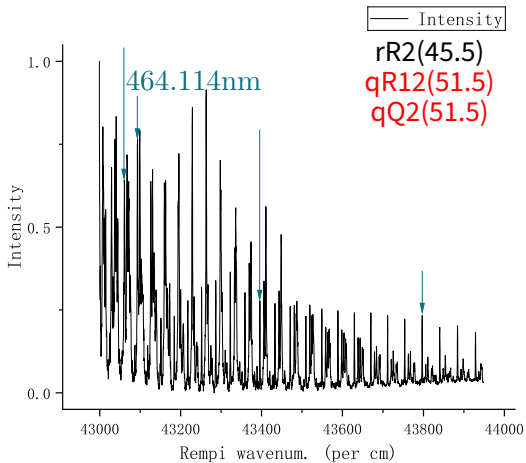
Peak 1



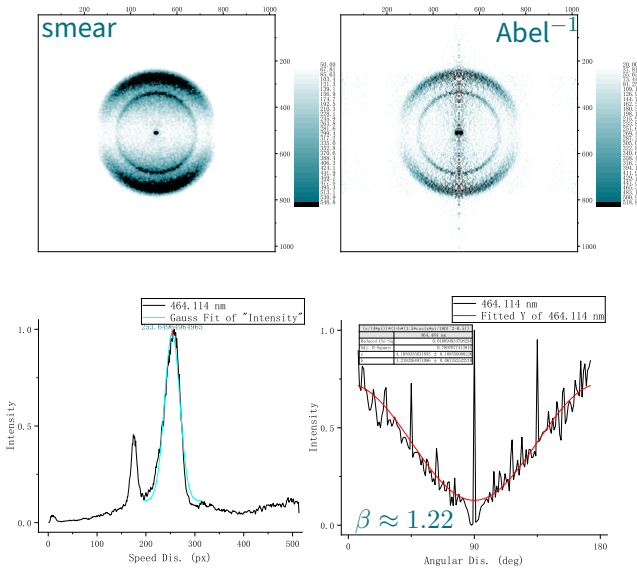
Peak 2



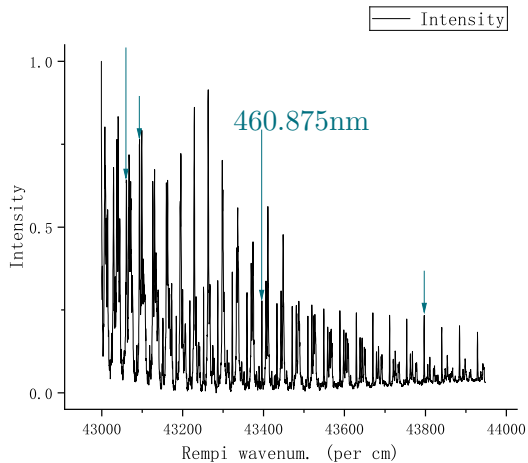
Peak 2



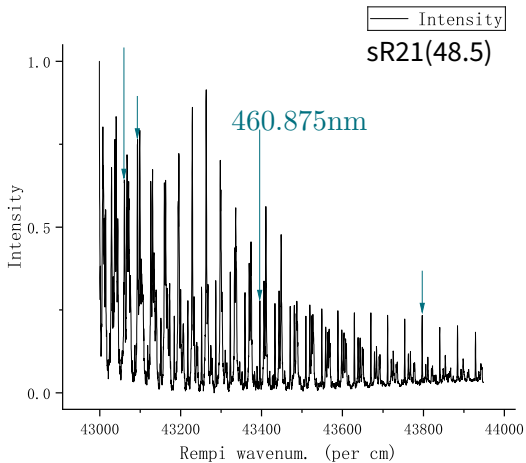
Peak 2



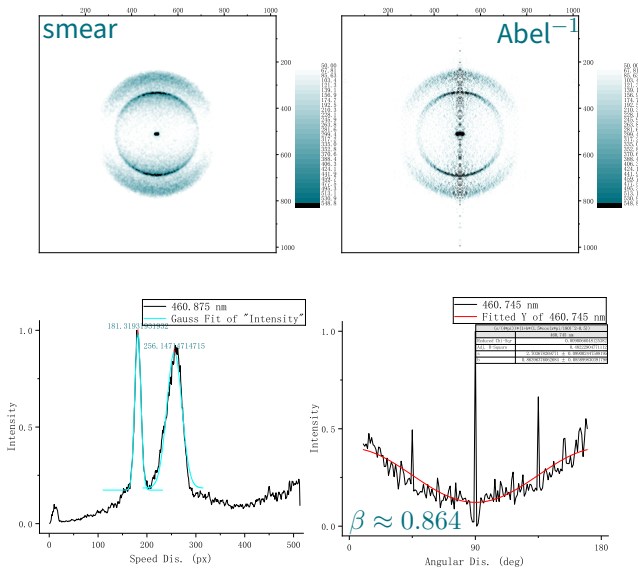
Peak 3



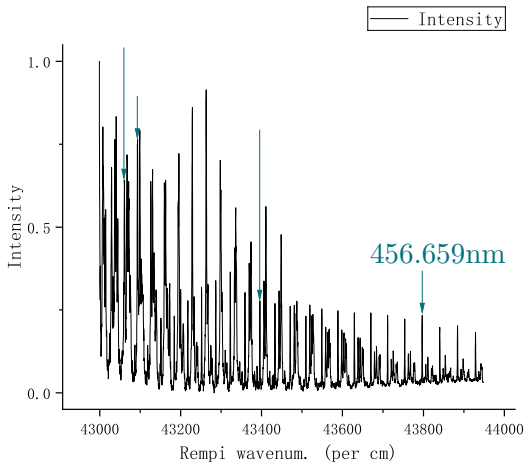
Peak 3



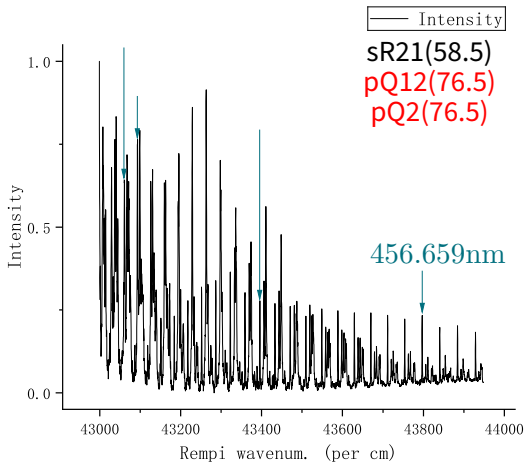
Peak 3



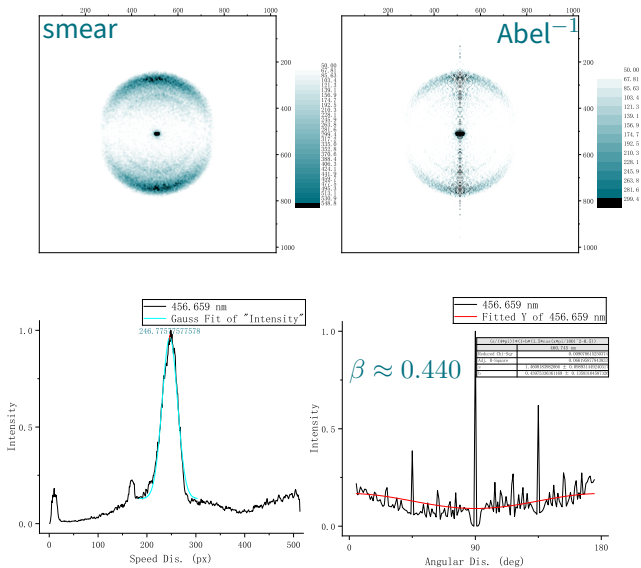
Peak 4



Peak 4



Peak 4



Contents

Galvano Sepctrum

REMPI scan

Selected peaks

Radius and angular distributions

Peak assignments

Speed correction

Contents

Galvano Sepctrum

REMPI scan

Selected peaks

Radius and angular distributions

Peak assignments

Speed correction

Peak assignments

464.484nm $\approx 43058.49\text{cm}^{-1}$	464.114nm $\approx 43092.81\text{cm}^{-1}$	460.875nm $\approx 43395.69\text{cm}^{-1}$	456.659nm $\approx 43796.34\text{cm}^{-1}$
px = 253.177	px = 253.650	px = 181.319 & 256.147	px = 246.776
<i>rR2</i> 44.5 <i>qR12</i> 51.5 <i>qQ2</i> 51.5	<i>rR2</i> 45.5 <i>qR12</i> 51.5 <i>qQ2</i> 51.5	<i>sR21</i> 48.5	<i>sR21</i> 58.5 <i>pQ12</i> 76.5 <i>pP2</i> 76.5

Notice

Colored assignments are mismatched, and will not be used to calculate.

Contents

Galvano Sepctrum

REMPI scan

Selected peaks

Radius and angular distributions

Peak assignments

Speed correction

Contents

Galvano Sepctrum

REMPI scan

Selected peaks

Radius and angular distributions

Peak assignments

Speed correction

Speed correction

y trans. energy of NO

	E_{total}	$E_{\text{bond}}(\text{O}-\text{NO})^1$	$E_{\text{int.}}(\text{NO})$
Peak 1 464.484nm	43 058.49cm ⁻¹	25 128.57cm ⁻¹	$\Delta E_v(1 \rightarrow 0) + E(J = 44)$
Peak 2 464.114nm	43 092.81cm ⁻¹		$\Delta E_v(1 \rightarrow 0) + E(J = 45)$
Peak 3 460.875nm	43 395.69cm ⁻¹		$\Delta E_v(1 \rightarrow 0) + E(J = 48)$
Peak 4 456.659nm	43 796.34cm ⁻¹		$\Delta E_v(1 \rightarrow 0) + E(J = 58)$

¹Rémy Jost et al. *The Journal of Chemical Physics* **105.3** (July 1996).

Speed correction

y trans. energy of NO

	E_{total}	$E_{\text{bond}}(\text{O}-\text{NO})^2$	$E_{\text{int.}}(\text{NO})$
Peak 1 464.484nm	43 058.49cm ⁻¹	25 128.57cm ⁻¹	2341.932 775 0cm ⁻¹ + $E(J = 44)$
Peak 2 464.114nm	43 092.81cm ⁻¹		2341.932 775 0cm ⁻¹ + $E(J = 45)$
Peak 3 460.875nm	43 395.69cm ⁻¹		2341.932 775 0cm ⁻¹ + $E(J = 48)$
Peak 4 456.659nm	43 796.34cm ⁻¹		2341.932 775 0cm ⁻¹ + $E(J = 58)$

²Rémy Jost et al. *The Journal of Chemical Physics* **105.3** (July 1996).

³J. Danielak et al. *Journal of Molecular Spectroscopy* **181.2** (1997), pp. 394–402.

Speed correction

y trans. energy of NO

	E_{total}	$E_{\text{bond}}(\text{O}-\text{NO})^2$	$E_{\text{int.}}(\text{NO})$
Peak 1 464.484nm	43 058.49cm ⁻¹	25 128.57cm ⁻¹	2341.932 775 0cm ⁻¹ + $E(J = 44)$
Peak 2 464.114nm	43 092.81cm ⁻¹		2341.932 775 0cm ⁻¹ + $E(J = 45)$
Peak 3 460.875nm	43 395.69cm ⁻¹		2341.932 775 0cm ⁻¹ + $E(J = 48)$
Peak 4 456.659nm	43 796.34cm ⁻¹		2341.932 775 0cm ⁻¹ + $E(J = 58)$

Vib. energy level³

$$E_v = \omega_e \left(v + \frac{1}{2}\right) - \omega_e x_e \left(v + \frac{1}{2}\right)^2 + \omega_e y_e \left(v + \frac{1}{2}\right)^3.$$

²Rémy Jost et al. *The Journal of Chemical Physics* **105.3** (July 1996).

³J. Danielak et al. *Journal of Molecular Spectroscopy* **181.2** (1997), pp. 394–402.

Speed correction

y trans. energy of NO

	E_{total}	$E_{\text{bond}}(\text{O}-\text{NO})^4$	$E_{\text{int.}}(\text{NO})$
Peak 1 464.484nm	43 058.49cm ⁻¹	25 128.57cm ⁻¹	5814.033cm ⁻¹
Peak 2 464.114nm	43 092.81cm ⁻¹		5965.969cm ⁻¹
Peak 3 460.875nm	43 395.69cm ⁻¹		6239.696cm ⁻¹
Peak 4 456.659nm	43 796.34cm ⁻¹		8004.278cm ⁻¹

⁴Rémy Jost et al. *The Journal of Chemical Physics* **105**.3 (July 1996).

⁵J. Danielak et al. *Journal of Molecular Spectroscopy* **181**.2 (1997), pp. 394–402.

⁶Colin M. Western. *Journal of Quantitative Spectroscopy and Radiative Transfer* **186** (2017), pp. 221–242.

Speed correction

y trans. energy of NO

	E_{total}	$E_{\text{bond}}(\text{O}-\text{NO})^4$	$E_{\text{int.}}(\text{NO})$
Peak 1 464.484nm	43 058.49cm ⁻¹	25 128.57cm ⁻¹	5814.033cm ⁻¹
Peak 2 464.114nm	43 092.81cm ⁻¹		5965.969cm ⁻¹
Peak 3 460.875nm	43 395.69cm ⁻¹		6239.696cm ⁻¹
Peak 4 456.659nm	43 796.34cm ⁻¹		8004.278cm ⁻¹

Rot. energy level⁵

Simulated data generated by PGOPHER⁶.

⁴Rémy Jost et al. *The Journal of Chemical Physics* **105.3** (July 1996).

⁵J. Danielak et al. *Journal of Molecular Spectroscopy* **181.2** (1997), pp. 394–402.

⁶Colin M. Western. *Journal of Quantitative Spectroscopy and Radiative Transfer* **186** (2017), pp. 221–242.

Speed correction

y trans. energy of NO

$E_{\text{int.}}^{(O)}$	$E_{\text{trans}}(\text{total}) \approx 2.875464 E_{\text{trans}}(\text{NO})$ $= E_{\text{total}} - E_{\text{bond}}(\text{O-NO}) - E_{\text{int.}}(\text{O}) - E_{\text{int.}}(\text{NO})$	$E_{\text{trans}}(\text{NO})$ $= \frac{1}{2} m(\text{NO}) v^2(\text{NO})$
3P_2	11081.356cm ⁻¹	4375.588cm ⁻¹
	10964.609cm ⁻¹	4334.685cm ⁻¹
	10794.143cm ⁻¹	4344.824cm ⁻¹
(0cm ⁻¹)	9398.766cm ⁻¹	3870.489cm ⁻¹
3P_1	10922.731cm ⁻¹	4320.423cm ⁻¹
	10805.984cm ⁻¹	4279.520cm ⁻¹
	10635.518cm ⁻¹	4289.659cm ⁻¹
(158.625cm ⁻¹)	9240.141cm ⁻¹	3815.324cm ⁻¹
3P_0	10854.379cm ⁻¹	4296.653cm ⁻¹
	10737.632cm ⁻¹	4255.749cm ⁻¹
	10567.166cm ⁻¹	4265.888cm ⁻¹
(226.977cm ⁻¹)	9171.789cm ⁻¹	3791.553cm ⁻¹

⁷Charlotte Emma Moore and Jean W. Gallagher. "Tables of spectra of hydrogen, carbon, nitrogen, and oxygen atoms and ions". 1993.

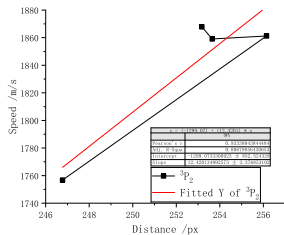
Speed correction

y Trans. speed of NO

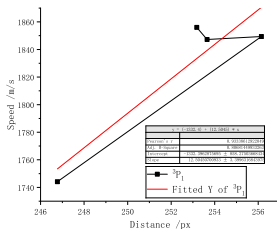
$E_{\text{int.}}(\text{O})$	$v(\text{NO}) = \sqrt{\frac{2E_{\text{trans}}(\text{NO})}{m(\text{NO})}}$	Δy
3P_2 (0cm^{-1})	1867.845m s ⁻¹	253.177
	1859.094m s ⁻¹	253.650
	1861.267m s ⁻¹	256.147
	1756.732m s ⁻¹	246.776
3P_1 (158.625cm^{-1})	1856.033m s ⁻¹	253.177
	1847.226m s ⁻¹	253.650
	1849.413m s ⁻¹	256.148
	1744.168m s ⁻¹	246.776
3P_0 (226.977cm^{-1})	1850.920m s ⁻¹	253.177
	1842.089m s ⁻¹	253.650
	1844.282m s ⁻¹	256.147
	1738.726m s ⁻¹	246.776

Speed correction

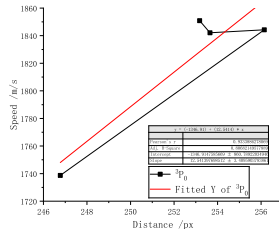
y Trans. speed of NO



$12.42 \text{ m s}^{-1} / \text{px} @ {}^3P_2$



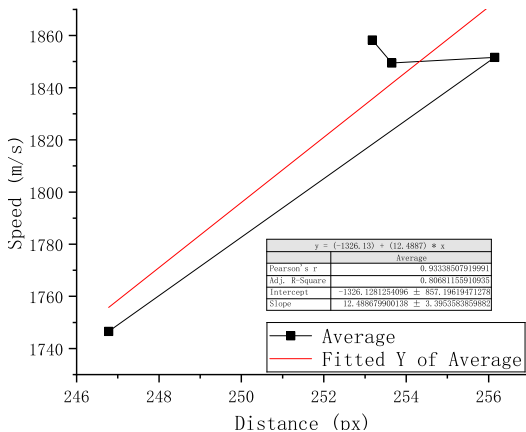
$12.54 \text{ m s}^{-1} / \text{px} @ {}^3P_1$



$12.50 \text{ m s}^{-1} / \text{px} @ {}^3P_0$

Speed correction

y Trans. speed of NO



$12.49 \text{ m s}^{-1} / \text{px} @ \text{Average}$

Reference

- [1] J. Danielak et al. *Journal of Molecular Spectroscopy* **181.2** (1997), pp. 394–402.
- [2] Rémy Jost et al. *The Journal of Chemical Physics* **105.3** (July 1996).
- [3] Charlotte Emma Moore and Jean W. Gallagher. “Tables of spectra of hydrogen, carbon, nitrogen, and oxygen atoms and ions”. 1993.
- [4] Colin M. Western. *Journal of Quantitative Spectroscopy and Radiative Transfer* **186** (2017), pp. 221–242.