**Go to end for table detailing all NO\_xxx.sxy and SCAN\_xxx files.**

**Analysis of this data can be found in C:\Jack Eardley PhD documents\2017\April\22-31 and C:\Jack Eardley PhD documents\2017\May.**

19.4.17

Made molecular beam of 0.08 Bar NO2 in 4 Bar argon, backing pressure 3.65 mBar.

396 nm laser gave 0.3 mJ/pulse power with 250 us Q-switch delay, unfocussed.

225 nm laser gave 0.15 mJ/pulse power with a 500 mm focus

Chamber pressure empty: 4.2E-7 mBar

Molecular beam leak pressure: 8E-6 mBar

Molecular beam running: 1E-5 mBar

Could detect NO in molecular beam (residue) and from NO2 dissociation but could not see any O signal.

20.4.17

Find lasers on fast photodioide and ensure timing for photostop is correct with 50 ns delay between lasers.

Took data of NO scans but could not find O.

21.4.17

New molecular beam made with 0.152 Bar NO2 and 4 Bar argon giving 4 % NO2 beam.

Realigned both laser, 225 nm now uses 300 mm lens to focus and 390 nm uses 500 mm lens slightly off focal point to give focussed light.

Blackened the lines of the gas source lines to ensure minimal photodegredation of sensitive NO2 molecules.

Took NO2 scan data

24.4.17

New molecular beam of 0.56 Bar NO2 in 4 Bar argon.

Found O+ signal from photodissociation after long search. 5.938 to 6.04 ms time of flight for O+.

Took data of O and NO from dissociation images

25.4.17

Optimise laser temporal and spatial overlaps.

Started systematic data labelling.

26.4.17

Took more data, noticed NO has lorentzian line widths in spectrum. Images showed molecular beam misaligned.

1.5.17

New Teflon poppet for molecular beam, usually more reliable than the macor.

New molecular beam backing mix of 0.076 Bar NO2 in 4.5 Bar argon (2 %) changed molecular beam firing time to find peak in molecular beam for new poppet.

Took data.

2.5.17

Made new molecular beam mix at 4.5 Bar Argon (4.3 % NO2)

Observed a far lower molecular beam leak rate from Teflon poppet

Optimise molecular beam sealing spring tension

Took data.

Found new reliable VMI voltage settings of R=2000, E1= 1723 and E2=1665 V.

Replaced aluminium enhanced mirrors after 390 nm dye laser with dichroics and saw power increase.

3.5.17

Made new Coumarin 2 dye for 226 nm laser

Optimise signal

4.5.17

Take data

5.5.17

Take data

6.5.17

New molecular beam, 0.2 Bar NO2 in 4.5 Bar argon, 4.4 % NO2 in Argon, 3.9 Bar backing pressure.

Take data

9.5.17

New beam 0.248 Bar NO2 in 3.789 Bar Xenon, 6.5 % NO2 in xenon.

Take data

10.5.17

Take data

11.5.17

Molecular beam backing pressure 3 Bar.

Take data.

Concluded that higher backing pressures give lower beam speeds, also higher dissociation wavelengths are better.

|  |  |
| --- | --- |
| **Filename** | **Description** |
| NO\_000 | Probe wavelength=226.808, dissociation wavelength=390 on NO 2Pi3/2, P12, J=1.5 line, image of NO2 dissociation. |
| NO\_001 | Same as above without dissociation laser to give background measurement |
| NO\_002 | Same conditions as NO\_000 but different molecular beam delay time to take measurement before molecular beam arrives to see thermal background |
| NO\_003 | All lasers and molecular beam off, ion gauge on in detection chamber to give isotropic distribution of ions and find the burn hole in the detector |
| SCAN\_000 | Scan across NO 2Pi3/2, P12, J=1.5 line at dissociation wavelength 390 nm |
| SCAN\_001 | Scan across O 3P2 line at dissociation wavelength of 390 nm(signal saturated at peak) |
| SCAN\_002 | Repeat SCAN\_001 with higher resolution and lower probe laser power |
| NO\_004 | Image of O in 3P2 state, dissociation laser wavelength 390 nm, probe laser at 225.5702 nm |
| NO\_005 | Repeat measurement NO\_004 with 225.5694 nm probe laser |
| NO\_006 | Repeat NO\_004 with probe laser at 225.5718 nm |
| 26/04/17 |  |
| NO\_007 | Photodissociation of NO2 at 390 nm, probe laser at 225.5756 nm |
| NO\_008 | Same as NO\_007 with 394 nm dissociation laser |
| NO\_009 | Same as NO\_007 with 386 nm dissociation laser |
| NO\_010 | Same as NO\_007 with 382 nm dissociation laser |
| NO\_011 | 226.1440 nm probe laser to image NO 2Pi1/2 state, no dissociation laser on to view molecular beam velocity profile |
| 1/5/17 |  |
| NO\_012 | 226.1440 nm probe laser for NO 2Pi1/2 state with dissociation laser at 388 nm, new nozzle Teflon poppet |
| NO\_013 | 225.5728 nm probe laser for oxygen 3p2 line dissociation at 388 nm, molecular beam delay time 353.17 us. |
| NO\_014 | Probe laser same as NO\_013 dissociation laser at 386 nm, 352.17 us molecular beam delay |
| NO\_015 | Same as NO\_014 with 393 nm dissociation laser |
| NO\_016 | Same as NO\_014 with 395 nm dissociation laser |
| NO\_017 | Same as NO\_014 with 397 nm dissociation laser |
| NO\_018 | Same as NO\_014 with 398 nm dissociation laser |
| NO\_019 | Probe laser at 226.1440 nm, dissociation laser off, measure molecular beam velocity distribution |
| NO\_020 | Thermal background measurement with same conditions as NO\_019 but laser timed before molecular beam arrival so as to measure background gas |
| NO\_021 | 225.5728 nm probe laser, no dissociation laser, look for O+ mass at 5.938 to 6.048 us TOF delay, maximum laser power. |
| NO\_022 | Same probe laser as NO\_021, 395 nm dissociation laser, 352.17 us molec beam delay time |
| NO\_023 | Same as NO\_022 but with 362.17 us molecular beam delay |
| NO\_024 | 372.17 us same as above all other settings |
| NO\_025 | 382.17 us |
| NO\_026 | 392.17 us |
| NO\_027 | 412.17 us |
| NO\_028 | 442.17 us |
| NO\_029 | 472.17 us |
| NO\_030 | 342.17 us |
| NO\_031 | 332.17 us |
| NO\_032 | 322.17 us |
| NO\_033 | 302.17 us |
| NO\_034 | 282.17 us |
| NO\_035 | 252.17 us |
| NO\_036 | 222.17 us |
| 2/5/17 |  |
| NO\_037 | 226.8073 nm probe laser, NO at 2Pi3/2, P12, J=3/2, 394.4 nm dissociation laser wavelength (measured by wavemeter lambda(vac)), 8.188 to 8.228 us TOF time. |
| NO\_038 | Repeat NO\_037 with 392.597 nm dissociation laser |
| NO\_039 | 390.2914 nm dissociation laser with same other settings as NO\_037 |
| NO\_040 | 388.3883 nm dissociation laser with same other settings as NO\_037 |
| NO\_041 | Same as NO\_040 but with a more intense molecular beam (different spring settings) |
| NO\_042 | Thermal NO measurement with dissociation laser at 388.3883 nm and 226.140 nm probe laser |
| NO\_043 | NO in molecular beam to give velocity profile, same lasers as NO\_042 |
| 4/5/17 |  |
| NO\_044 | 370 us molecular beam delay, 4.4% NO2 in Argon at 3.4 Bar backing pressure, 5.961 to 6.001 us TOF delay time, 225.5728 nm probe laser wavelength, 395.1 nm dissociation laser, 3500 shots, looking at Oxygen atoms |
| NO\_045 | Same as NO\_044 with 394.9 nm dissociation laser |
| NO\_046 | Same as NO\_044 with 394.7 nm dissociation laser |
| NO\_047 | Same as NO\_044 with 394.5 nm dissociation laser |
| NO\_048 | Same as NO\_044 with 394.3 nm dissociation laser |
| NO\_049 | Same as NO\_044 with 394.1 nm dissociation laser |
| NO\_050 | No dissociation laser, 226.1440 nm probe laser, molecular beam velocity profile image. |
| NO\_051 | Background thermal gas measurement with same settings as NO\_050 but measuring before molecular beam arrival |
| 5/5/17 |  |
| NO\_052 | 394.55 nm dissociation laser (wavemeter measured), 225.5694 nm probe laser wavelength, 5.945 to 5.985 us TOF delay time, molecular beam 404.17 us delay time, it appeared that the probe laser was not evenly sampling O velocities in the laser axis most probably due to a Doppler shift. |
| NO\_053 | Same settings as NO\_052 but with a continuously scanned probe laser from 225.57 to 225.563 nm, this way the Doppler shift is accounted for, also dissociation laser wavelength = 394.2971 nm |
| 6/5/17 |  |
| NO\_054 | 226.1420 nm probe laser wavelength, early in molecular beam speed measurement, 300 us molecular beam firing delay, NO mass window, no dissociation laser |
| NO\_055 | 5.8855 to 6.0155 us TOF mass window, 394.55 nm dissociation laser wavelength, 225.57 to 225.565 nm probe wavelength scan, 300 us molecular beam delay time |
| NO\_056 | Repeat NO\_055 with 391.9966 nm dissociation laser wavelength |
| NO\_057 | 390 nm dissociation laser wavelength other settings same as NO\_055 |
| 9/5/17 |  |
| NO\_058 | Xenon molecular beam (6.5% NO2), no dissociation laser, 226.142 nm probe laser wavelength, 480 us molecular beam delay time, 1.2E-5 mBar source chamber pressure whilst running beam |
| NO\_059 | Same as NO\_058 but with full probe laser power and measuring before molecular beam arrives to measure thermal background gas |
| NO\_060 | 393.9234 nm dissociation laser (wavemeter measured) 225.5681 nm probe, measuring O 3P2, use central probe laser wavelength to avoid having to scan the probe. 460 us molecular beam delay time |
| NO\_061 | Repeat NO\_060 with 393.8854 nm dissociation laser (measured by dye laser) |
| NO\_062 | 226.1090 nm probe laser for NO 2Pi1/2 J=8, omega=8.5, 393.9234 nm dissociation laser wavelength |
| NO\_063 | NO 2Pi1/2 J=7 226.13 nm probe and 393.9234 nm dissociation laser |
| SCAN\_004 | NO 2Pi1/2 scan, 393.9234 nm dissociation laser wavelength, Xenon NO2 molecular beam |
| NO\_064 | NO 2Pi1/2 J=1, 226.1850 nm probe and same dissociation laser as NO\_063 |
| NO\_065 | NO 2Pi1/2 J=2, 226.2066 nm probe and same dissociation laser as NO\_063 |
| NO\_066 | NO 2Pi1/2 J=3, 226.2260 nm probe and same dissociation laser as NO\_063 |
| NO\_067 | NO 2Pi1/2 J=4, 226.2420 nm probe and same dissociation laser as NO\_063 |
| NO\_068 | NO 2Pi1/2 J=5, 226.1520 nm probe and same dissociation laser as NO\_063 |
| NO\_069 | NO 2Pi1/2 J=6, 226.1450 nm probe and same dissociation laser as NO\_063 |
| NO\_070 | NO 2Pi1/2 J=7, 226.1290 nm probe and same dissociation laser as NO\_063 |
| NO\_071 | NO 2Pi1/2 J=8, 226.1130 nm probe and same dissociation laser as NO\_063 |
| NO\_072 | NO 2Pi1/2 J=9, 226.0910 nm probe and same dissociation laser as NO\_063 |
| NO\_073 | NO 2Pi1/2 J=10, 226.0680 nm probe and same dissociation laser as NO\_063 |
| NO\_074 | NO 2Pi1/2 J=11, 226.0470 nm probe and same dissociation laser as NO\_063 |
| NO\_075 | NO 2Pi1/2 J=12, 226.2530 nm probe and same dissociation laser as NO\_063 |
| NO\_076 | O 3P2 393.9234 nm dissociation laser wavelength, scan probe laser from 225.5655 to 225.5617 nm, zero time delay between dissociation and probe laser. |
| NO\_077 | Repeat NO\_076 with 100 ns delay between dissociation and probe laser |
| NO\_078 | Repeat NO\_076 with 300 ns delay between dissociation and probe laser also fixed probe at 225.5624 nm (centre of transition, to save time) |
| NO\_079 | Repeat NO\_078 with 600 ns delay between dissociation and probe laser |
| NO\_080 | Repeat NO\_078 with 1000 ns delay between dissociation and probe laser |
| 10/5/17 |  |
| NO\_081 | 226.1515 nm probe laser wavelength, 460 us molecular beam delay time, 3.25 Bar molecular beam backing pressure, no dissociation laser. Beam speed measurement |
| NO\_082 | Same as NO\_081 but with molecular beam delay=0 to measure thermal background before molecular beam arrives |
| NO\_083 | 393.702 nm dissociation laser wavelength, O mass window, 460 us molecular beam delay time, scan probe laser wavelength from 225.5692 to 225.5658 nm, zero delay between lasers |
| NO\_084 | Repeat NO\_083 with 100 ns delay time between dissociation and probe lasers |
| NO\_085 | Repeat NO\_083 with 300 ns delay time between dissociation and probe lasers |
| NO\_086 | Repeat NO\_083 with 500 ns delay time between dissociation and probe lasers |
| NO\_087 | Repeat NO\_083 with 800 ns delay time between dissociation and probe lasers |
| NO\_088 | Repeat NO\_083 with 1200 ns delay time between dissociation and probe lasers |
| NO\_089 | Repeat NO\_083 with 1500 ns delay time between dissociation and probe lasers |
| NO\_090 | Repeat NO\_083 with 1900 ns delay time between dissociation and probe lasers |
| 11/5/17 |  |
| NO\_091 | 490 us molecular beam delay time, 226.152 nm probe laser wavelength, no dissociation laser, molecular beam speed measurement, 3 Bar backing pressure |
| NO\_092 | 0 molecular beam delay time, other conditions same as NO\_091, thermal NO background measurement |
| NO\_093 | Scan probe from 225.5662 to 225.5648 nm, 490 us molecular beam delay, 392.5778 nm dissociation laser wavelength. Zero photostop delay time. |
| NO\_094 | 393.0935 nm dissociation laser wavelength, other settings same as NO\_093 |