The Brouard Group

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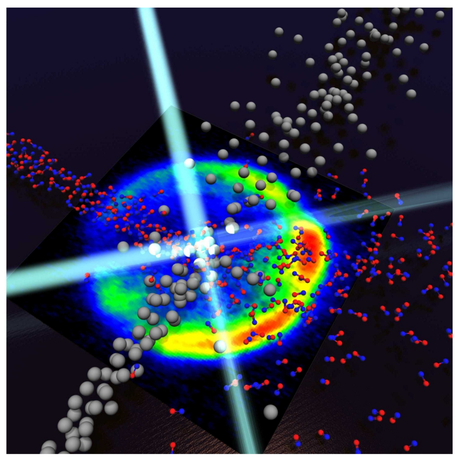
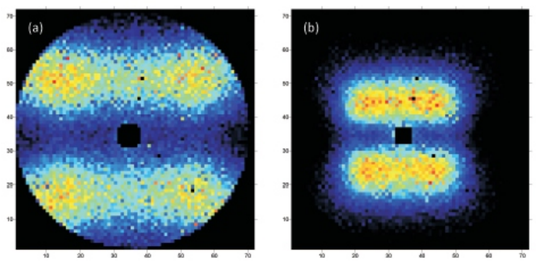
A Brief Overview



Investigations into the dynamics of gas phase chemical processes and collisions using ion imaging techniques.

Simulations and development of models to describe these fundamental processes.

Development and application of chemical imaging techniques used in medical sciences, and for high throughput chemical analysis.



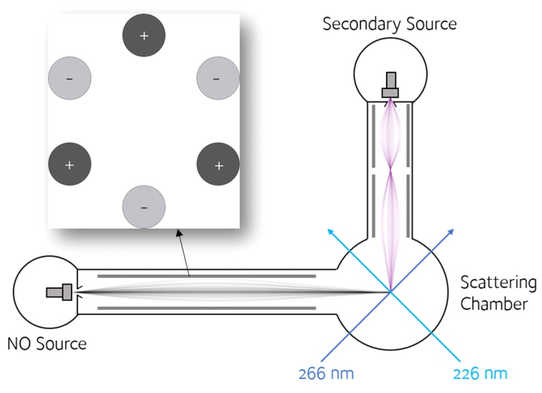
Raw ion images of the Br^+ and F^+ ion fragments following the Coulomb explosion of the DBrDFCyBPh molecule.

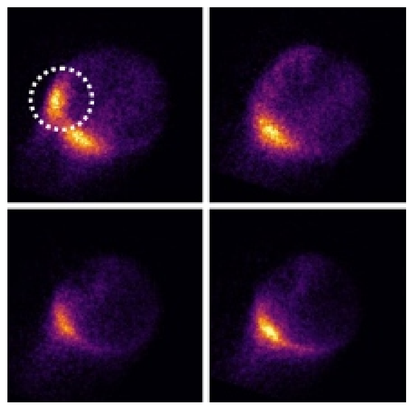
State-Resolved Oriented Scattering

Our experiment determines the velocity distribution of quantum state-selected, scattered NO following a collision with an atom or molecule, such as a symmetric top.

NO and symmetric top molecules can be oriented using electric fields to control how they collide, for example colliding with the N-end or the O-end of NO.

This allows us to study the fundamentals of the chemical reaction, and investigate how the outcome of a collision may be controlled.



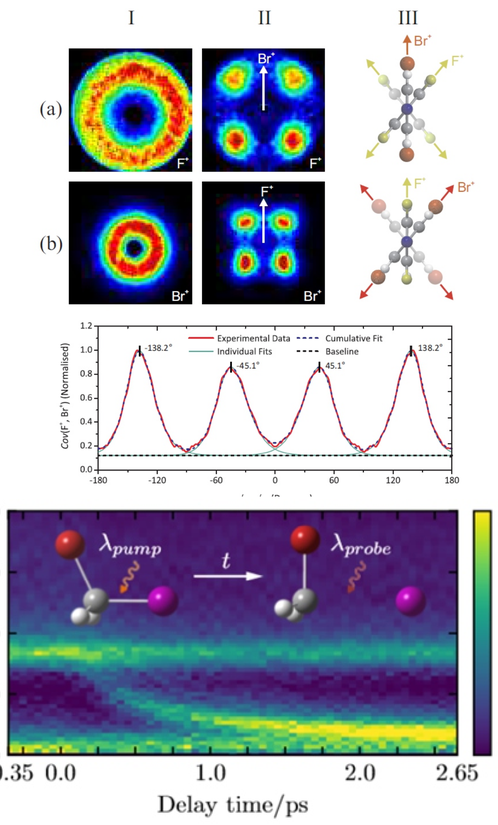


Ultrafast Photoinduced Dynamics

Intense femtosecond laser pulses are used to Coulomb explode target molecules. Molecules are rapidly ionised, causing them to break up into many charged fragments that electrostatically repel one another.

Coulomb explosion is used to probe molecular structure. We measure the charged fragment velocities, indicative of the structure immediately before explosion, and inspect how they are correlated.

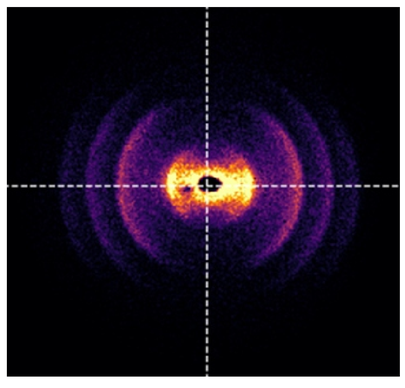
Pump-probe schemes allow us to study the structural dynamics of such processes in real-time.



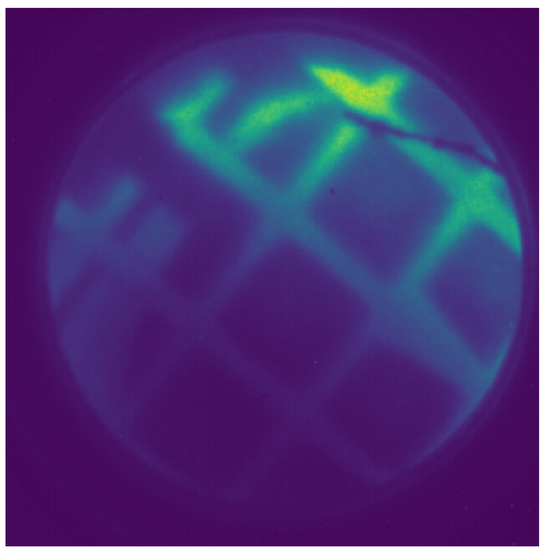
Developing Camera Technologies

The PImMS camera is a fast imaging sensor, capable of recording ion images with a timing precision of 12.5ns.

The Timepix3 camera, which makes use of a novel optical trigger, would improve the timing precision to 1.56ns, enhancing 3D imaging capabilities.



Imaging Mass Spectrometry



With the development of cameras with time-stamping devices, recording mass spectra at the level of a single camera pixel has finally become a possibility. This technological advance enables the creation of chemical maps of surfaces, which has a wide range of applications, spanning from biology and medicine to material science and semiconductor research.

Changing the voltages applied to the electrodes allows us to determine how the particles will be imaged. Therefore, we can choose whether to record the spatial or the velocity information of the ions.

About Us

We are a very friendly and collaborative group that offers a wide range of potential projects, and a great balance of experimental and theoretical work.

For further information, contact mark.brouard@chem.ox.ac.uk or just speak to any of the group members here - we would be happy to talk to you and show you around our lab!