Examining the reactions of ions and radicals at low temperatures

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It is challenging to study gas-phase reactions between ions and radicals at low temperatures, and with control over all of the reaction parameters. I will present our approach for generating beams of velocity- and state-selected radicals with tuneable properties using magnetic fields [1-2]. While our approach was initially developed to produce slow H-atom beams, we show that the same principles can also be applied to generate filtered beams of molecular radical species (including O_2 and OH).

Recently, we have combined one of our radical beam sources with a cryogenic ion trap, with the goal of studying ion–radical reactions under cold and controlled conditions (see Figure 1). Reactions take place within Coulomb crystals, enabling us to monitor the reaction processes with exceptional sensitivity (down to the single-ion level) [3-4]. The advantages of studying reactions within a Coulomb crystal environment will be set out, and a new imaging method that enables spatial and temporal detection of ions will be presented [5]. Finally, potential broader applications of our methods, including the exploration of new research directions and collaborative projects, will be discussed.

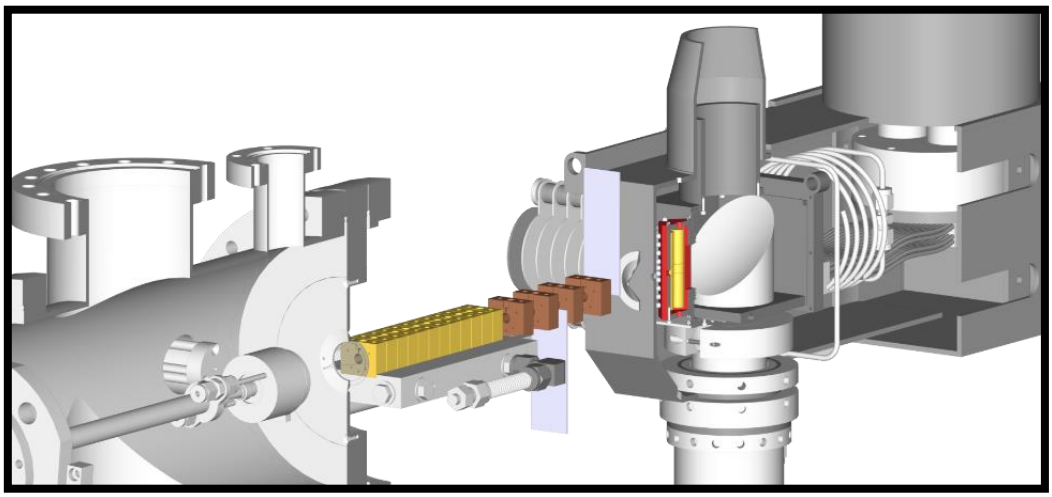

Figure 1. Schematic illustration of the combined radical beam and cryogenic ion trap apparatus.

References

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