SAPHIRA – A new Storage ring in Aarhus for PHoton Ion Reaction Analysis

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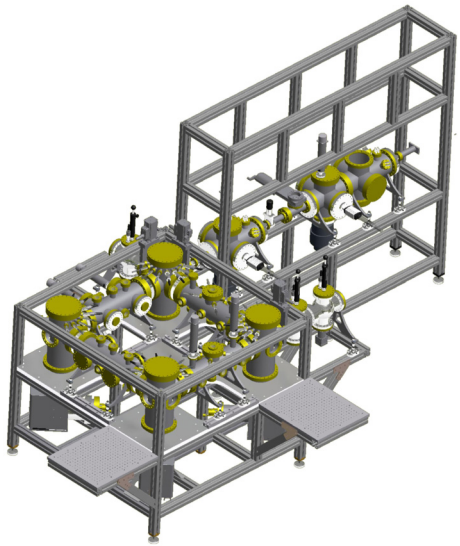
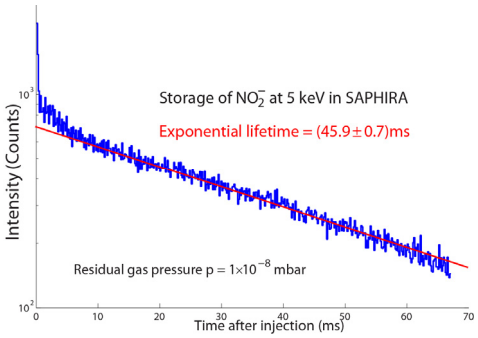
The construction of SAPHIRA, an electrostatic storage device (ESD), was recently finished. With SAPHIRA we demonstrate a new generation of ESDs that builds on the established design known from ELISA in Aarhus. Improved ion optics and a compact design (1m by 1m) make this type of device suitable for experiments at new specialized light sources like ASTRID2, FLASH or XFEL. These specialized light sources enables measurements of tightly bound electrons, fundamental molecules like H_2^- and highly excited states of biochromophores like retinal.



The storage concept was verified by storing a bunch of NO_2^- ions for 60ms. The ions were generated by a home made cold plasma ion source, accelerated to $5\ \mathrm{keV}$ and mass selected by a dipole magnet. The lifetime under high pressure conditions $(10^{-8}\ \mathrm{mbar})$ is shown to be $(45.9 \pm 0.7)\ \mathrm{ms}$. SAPHIRA has been installed at the Separator II facility [1] where also an existing electron spectrometer is available [2]. A new charged fragment analyser has been installed which complements the two neutral fragment detector chambers in SAPHIRA.



The first experiments will focus on characterizing and optimizing the storage conditions in SAPHIRA. Then a new time-resolved mass spectrometry technique will be demonstrated. A new tunable femtosecond laser to be installed in the laboratory will allow us to do pump-probe spectroscopy of biochromophores. With such a setup we can obtain gas phase response times of photo absorption of biochromophores. Focus will be on absorption spectroscopy of biochromophores of the Green Fluorescent Protein (GFP) and retinal. [3, 4] Gas phase measurements provide a true reference for describing the effect of the protein environment. The retinal chromophore in particular plays a key role in mammalian vision and is therefore a highly relevant molecule for gas phase reference measurements.

References:
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