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Liquid flexRIXS: A RIXS endstation for molecular systems at BESSY II

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Abstract: The liquid flexRIXS endstation is dedicated to resonant inelastic x-ray scattering experiments on liquid samples and gasses in the soft x-ray range. The liquids are injected into the chamber via a liquid jet system whereas gasses and also small amounts of liquids can be investigated using a liquid/gas flow cell. The MCP-based RIXS spectrometer allows for a resolving power of better than 1000.

1 Introduction

Liquid flexRIXS is an endstation for time-resolved and steady-state RIXS measurements on liquid samples and for complementary use at FELs and at BESSY II. The RIXS spectrometer of the end station is a modified GRAZE IV (XES 350) with three gratings. These cover the range between 50 and 900 eV. The resolution amounts to approximately 40 meV at 50 eV and 0.7 eV at 900 eV. Total fluorescence yield absorption measurements with a photodiode or partial fluorescence yield absorption measurements with the spectrometer are possible. Liquid samples are prepared in vacuum as thin jets (diameter 5-30 μm). The jet freezes after passing the interaction region in a liquid nitrogen cooled trap. To protect the beam line from the typical 10^{-3} mbar range in the measurement chamber during liquid jet operation, three differential pumping stages are used. The MCP-based detector is protected by an X-ray transmissive yet vacuum-tight thin foil. Static and time resolved RIXS measurements at liquids and gasses as well as non-linear processes are conducted with this experimental station at BESSY II and FELs. Depending on the X-ray spot size the jet speed in vacuum allows for refreshing the sample in the interaction region with MHz repetition rates. The apparatus is open to collaborative Research at BESSY II and FELs.

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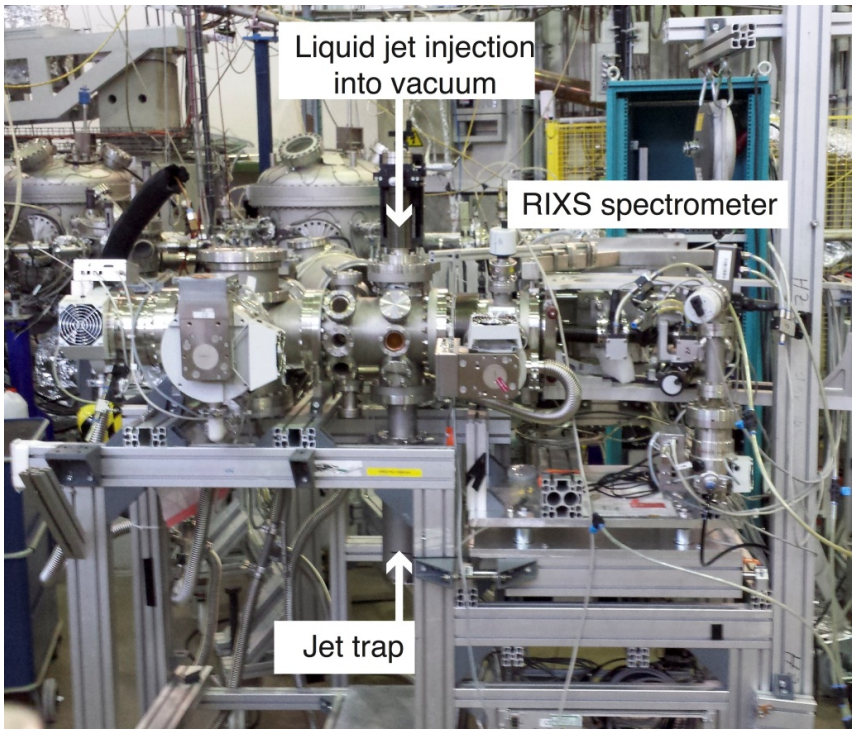

Figure 1: View of the Liquid flexRIXS end station.

2 Instrument application

Typical applications are:

- Static RIXS of liquids and liquid solutions of molecules at BESSY II
- Pump-probe RIXS of liquids and liquid solutions at FELs
- Investigation of non-linear X-ray induced processes at FELs
- Static and pump-probe fluorescence yield absorption at BESSY II and FELs

3 Technical Data

Energy range	Soft X-rays from 50 to around 900 eV
Resolving power	Better than 1000
Sample environment	Liquid jet in vacuum, three differential pumping stages towards the beam line, gas and liquid flow cell can be mounted instead of jet
Temperature range	Jet temperature can be controlled with a water jacket
Detectors	GaAs-Photodiode and RIXS spectrometer with MCP, phosphor and CCD
Samples	Liquid and gas

Table 1: Technical parameters of the Liquid flexRIXS end station.

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