



The Nanocluster Trap endstation at BESSY II

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Instrument Scientists:

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Abstract: The Nanocluster Trap endstation at BESSY II combines a cryogenic linear radio-frequency ion trap with an applied magnetic field for x-ray magnetic circular dichroism studies of cold and size-selected trapped ions. Applications include atomic, molecular, and cluster ions as well as ionic complexes.

1 Introduction

With the Nanocluster Trap endstation, BESSY II hosts a unique experimental setup for x-ray magnetic circular dichroism (XMCD) spectroscopy of size selected and trapped cold ions (Hirsch et al., 2015; Langenberg et al., 2014; Niemeyer et al., 2012; Zamudio-Bayer, Hirsch, Langenberg, Kossick, et al., 2015; Zamudio-Bayer, Hirsch, Langenberg, Ławicki, et al., 2015; Zamudio-Bayer, Hirsch, Langenberg, Niemeyer, et al., 2015; Zamudio-Bayer et al., 2013). The setup consists of a cryogenic linear radio-frequency (RF) quadrupole ion trap inside a superconducting solenoid for XMCD spectroscopy of size-selected atomic, molecular, and cluster ions as well as ionic complexes. Nanocluster trap is jointly operated by Helmholtz-Zentrum Berlin, Uni Freiburg, TU Berlin, Kyushu University, and Toyota Technological Institute.

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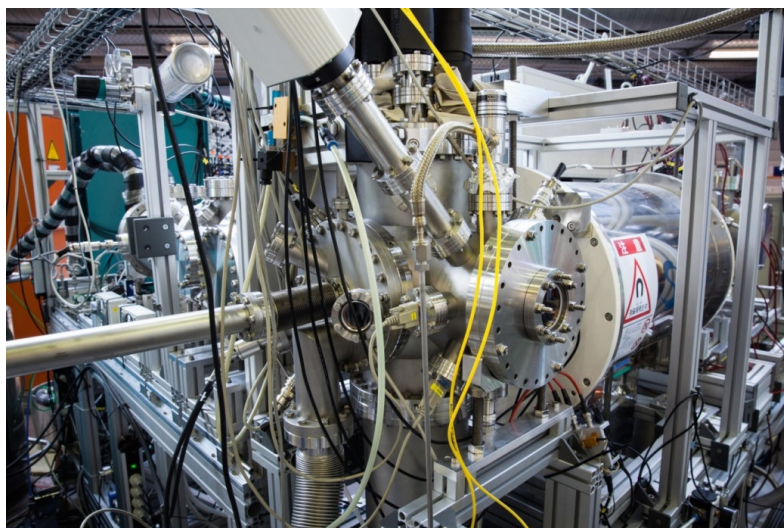


Figure 1: View of the Nanocluster Trap endstation.

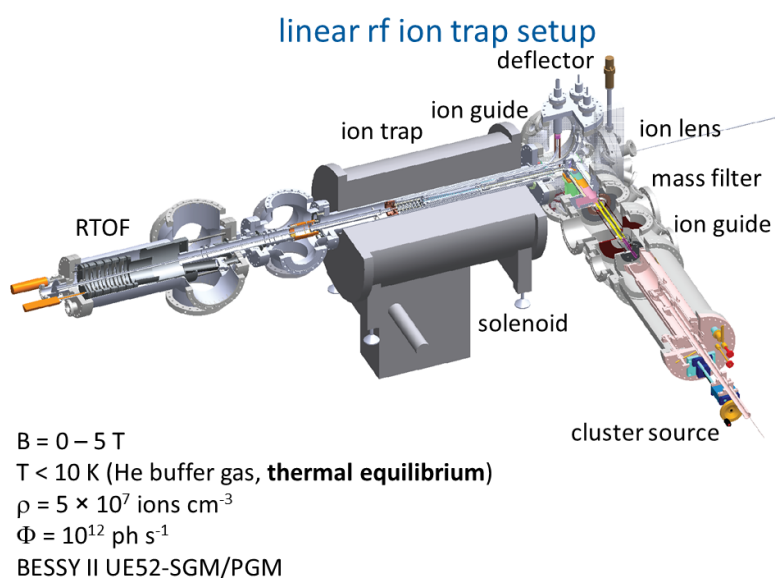


Figure 2: Schematic view of the Nanocluster Trap endstation with sample preparation (cluster source, ion guide/collision cell, and mass filter) and spectroscopy (ion trap, superconducting solenoid, and reflectron time-of-flight mass spectrometer) stages.

2 Instrument application

The Nanocluster Trap endstation at BESSY II is used to investigate magnetic phenomena on the atomic scale. It is routinely used in combination with a magnetron cluster source. Magnetic spin and orbital moments of size-selected pure and mixed transition metal clusters, molecules, and complexes can be determined. The ion trap can also be combined with a variety of different ion sources (e.g., electrospray ionization (Egorov et al., 2015) or laser evaporation) because of a flexible interface to the first ion guide. Nanocluster Trap is currently being upgraded to even more flexible ion trapping schemes and even lower cryogenic ($T < 5 \text{ K}$) ion temperature within BMBF project 05K13Vf2 hosted at Universität Freiburg.

3 Technical Data

Experiment in vacuum	Yes
Temperature range	5 - 300 K
Detector	High transmission reflectron time-of-flight mass spectrometer for ion yield spectroscopy
Manipulator	cryogenic linear quadrupole ion trap
Applied magnetic field	0 - 5 T
Mass range	10 - 4000 amu
Circularly polarized radiation	Yes

Table 1: Technical parameters of the Nanocluster Trap endstation.

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