

FEMTOSPEX Molecules and Surfaces: Electron spectroscopy setup for time-resolved laser-pump/X-ray-probe experiments at BESSY II

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Abstract: The flexible end station “FEMTOSPEX Molecules and Surfaces”, which will enable time resolved photoemission studies in the future at HZB, is presented.

1 Introduction

The FEMTOSPEX Molecules and Surfaces end station is designed for time-resolved photoelectron spectroscopy studies using an optical laser to pump the system under investigation. We are currently exploring in in-house projects the possibility to use the PPRE bunch available during normal user operation (Holldack et al., 2014) for time-resolved studies with a temporal resolution of about 60ps as well as using a HHG source for femtosecond time-resolved experiments.

The chamber is equipped with a VG Scienta ArTOF (Ovsyannikov et al., 2013) using a lens with an acceptance angle of 60 degrees. A typical spectrum using TaS₂ as sample and observing the charge density wave splitting is depicted in Figure 1.

Figure 2 shows the setup at the PGM beamline at the slicing facility.

*Cite article as: Helmholtz-Zentrum Berlin für Materialien und Energie. (2016). FEMTOSPEX Molecules and Surfaces: Electron spectroscopy setup for time-resolved laser-pump/X-ray-probe experiments at BESSY II. *Journal of large-scale research facilities*, 2, A81. <http://dx.doi.org/10.17815/jlsrf-2-87>

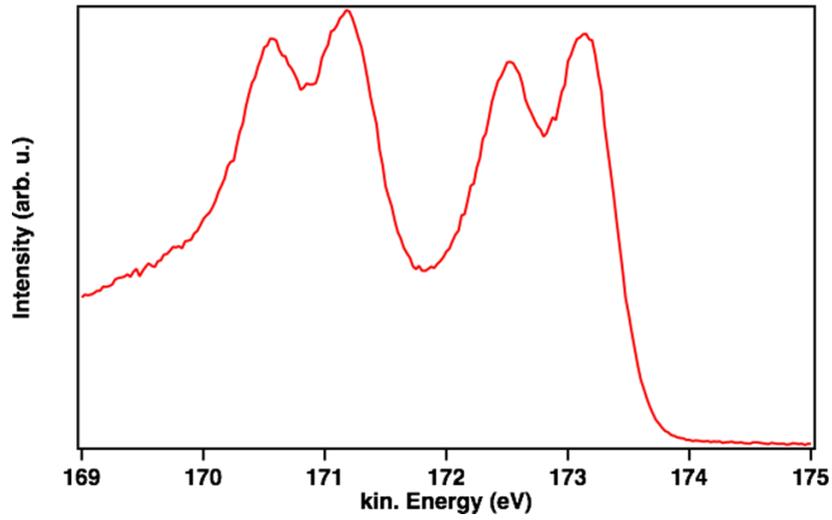


Figure 1: Ta 4f lines of TaS₂ cooled to ~25 K using 200 eV photons. The spin-orbit split doublet is accompanied by an additional charge density wave (CDW) splitting.

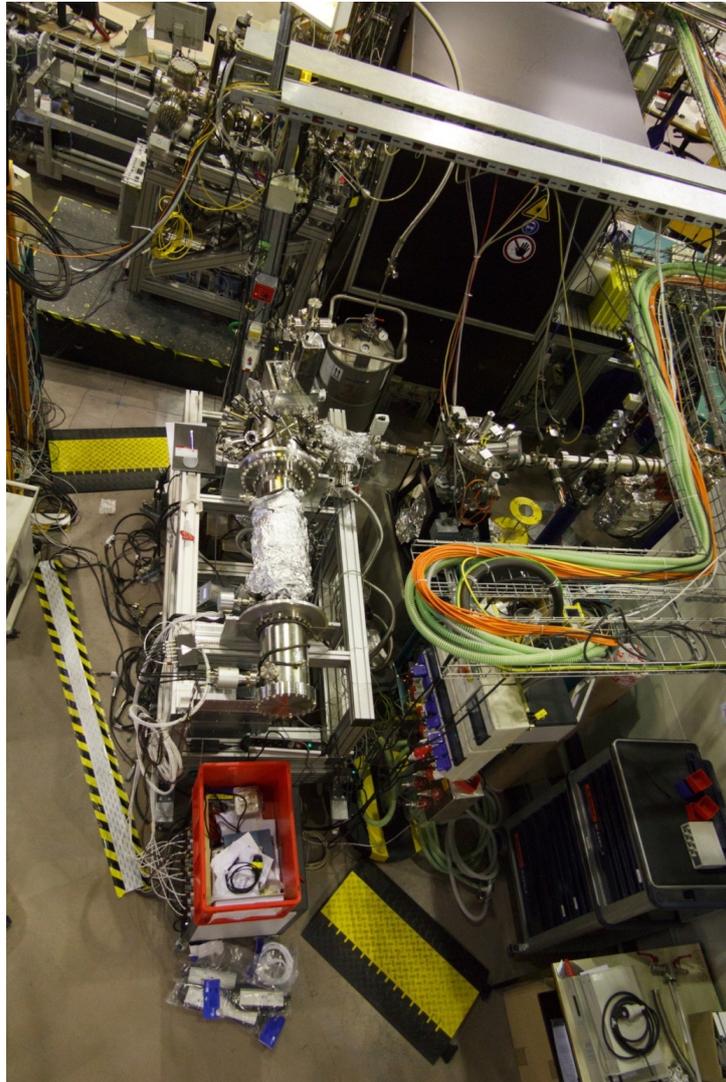


Figure 2: On-top view on the FEMTOSPEX Molecules and Surfaces station.

2 Instrument application

Typical applications are:

- time-resolved PES
- angular-resolved PES
- XPS
- UPS

3 Technical data

Monochromator	Soft X-ray
Experiment in vacuum	Yes
Detector	ARTOF EW 60° lens electron spectrometer
Manipulators	<ul style="list-style-type: none"> • VAb Manipulator with two rotation axes in theta-twotheta configuration • wobble stick for adjusting the phi axis of the samples • APD for defining the temporal overlap • Quartz slit for adjusting the halo/slice separation
Cryostat	Janis ST-400 cryostat typical sample temperature ~25 K
Preparation chamber	<ul style="list-style-type: none"> • Sputter gun • Residual gas analyser

Table 1: Technical parameters of the FEMTOSPEX Molecules and Surfaces station

References

- Holldack, K., Ovsyannikov, R., Kuske, P., Müller, R., Schällicke, A., Scheer, M., ... Föhlisch, A. (2014). Single bunch X-ray pulses on demand from a multi-bunch synchrotron radiation source. *Nature Communications*, 5, 4010. <http://dx.doi.org/10.1038/ncomms5010>
- Ovsyannikov, R., Karlsson, P., Lundqvist, M., Lupulescu, C., Eberhardt, W., Föhlisch, A., ... Mårtensson, N. (2013). Principles and operation of a new type of electron spectrometer ArTOF. *Journal of Electron Spectroscopy and Related Phenomena*, 191, 92 - 103. <http://dx.doi.org/10.1016/j.elspec.2013.08.005>