

Progress in Photoelectron Momentum Imaging

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Lunch Seminar - VUVX 2026

June 23 | 12:45-13:45 | Room: Sonja Lyttens
Angström Laboratory, Uppsala University

We give an overview of recent advances in photoelectron momentum microscopy (MM). MM offers an alternative to performing ARPES and photoelectron diffraction (PED) for energies from the VUV to hard X-rays. MM captures (k_x, k_y) momentum images with diameters ranging from 2 to 12 \AA^{-1} (with a best angular resolution of 0.03° ^[1]). A novel type of objective lens enables several modes of operation ^[2]. The electric field at the sample surface can be shaped from strongly accelerating (similar to a conventional PEEM) to zero-field and retarding. Retarding fields effectively reduce the space-charge interaction by redirecting slow electrons back to the sample. The 'repeller mode' is useful for ARPES at high energies and time-resolved experiments involving intense pump pulses. Space-charge suppression has been proven at the free-electron laser FLASH ^[3] and at high-harmonic-generation sources ^[4].

Three approaches to implementing energy resolution were developed. The first approach was a dispersive energy analyzer operated in imaging mode, as pioneered by Bauer et al. ^[5]. The second uses time-of-flight (ToF) recording to efficiently capture $I(E_{\text{kin}}, k_x, k_y)$ data stacks ^[6]. The third approach combines a hemispherical analyzer with ToF recording, utilizing the benefits of both. A prototype instrument is located at beamline I09 at the Diamond Light Source ^[7]. An energy resolution of 4.2 meV was achieved, with potential for further improvement. We present examples for all operating modes.

[1] O.Fedchenko et al, *New J.of Phys.* **21**,113031(2019)

[2] O.Tkach et al, *Ultramicroscopy* **276**,14167(2025) and *Rev.Sci.Instrum.* **97**,033703(2026)

[3] G.Schönhense et al,*Rev.Sci.Instrum.* **92**,053703 (2021)


[4] S.Fragkos et al, *Nature Commun.* **16**,5799(2025) and *Rev.Sci.Instrum.* **96**,115201(2025)

[5] E.Bauer et al, *J. Electron Spectrosc. Relat. Phenomena* **84**,201(1997)

[6] K.Medjanik et al, *Nature Materials* **16**,615(2017)

[7] M.Schmitt et al, *Ultramicroscopy* **276**,14169(2025)

Note: The lunch seminar is conducted at the VUVX 2026 conference, and you need to be registered for the VUVX conference to be able to take part in the seminar.

 Learn more at [VUVX2026.se](https://www.vuvx2026.se)

Speakers



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