Erratum | Vol. 30, No. 19 / 12 Sep 2022 / *Optics Express* 34935

Optics EXPRESS

Polycapillary-boosted instrument performance in the extreme ultraviolet regime for inverse photoemission spectroscopy: erratum

CHRISTOPH BRAIG,[1,*] ANDREY SOKOLOV,[2] REGAN G. WILKS,[3,4] XENIYA KOZINA,[3] THOMAS KUNZE,[3] SEMFIRA BJEOUMIKHOVA,[5] MARKUS THIEL,[5] ALEXEI ERKO,[1] AND MARCUS BÄR[3,4,6]

[1] *Institut für angewandte Photonik e.V., Rudower Chaussee 29/31, 12489 Berlin, Germany*
[2] *Department for Nanometer Optics and Technology, Helmholtz-Zentrum Berlin für Materialien und Energie, Albert-Einstein-Str. 15, 12489 Berlin, Germany*
[3] *Renewable Energy, Helmholtz-Zentrum Berlin für Materialien und Energie, Hahn-Meitner-Platz 1, 14109 Berlin, Germany*
[4] *Energy Materials In-Situ Laboratory Berlin (EMIL), Albert-Einstein-Str. 15, 12489 Berlin, Germany*
[5] *Helmut Fischer GmbH, Rudower Chaussee 29/31, 12489 Berlin, Germany*
[6] *Institut für Physik, Brandenburgische Technische Universität Cottbus-Senftenberg, Platz der Deutschen Einheit 1, 03046 Cottbus, Germany*
[*] *braig@iap-adlershof.de*

Abstract: We correct values and figures for the resolution of the spectrometer, as proposed in [Opt. Express **25**, 31840 (2017)]. The new results take into account previously unknown, incoherent phase fluctuations, caused by the polycapillary lens (PCL), and estimate the realistic performance of the instrument.

The data for focal spot size and energy resolution of the spectrometer in the original paper [1] erroneously relied on the assumption that the PCL operates coherently, like an ordinary lens or mirror. Recent simulations and experiments [2] revealed significant wavefront perturbations, due to the multi mode propagation inside the capillaries with their relatively large diameter of several 10 μm. Those phase fluctuations reduce the resolution of the instrument in the following way.

- In the abstract, “Its wavelength-dispersive component, a customized reflection zone plate, can maintain an energy resolution of 1.4 eV, whereas the sensitivity may be enhanced by more than one order of magnitude, compared to conventional spectrometers.”
- In Sect. 4, the resolution limit ΔE [eV] in Table 3 should be modified to the value “≤ 1.9.”
- Furthermore in Sect. 4, “The exit arm length R_2' [3] and the grating’s $c_{\rm ff} \equiv \cos\beta_0/\cos\alpha_0$ are chosen to support these goals, to ensure a resolution $0.91\,\text{eV} \leq \Delta E \leq 1.9\,\text{eV}$ [$\cdots$].”
- In Sect. 4, the error budget is now described by “Misalignments of that magnitude have no impact on the simulated Gaussian focus FWHM, which measures $\lesssim 4.6\,\text{mm} \times 1.8\,\text{mm}$ (H $\times$ V), in its dispersive (V) dimension not more than for a monochromatic source. [$\cdots$] The resolution, plotted on the right of Fig. 10, nevertheless degrades to no more than $\approx 1.9\,\text{eV}$ for an infinitely extended source.”
- In the context of Fig. 10 within Sect. 4, “[$\cdots$] the ‘full aperture’ usage of the PCL, only simulated until now, would still enable a resolution of $(0.98 \pm 0.03)\,\text{eV}$ for $\varnothing^{(1)}_{\text{src.}} = 0.1\,\text{mm}$.”
- In Sect. 5, the numerical values for the c_n in the sum as defined by Eq. (5) change to “[$\cdots$] $c_0 = 1.45\,\text{eV}$ as the leading term for E_0 and higher order coefficients $c_1 = 1.63 \times 10^{-1}$,

#473152
Journal © 2022

https://doi.org/10.1364/OE.473152
Received 18 Aug 2022; published 8 Sep 2022

Optics EXPRESS

$c_2 = 2.0 \times 10^{-2}\,\text{eV}^{-1}$, $c_3 = -2.6 \times 10^{-3}\,\text{eV}^{-2}$ and $c_4 = -5.8 \times 10^{-4}\,\text{eV}^{-3}$. Across an interval of 5.4 eV around E_0, Eq. (5) fulfills the [$\cdots$] limit $\Delta E \leq 1.9\,\text{eV}$ from Table 3, [$\cdots$]."

- In Fig. 10, a spectrum is shown on the left for $E = (36 \pm 4)\,\text{eV}$. Data change on the right.
- In Fig. 12, the energy scale, the ray tracing footprints and the FWHM ellipses change.
- In Sect. 6, "The low divergence [$\cdots$] will enable [$\cdots$] a spectral resolution of 1.4 eV."

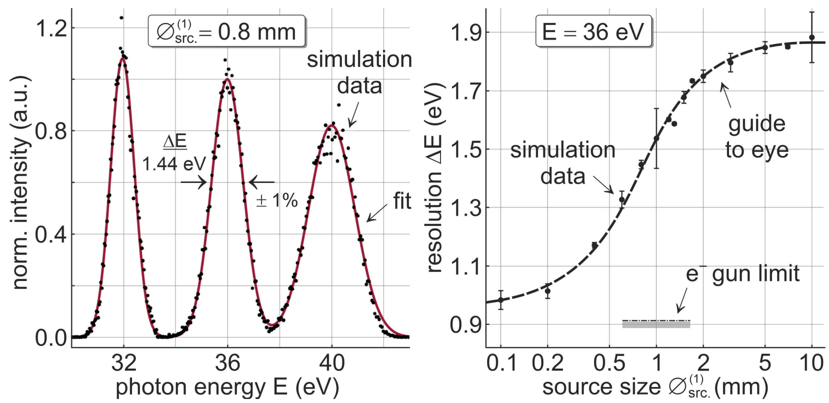

Fig. 10. Spectrometer resolution for the nominal source size of 0.8 mm (FWHM) on the left and for the design energy but a variable diameter of the emission region on the right, both simulated by ray tracing. The standard error budget [$\cdots$] is included.

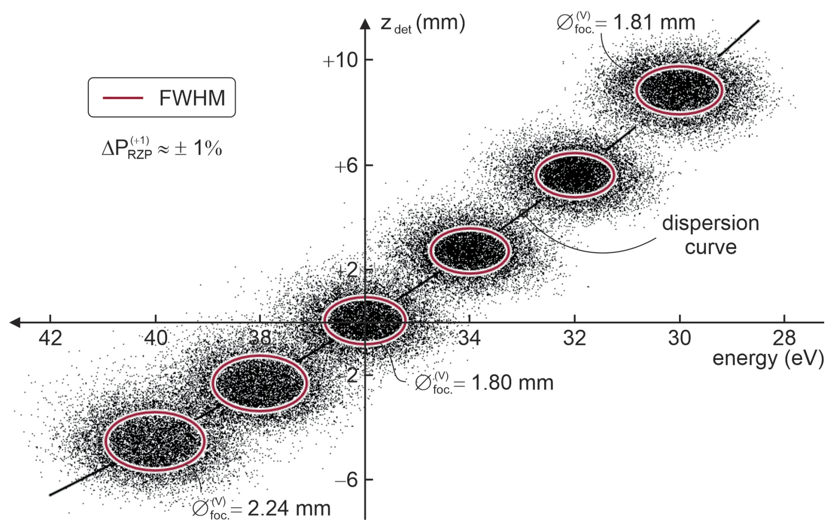

Fig. 12. Test spectrum around 36 eV as simulated by ray tracing (black dots), [$\cdots$]. The spatial resolution is indicated by the FWHM ellipse (dark red curve).

Disclosures. SB and MT: Helmut Fischer GmbH (E). The other authors declare no conflicts of interest.

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References

1. C. Braig, A. Sokolov, R. G. Wilks, X. Kozina, T. Kunze, S. Bjeoumikhova, M. Thiel, A. Erko, and M. Bär, "Polycapillary-boosted instrument performance in the extreme ultraviolet regime for inverse photoemission spectroscopy," Opt. Express **25**(25), 31840–31852 (2017).
2. J. Probst, H. Löchel, C. Braig, C. Seifert, and A. Erko, "Laboratory characterization of soft X-ray optics," in *OSA High-brightness Sources and Light-driven Interactions Congress* **2020** (EUVXRAY, HILAS, MICS), ETh1A.3 (2020).