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Narrow-band SASE FEL for EUV Lithography

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We present a high-slippage concept of SASE FEL that can produce narrow-band spectra at 13.5 nm for Extreme Ultraviolet Lithography (EUVL). The narrow-band SASE FEL differs from the seeded FEL which involves spectrally filtering the SASE output to produce a monochromatic seed and amplifying the coherent seed with additional undulators. Seeded FELs have been experimentally demonstrated to produce narrow-line spectra [see *]. In this paper we study a new SASE method that relies on strong slippage in the tapered undulators to produce a few longitudinal modes, thereby narrowing the output spectra without using a monochromatic seed. We present numerical simulation results that show the high-slippage SASE FEL generates a few longitudinal modes and few spectral modes. The few-mode SASE produces a relative spectral bandwidth of 0.3% which is significantly narrower than the reflectivity curve of the molybdenum-silicon EUV mirrors that are used to reflect the EUV radiation in EUVL.

Footnotes

- D. Ratner et al., PRL 114 (2015) 050801 ; Alaria et al., Nat Photon 7 (2013) 913-

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Primary author: NGUYEN, Dinh (xLight Incorporated)

Co-authors: DUNHAM, Bruce (xLight Incorporated); MAYES, Christopher (xLight Incorporated); STUPAKOV, Gennady (xLight Incorporated); NEIL, George (Private Address); LOU, William (xLight Incorporated)

Presenter: NGUYEN, Dinh (xLight Incorporated)

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