



XUUS: eXtreme Ultraviolet Ultrafast Source

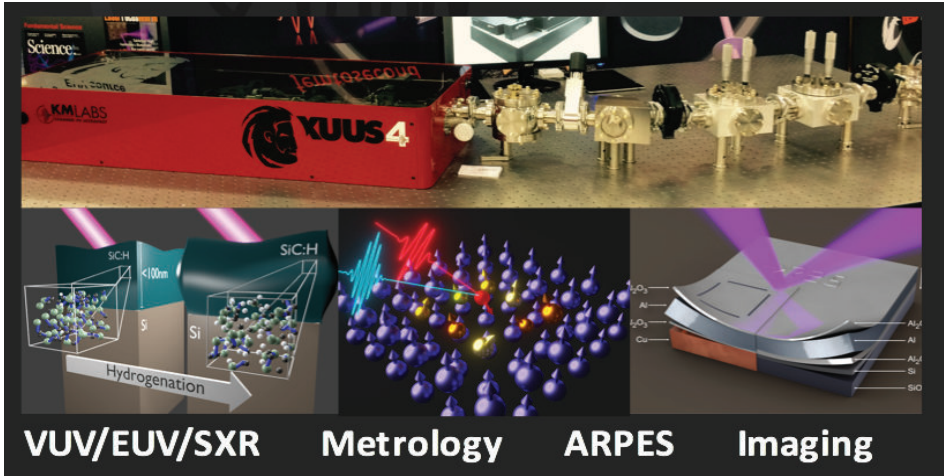
A coherent EUV and soft X-ray source for your lab

Applications

- Metrology for nanoelectronics and in support of EUV lithography
- High-resolution and time-resolved coherent imaging
- Ultrafast magnetic materials & spintronics studies
- Photoemission: tr-ARPES & attosecond materials science
- General: high spatial/temporal resolution pump-probe experiments
- Molecular dynamics and attosecond science

Features

- Wavelength ranges:
 - EUV 10-47 nm (26-124 eV)
 - Soft X-rays 4-10 nm (124-300 eV)
 - Soft X-rays 1-10 nm (124-1000 eV)
- Highest efficiency HHG: average EUV power of up to 10 μ W
- Fully engineered for outstanding long-term power & pointing stability (<5% & <10 μ Rad over 12 hours)
- Fully coherent near-Gaussian laser-like output beam
- Ultra-low gas load into beamline for maximized optical transmission and UHV compatibility
- Minimized gas and vacuum pump usage (500 hrs from standard 100 L bottle typical)
- Graphical, intuitive software control with integrated diagnostics



XUUS™ extreme UV ultrafast source is a coherent EUV/soft X-ray light source based on high-harmonic generation (HHG). It is a fully engineered and integrated commercial source based on a single rugged opto-mechanical platform. It employs KMLabs' patented hollow waveguide for the high-harmonic up-conversion process.

XUUS Outstanding Characteristics

- Engineered waveguide geometry optimized for highest conversion efficiency
- Optimal phase matching with high spatial coherence
- Waveguide offers stable and near-Gaussian coherent EUV beam
- Proprietary XUUS hollow waveguide cartridge allows for long lifetime and quick cartridge exchange with minimal realignment
- Minimized gas usage – reduced operating cost vs. alternate HHG techniques
- Automatic pump beam alignment and stabilization

XUUS Beamline Outstanding Characteristics

- Modularized XUUS beamline for maximized flexibility - tailored to your application
- Modules for:
 - Steering and focusing the EUV beam
 - Filtering IR and selecting an individual harmonic spectral peak
 - Measurement of EUV power/spectrum
- Optimized optics for maximum EUV throughput
- Rigorous and background-free EUV flux characterization based on NIST-calibrated detectors

Integrated System Outstanding Characteristics

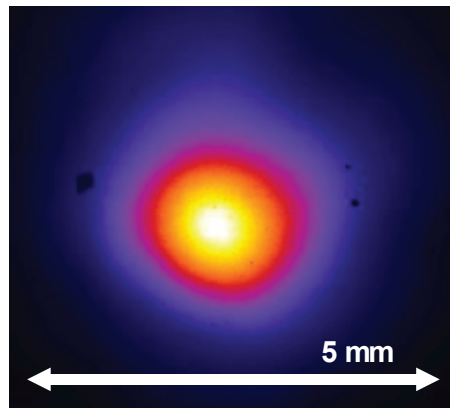
- Fully integrated and tested single-supplier system
- Repetition rate and pulse energy can be varied to optimize EUV flux for different spectral regions



Key Specifications

XUUS Source Product Specifications					
HHG wavelength	30 nm		18 nm	13 nm	6.7 nm
Photon Flux at Source	>>5 x10 ¹¹ ph/sec /1% BW		>10 ¹⁰ ph/sec /single harmonic	>10 ¹⁰ ph/sec/single harmonic	>10 ⁷ ph/sec/10%BW
Driving lasers	0.5 mJ, <40 fs 10 kHz, 5W 800 nm	0.2 mJ, <40fs, 50kHz, 10W 800 nm	2 mJ, <40fs 3 kHz, 6W 800 nm	3 mJ <40 fs 3kHz, 9W 800nm	2 mJ, <50 fs 1kHz, 2W 1400 nm
	RAEA HP	RAEA HP+	RAEA HP	RAEA HP+	RAEA HE+ & OPA
Pulse Duration	HHG produces attosecond pulses or pulse trains depending on the implementation. The envelope in the simplest implementation is < 15fs using 40fs Wyvern and <10fs using 21fs Dragon				
Linewidth	Linewidth variable from 100meV to quasi-continuum				
Pointing Stability*	<5 μRad RMS				
Power Stability*	<5% RMS (100ms integration time)				
Mode Quality	Near TEM ₀₀				
Divergence	Depends on waveguide diameter, 0.5 - 4 mrad typical				

* Temperature stable to ± 1°C



Soft X-ray XUUS Beam Profile
at 8 nm wavelength

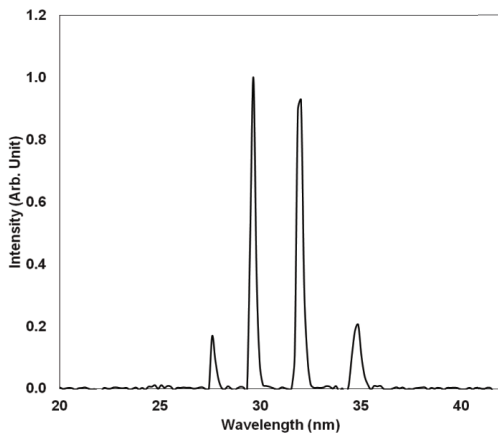
Standard XUUS Imaging Spectrometer Beamline			
Tunable Spectral Range*	25 to 47 nm (26 to 49 eV)	10 to 25 nm (49 to 124 eV)	3 to 10 nm (124 to 400 eV)
Spectral Resolution*	0.05 to 0.1 nm	0.1 to 0.5 nm	0.1 to 0.75 nm
Focused High Harmonic Beam	<150 μm**	<150 μm**	<100 μm**
Diameter (1/ Typical Throughput Efficiency***	>10%***	>10%***	>1%***

* Gratings are pre-selected for specific spectral range and resolution

** Custom configurations available

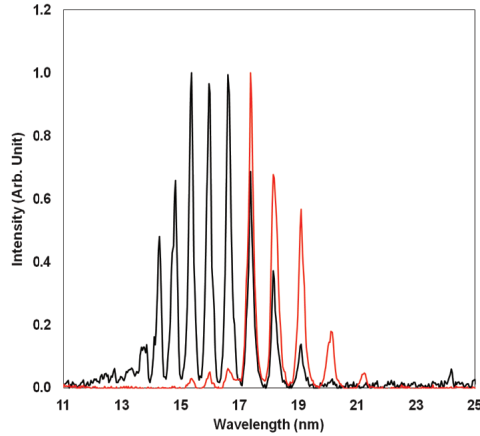
*** No metal filters

XUUS tunability in different wavelength ranges and filter sets



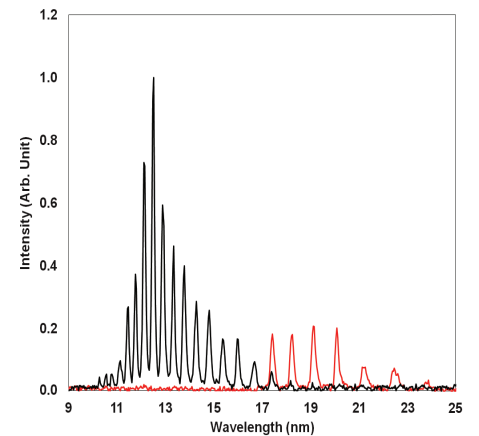
HHG spectra peaked at 30nm:

- Narrow linewidth <100meV without any pinhole or slit



HHG spectra peaked at 17nm:

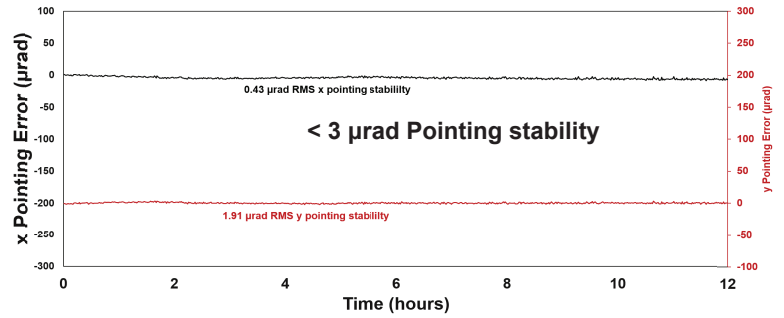
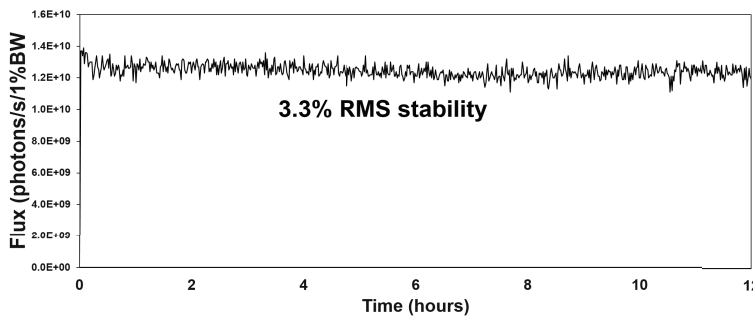
- HHG spectrum through Al filter, spectrometer optimized for 17nm
- HHG spectrum through Zr filter, spectrometer optimized for 17nm



HHG spectra peaked at 12.5nm:

- HHG spectrum through Al filter, spectrometer optimized for 17nm
- 0.1nm spectral resolution using standard grating

Typical 13.5 nm Performance Data



System Layout, XUUS Optical Head and Beamline

