

## HHG BEAMLINES AND SPECTROMETERS

SXR  
XUV  
VUV



## HHG source systems

### Turn-key HHG source

- reliable and stable operation for weeks without realignment
- low maintenance effort, full focus on the experiment
- one-stop integrated system
- modular system design with excellent accessibility

### Long-term stable gas targets

- durability with increased LIDT, constant gas flow for months
- accurate closed-loop positioning
- closed-loop gas flow controller
- quick exchange with solid and rotating targets

### Vacuum skimmer

- reduced XUV re-absorption for higher signal strength
- $10^{-4}$  reduction in gas load

### XUV spectral filters

- segmented foils for collinear pump/probe experiments
- improved heat dissipation for high-intensity beams and stable operation for months



Turn-key system for investigation of high-order harmonic generation in laser-produced plasmas. Flexible motorized target setup for rotating and flat solid targets and gas targets. Multiple beam access options for two-color pumping of plasma. Integrated frequency-doubling stage. Spectral filtering stage for high-intensity beams.



(1) Cross-drilled gas target allowing for long-term stable operation with constant gas flow. Convenient alignment with full beam due to high durability.

(2) Vacuum skimmer for reduced XUV re-absorption.

## In-line spectrometers

### In-situ source characterization

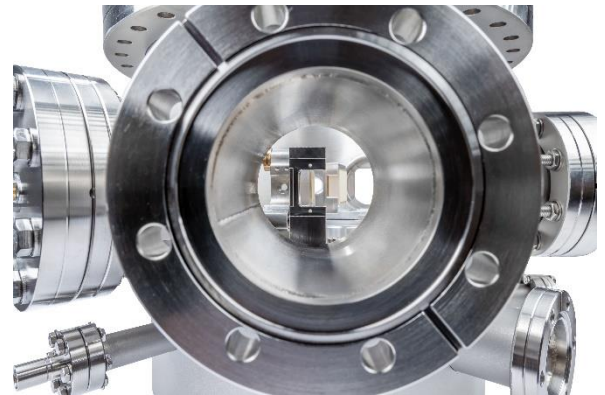
- no-slit flat-field spectrometer with beam bypass
- no need for an alignment-sensitive narrow entrance slit
- ~20x more light collection than standard spectrometers, resulting in a proportional improvement of the signal-to-noise
- full automation for convenient control by software
- imaging spectroscopy option
- beam profiler option
- calibrated photodiode option
- wavefront sensor option



Compact spectrometer for in-situ HHG source characterization in the water window. Direct imaging of the source without entrance slit for maximum efficiency and day-to-day robustness. Undistorted beam in bypass mode. UHV vacuum setup. Longitudinal dimension <math><0.5\text{m}</math>. All settings controlled remotely by software.

### Customization

- every spectrometer is customized to exactly match the desired application, e.g.
- beamline integration
- auxiliary ports and view ports



Beam-like view into in-line spectrometer. Reliable switching between bypass and spectroscopy modes by closed-loop positioners.

## Experimental target setups

### Turn-key reliability

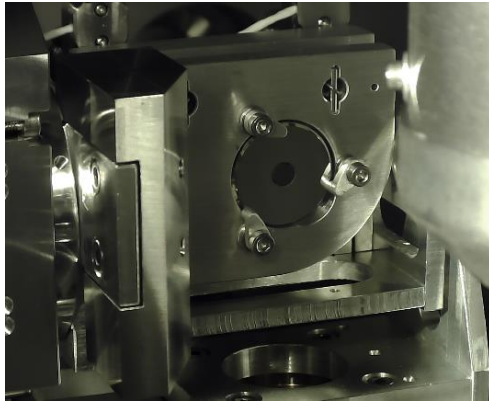
- vibration-decoupling UHV chamber design
- large variety of experimental configurations
- flexible integration of instrumentation – TOF, VMI, XPS, etc

### XUV/VIS-IR beam recombination

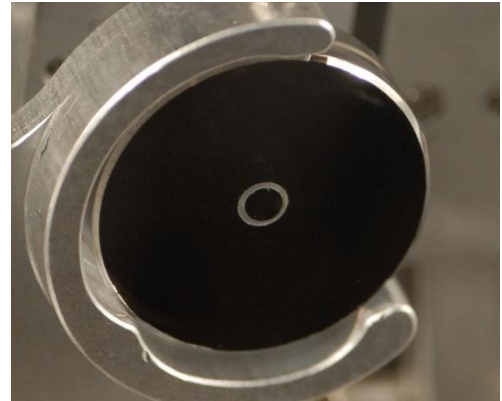
- double-mirror assembly for collinear geometry
- toroidal mirrors for non-collinear geometry

### Customization

- thorough requirements review and a collaborative design process ensure highest performance of the target chamber



Double-mirror delay assembly XUV/VIS-IR for collinear beam refocusing. Temporal resolution of  $\pm 3\text{as}$ . 5 degrees of freedom. Spectral isolation of the cut-off region. Low wavefront distortion due to optically precise shaped segments



Double-mirror for pump-probe attosecond experiments. Tailored mirror coating for specific energy selection for reliable generation of isolated attosecond pulses.

## Specifications

Attosecond pulse wavelength	6-120nm / 10-200eV *	
Isolated attosecond pulse wavelength	6-16nm / 80-200eV *	
Flux fluctuations	<3% rms in 12 hours *	
Pointing fluctuations	<3urad rms in 12 hours *	
Operating pressure	<10 <sup>-9</sup> mbar (<10 <sup>-11</sup> mbar available)	
Positioning	manual or motorized closed-loop	
Customizable	fully customizable	
	60nm / 21eV	13.5nm / 90eV
Average power per harmonic	up to 400uW *	up to 0.9uW *
Photon flux per harmonic	up to 10 <sup>14</sup> ph/s *	up to 5·10 <sup>10</sup> ph/s *
Bandwidth of harmonics	<10 <sup>-2</sup>	<5·10 <sup>-3</sup>

\* with suited driving laser