Invitation for Bid - EUV Light Source for Magnetic Spectroscopy and Nanoscopy

Bid# 2021-03-003

Attachment 1: Technical specifications

1. The EUV light source

The EUV pulses are generated by high harmonic generation (HHG) from inert gas cells pumped by near-infrared (NIR) femtosecond pulses. The generation setup shall include the following components:

a) A femtosecond oscillator to seed the NIR amplifier. An output port is preferred to deliver the extra oscillator energy that at not used to seed the amplifier for other experiments.
b) A femtosecond pulse amplifier with built-in tunable compressor. A pulse picker is preferred that support single-shot output, and/or burst mode for a short duration of 100 μs, and/or a reduced repetition rate. The short- and long-term pointing stability of the amplifier at constant and variable environmental temperature shall be specified.
c) A converter, if necessary, to keep the pulse duration below 40 fs in the NIR region. An output is required to split more than 1 Watt of average power from this beam for THz experiments.
d) Diagnostic tools for the quality of NIR pulses before the HHG conversion unit.
e) HHG generation and separation unit.
    i. The primary band of the HHG output covers 30-50 eV. Photon energy extending to 60 eV is preferred.
    ii. The total photon flux at the sample is about or over 10^{12} photons/s when focused using toroid mirror set. Please specify the possible choices of separator sets and the corresponding NIR rejection ratio at the entrance of sample chamber, which is about 2000 mm away from the source. Higher flux up to 10^{13} photons/s is preferred.
    iii. The setup shall reserve the capability to generate photons in the energy range of 60-100 eV. A separate line item that includes necessary components and documentations associated with the switching procedure shall be included.
    iv. The beamline shall sustain a vacuum pressure below 2e-6 mbar at the entrance of sample chamber, to avoid condensation on the cryogenic sample holder.

2. The EUV beamline

a) Focusing unit.
    i. Broadband demagnification focusing mirror sets with a minimum spot size smaller than 5 µm (3 µm is preferred). The mirror-to-sample distance between 100 mm to 200 mm will be determined when finalizing the design.
    ii. Alignment mechanics for the mirror sets allowing adjustment in vacuum.
b) EUV imaging spectrometer with grating.
    i. The spectrograph shall reach a resolution of $\lambda/\Delta\lambda > 250$ and cover the primary band of the HHG source. The source-to-flange distance between 120 mm to 200 mm will be determined when finalizing the design.
    ii. An imaging mode with high collection efficiency is preferred as opposed to reducing the beam divergence with entrance slit.
    iii. Motorized grating is preferred for online alignment.
c) The setup shall reserve the capability to switch the EUV beam to a different end station with a focusing mirror set with multilayer coating that selects a single harmonic. The photon flux of a single harmonic at 40 eV at the sample is about or over 10^{11} photons/s. A separate line item shall include necessary components and documentation specifying the possible choices of filter sets, mirrors and the corresponding NIR rejection ratio at the sample location. Higher flux up to 10^{12} photons/s is preferred.

3. Synchronized light source for time-resolved spectroscopy
    a) Frequency converter.
        i. Part of the NIR amplifier's power shall be converted to variable wavelength between 230-900 nm, with a minimum average power of 0.5 W at 700 nm.
        ii. The capability of wavelength extensions is preferred between 900 nm to 2600 nm and between 2600 nm to 16000 nm. A separate line item may be included when available.
    b) Computer control hardware and software. An application programming interface (API) compatible with standard programming language such as python, C++ and MATLAB is preferred.