Access to the Central Laser Facility - Artemis

Beamtime application for the period September 2024 – June 2025

Applications are now invited for access to the Artemis laser facility at the Central Laser Facility (CLF) (Science and Technology Facilities Council (STFC) Rutherford Appleton Laboratory), during the period Sept 2024 – June 2025. A total of fourteen weeks' access is available on the facility. We are offering access to both the 1-kHz and 100-kHz laser systems. Experiments using the 1 kHz system will be scheduled from Sept 2024- March 2025. Experiments using the 100 kHz system are backlogged and will be scheduled Dec 2024- June 2025.

In this round, all access weeks are funded by STFC. All proposals must have at least one co-investigator who is a permanent member of staff at a UK academic institution.

Applications will be reviewed and prioritised by the Artemis Facility Access Panel.

The deadline for applications is 17:00 BST 29 April 2024

Please talk to facility staff before you submit your proposal, to ensure that it is feasible.

More information on the call and how to submit can be found here.

Please read the detailed call information before applying.

For this call we are using a new proposal submission system. Guidance on using this system is located here.

Dr Emma Springate
Artemis Group Leader
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Facilities available

1-kHz laser system

Experiments on the 1-kHz laser system will be scheduled in Sept 2024 – March 2025. In this call period, Artemis will offer ultrashort laser and extreme ultraviolet (XUV) pulses at 1-kHz repetition rate, with end stations for:

- time-resolved spectroscopy in gases, using an electron time-of-flight spectrometer or velocity-map imaging detector;
- XUV spectroscopy.

The laser and XUV pulses are generated from a Ti:sapphire laser system with twin outputs, each producing 8-mJ, 30-fs, 780-nm pulses at a 1-kHz repetition rate. One output can be used to pump an optical parametric amplifier (OPA) system providing tuneable pulses in the spectral range of 235 nm – 15 µm, with up to 1 mJ per pulse at 1300 nm in a 40-fs pulse. The OPA output at 1700 nm can be further compressed to ~ 12 fs with ~ 0.4 mJ per pulse.

Any of the Artemis laser outputs can be used to generate XUV pulses through high harmonic generation (HHG). Two XUV beamlines are available: one with a monochromator for photoelectron spectroscopy, and the other a high-flux XUV beamline for HHG spectroscopy.

Photoelectron spectroscopy

The monochromatised XUV beamline contains:

- HHG chamber with differentially pumped continuous nozzle;
- Monochromator to select a single XUV harmonic in the spectral range 12 eV – 80 eV while preserving the pulse length. The photon flux is ~ $2x10^{10}$ photons/s at 30 eV, but drops at energies above 45 eV. Best XUV energy resolution is 120 meV;
- absolutely calibrated XUV photodiode to measure XUV flux; and
- relay imaging chamber with toroidal mirror and optics to enable laser and XUV pulses to be recombined for pump-probe experiments.

The end-stations available on this beamline for time-resolved spectroscopy are:

- atomic and molecular physics end-station with velocity-map imaging detector or time-of-flight electron spectrometer. The end station offers the following molecular sources i) a skimmed pulsed molecular beam (1 kHz) with backing pressures up to 3 Bar and ii) an effusive molecular source with the option of heating up to 100 C.

Spectroscopy and imaging

This high-flux XUV beamline contains:

- HHG chamber with differentially pumped continuous nozzle;
- XUV flat-field spectrometer, which can be used for HHG spectroscopy or HHG optimisation experiments.

100-kHz laser system

Experiments using the 100-kHz system are backlogged and will be scheduled Dec 2024 – June 2025. In this call period, we offer laser and XUV pulses at 100 kHz derived from our infrared OPCPA system, with a new XUV beamline and flat-field spectrometer, and end-station for time- and angle-resolved photoemission spectroscopy from the solid state.

In this period, we will offer the following outputs from the light source:

- 170-µJ, 50-fs pulses at 1750 nm. This output, or its second harmonic, can be used for high-harmonic generation
- XUV photons in the 17 – 41 eV range, with ~ 10^{10} photons/sec at 32 eV.
- Pump pulses at 440 nm (1 µJ, 50 fs), 875 nm (5 µJ, 50 fs), 1750 nm (20 µJ, 50 fs), and 2500 nm (50 µJ, <150 fs).
- The ability to pump at ~600 nm and ~750 nm (1 µJ, 50 fs) is under development. Contact staff if you are interested in using these wavelengths.

Key experimental hardware includes:

- HHG chamber with differentially pumped continuous nozzle;
- XUV flat-field spectrometer, which can be used for HHG spectroscopy or HHG optimisation experiments;
- Monochromator to select a single XUV harmonic in the spectral range 17 – 41 eV;

- XUV spot down to ~20 µm diameter;
- UHV end-station for time- and angle-resolved photoemission spectroscopy (tr-ARPES). This is equipped with a SPECS Phoibos 100 hemispherical analyser, Fermiologics FeSuMa analyser, a five-axis cryo-manipulator, a preparation chamber, and a fast load lock for sample transfer.

More details about photon parameters, the UHV end-station, and sample preparation capabilities are available at https://www.clf.stfc.ac.uk/Pages/Condensed-matter-end-stations.aspx.

Further details and contacts

More technical specifications can be found at https://www.clf.stfc.ac.uk/Pages/Technical-Specification.aspx. We urge you to contact an appropriate Artemis staff member to discuss the requirements for your experiment prior to submitting a proposal.

After proposal submission, Artemis staff will make a technical assessment of feasibility and of potential safety issues arising from your proposed experiment. This report is passed to the access panel. Please make sure there are enough experimental details in your proposal to enable us to do this. In particular, please provide details of all samples and gases to be used.

We have very limited space for users to bring their own end-stations and breadboards. Any equipment brought to Artemis must conform to CLF safety standards.

During experiments, we recommend that four people from your team are present each day, and that two of these are experienced enough to lead the work. This will enable you to make the most of your time. The facility is fully supported Monday – Friday during regular business hours. At evenings and weekends, the facility is operated in data collection mode with limited support.

For more detailed information please contact:

- Emma Springate, (emma.springate@stfc.ac.uk)--Artemis group leader.
- Charlotte Sanders, (charlotte.sanders@stfc.ac.uk)--condensed matter physics, 2D materials.
- Yu Zhang (yu.zhang@stfc.ac.uk)--100-kHz laser system, condensed matter physics, magnetism, HHG spectroscopy.
- James Thompson, (james.thompson@stfc.ac.uk)--1-kHz laser system, gas-phase experiments.

Writing your proposal

A science case of up to three pages must be included in your proposal. You should give a clear account of the aims of the experiment, and set it within the broader scientific context. Keep in mind that not all review panel members will be experts in your field. If you are using samples that are not commercially available, you should indicate their source. In the case of solid-state samples, the proposal should include information about sample transport and in-situ preparation; data from pre-characterization of the samples (e.g., domain size, surface quality, etc.) can support the feasibility of the proposal.

You should justify the amount of beamtime you request, explaining what you aim to achieve on each week of your run and estimating the data collection time. Experiments are typically allocated 2 – 3 weeks of beamtime.

Submitting a proposal

Use the CLF online proposal system (https://proposal.isis.rl.ac.uk) to submit an electronic application. Instructions are available at https://www.clf.stfc.ac.uk/Pages/Proposal-System.aspx.

Review criteria

Applications for time on Artemis are reviewed and prioritised by the Artemis Facility Access Panel. Your proposal will be assessed with the following criteria:

- Absolute prerequisites, without which an application will not be recommended for funding:
    - scientific excellence in the specific objectives of the project;
    - international competitiveness; and
    - strategic value within the Artemis programme.
- Supporting evidence which increases the likelihood a successful outcome:
    - productivity of investigators;
    - quality of leadership and management; and
    - suitability of institution and group.

Additional criteria can include strategic alignment to UKRI areas (*e.g.,* grant supported), potential for economic impact, training, facility development, and impact plan.

Please note that, in making its assessment, the panel will refer to your previous track record of access to Artemis. The panel will have access to the experimental reports from your previous access periods at Artemis. Please contact emma.springate@stfc.ac.uk if you would like to update your report forms.