scientaomicron

ARPES LAB

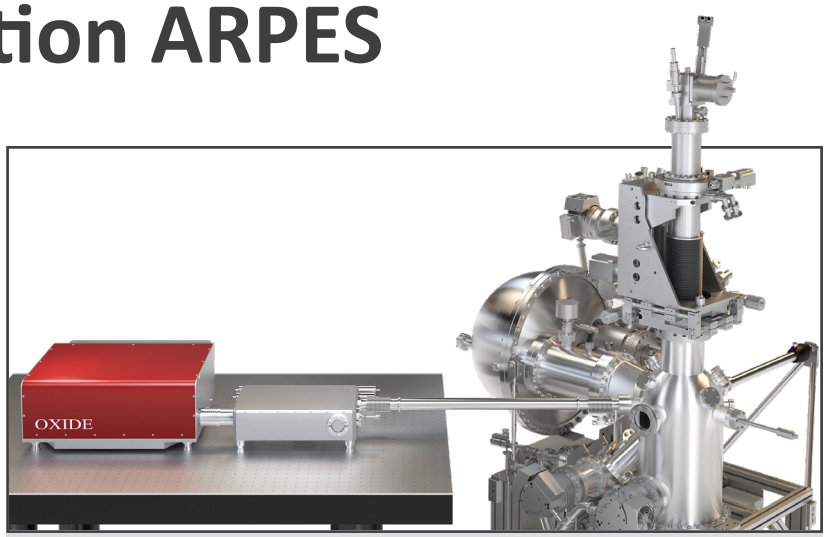
UV-X 11 eV laser
Ultra-high resolution ARPES

The Scienta Omicron ARPES Lab is the ideal system to combine with a turnkey UV-X 11 eV laser. The availability of this cutting edge, field proven photon source is possible through a collaboration with Oxide Corporation of Japan and gives scientists the opportunity to add this technology as part of a new ARPES Lab system or as an upgrade to an existing ARPES set-up.

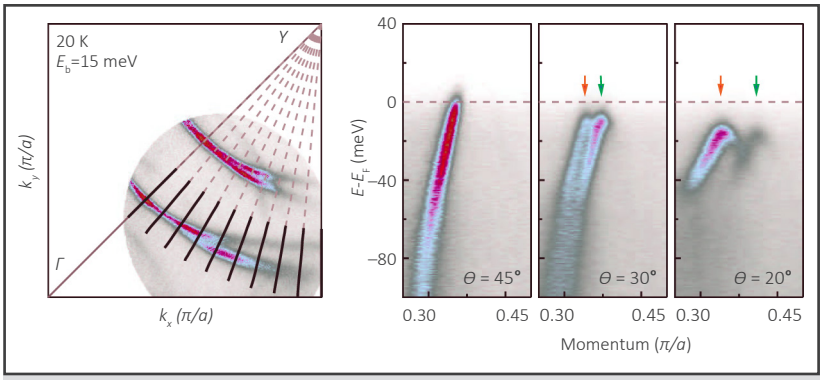
The UV-X series of pulsed vacuum-ultraviolet lasers have been designed for laboratory-based, high-resolution ARPES. UV-2 sources, with high timing resolution, sub-50 psec pulse length, and external triggering capability, are recommended for time-of-flight (TOF) based electron detection methods such as the ARTOF-2. UV-3 sources have been optimized for 50 MHz pulse repetition rate operation, in order to minimize space-charging effects in systems with hemispherical DA30-L analysers.

The 11 eV laser together with the Scienta Omicron ARPES Lab and its low vibration cryo-manipulator combine to create a powerful scientific tool which provides a solution not previously available to bridge the gap between traditional laser based, small momentum coverage ARPES and large momentum coverage synchrotron based ARPES.

The Prof. Xingjiang Zhou group at the Institute of Physics, Beijing has developed an ARPES set-up based on the Scienta Omicron ARTOF 10k analyser and the 11eV UV-2 laser. The system performs at better than 1 meV energy resolution and 0.1° angular resolution. An advantage of the 11 eV photon source is that it allows reaching a large part of the Brillouin zone with high resolution. Together with the ARTOF 10k analyser, or the DA30-L, it can cover nearly half a quadrant ensuring that all data is taken under the same experimental conditions.



The ARPES Lab is prepared with a port for the 11 eV laser. Scienta Omicron supports the connection of the laser to the ARPES Lab, including e.g. customized beam tubing, flex coupling and a UHV compatible LiF window to the analysis chamber.



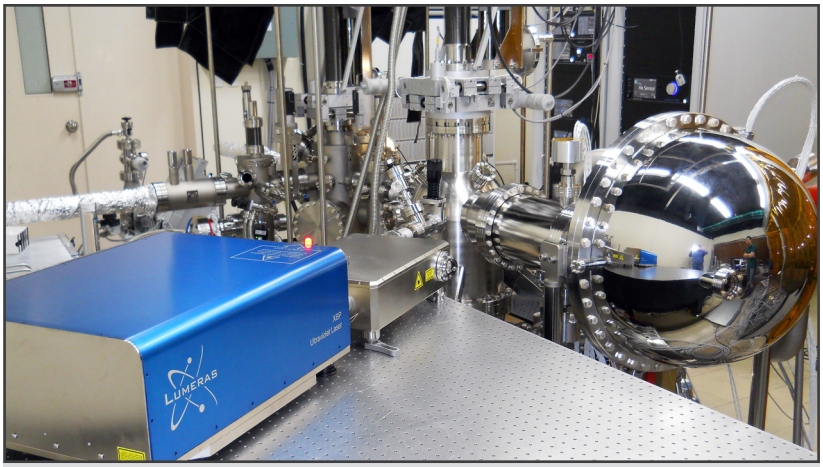
Fermi surface map and examples of momentum cuts of Bi2212 at 20 K in the superconducting state. The location of the momentum cuts are indicated as black lines in the surface map. The data was measured using the UV-2 11 eV laser and the Scienta Omicron ARTOF 10 k analyser. Data courtesy: XJ Zhou et al., Chin. Phys. Lett. Vol. 36, No. 6 (2019) 067402

UV-2 and UV-3
11 eV turnkey laser systems:

- 50 MHz version optimized for DA30-L
- 0.5- 5 MHz version optimized for ARTOF-2
- Pulse Bandwidth: <0.1 meV
- Variable flux and polarization
- Beam diameter down to 20 µm

Turnkey laser system

The compact geometry and flexible beam delivery system of the UV-X source facilitate easy integration into the laboratory environment. Each UV-X consists of a high-power laser head, ultraviolet monochromator and focusing module, and a wired touch-screen control interface. Motorized optics are provided for hands-free alignment of the ultraviolet beam into the analysis chamber. Polarization control and ultraviolet flux attenuation are available as options. Control of these parameters facilitates ARPES investigations of a broad range of quantum materials as described together with the first generation of the UV-X laser by the Prof. Z-X Shen group in Rev. Sci. Instrum. 87, 011301 (2016); https://doi.org/10.1063/1.4939759.



The 11eV laser technology initially supplied by Lumeras is now further developed and produced by Oxide, and available through Scienta Omicron. The source is field proven and has undergone significant improvements over the last few years. The photo shows an installation at Postech, Pohang in South Korea.

Technical Data

Property	Specification
Output Wavelength:	113.785 nm (10.897 eV)
Average Power:	> 10 µW
Pulse Bandwidth:	< 0.1 meV (0.001 nm)
Polarization:	Linear (Horizontal)
Beam diameter:	<0.25 mm without focusing option
UV-3 (optimized for DA30-L):	
Repetition Rate:	50 MHz
Pulse Duration:	< 20 psec
UV-2 (optimized for ARTOF-2):	
Repetition Rate:	0.5- 5 MHz
Pulse Duration:	< 50 psec

The system may be configured to direct 11 eV light in tree different directions to to fit specific lab space requirements.

Options:

- Polarization: Full range of linear polarizations as well as right and left-handed circular polarizations.
- Focus enhancement: Beam diameter reduced to < 20 um
- Attenuation control: Between 0 – 100 % of maximum
- Accessory hardware package to adapt UV-3 laser to UHV PES system including customized beam tubing, UHV LiF window assembly, Flux Detector, purge gas filter, and more.

Note: The UV-X is a class 1 laser system in normal operation when all system enclosures and beam tubes are in place.

Touch Screen Control Functions

1. Enable/Disable laser, open/close shutter
2. Optical harmonic power monitors
3. Motorized 11 eV beam pointing
4. 11 eV linear polarization rotation (optional)
5. 11 eV flux attenuation (optional)

Features and Safety Interlocks (Class 4 laser system)

1. Low jitter (10 psec) pulse synchronization electrical trigger
2. On/Off Key switch
3. Emergency Power Off (EPO) switch
4. Integrated laser shutter, with remote control capability
5. Two short-to-operate user interlocks on separate circuits
6. Remote monitoring of laser status, and shutter control

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