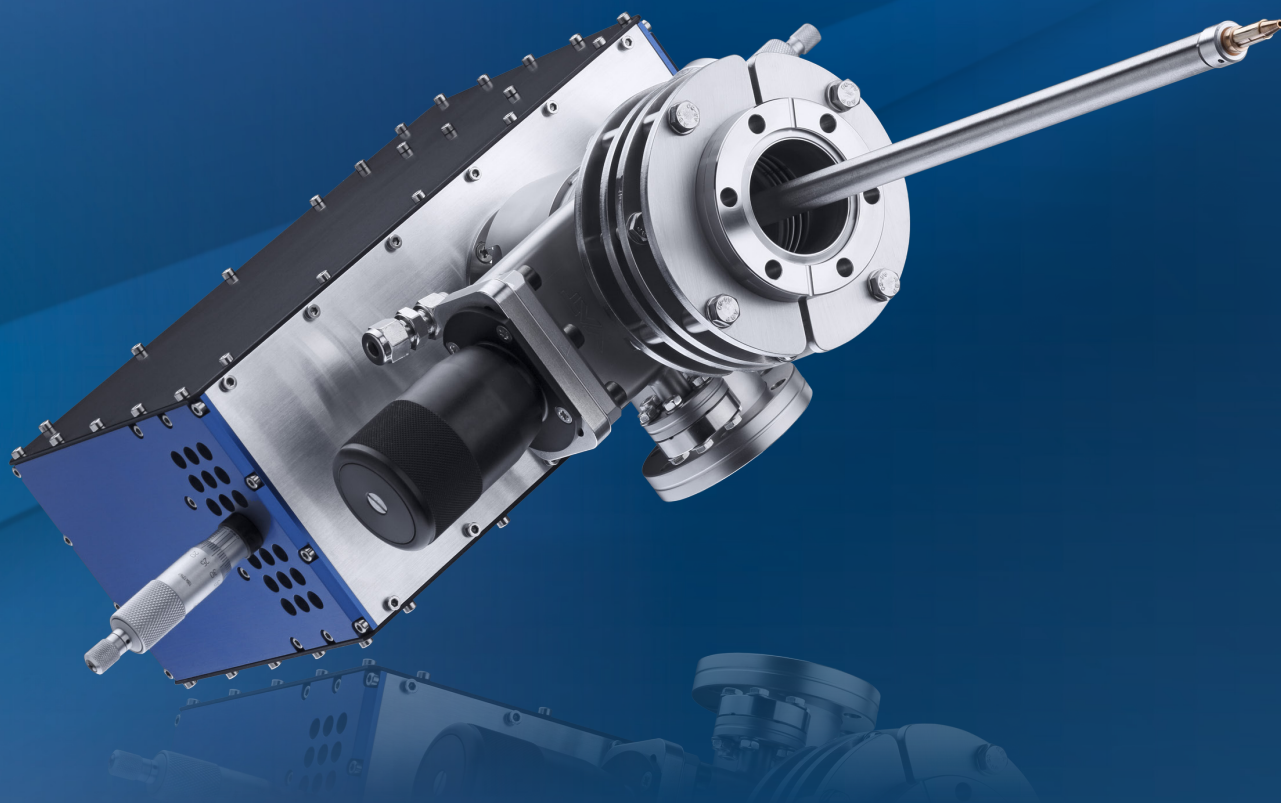


UV Source Series

UVS 10/35 GAS DISCHARGE, UVS 300 DUOPLASMATRON
AND UVLS MICROWAVE SOURCE FOR UPS AND ARPES

KEY FEATURES

- UV sources for ultimate intensity and stability
- Ease of operation
- Variable excitation lines
- Focussing capillary (optional)
- Polarizer (optional)
- TMM 304 UV monochromator (optional)



SPECS[™]

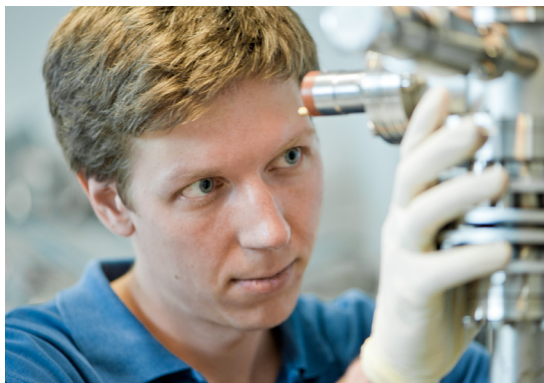
A member of SPECSGROUP

SPECS leads the way in developing cutting-edge components and systems for groundbreaking new surface analysis tools.

SPECS Surface Nano Analysis GmbH

SPECS Surface Nano Analysis GmbH headquarters is situated in the center of Germany's capital Berlin with subsidiaries in Switzerland, USA and China. SPECS has attracted a talented team of scientists and engineers who have dedicated their knowledge and experience to the development, design, and production of instruments for surface science, materials research, and nanotechnology for almost 30 years.

Packaging of a SPECS
component after final
testing



SPECS engineer during
system assembly



In order to continuously improve performance and to make available latest developments, we are in contact with numerous scientists, users and customers from all over the world. Reliable quality control (ISO 9001 certified) and excellent fast service, both remote and on-site, ensures maximum uptime and long-term operation and reliability of SPECS instruments over many years.

UV Source Series

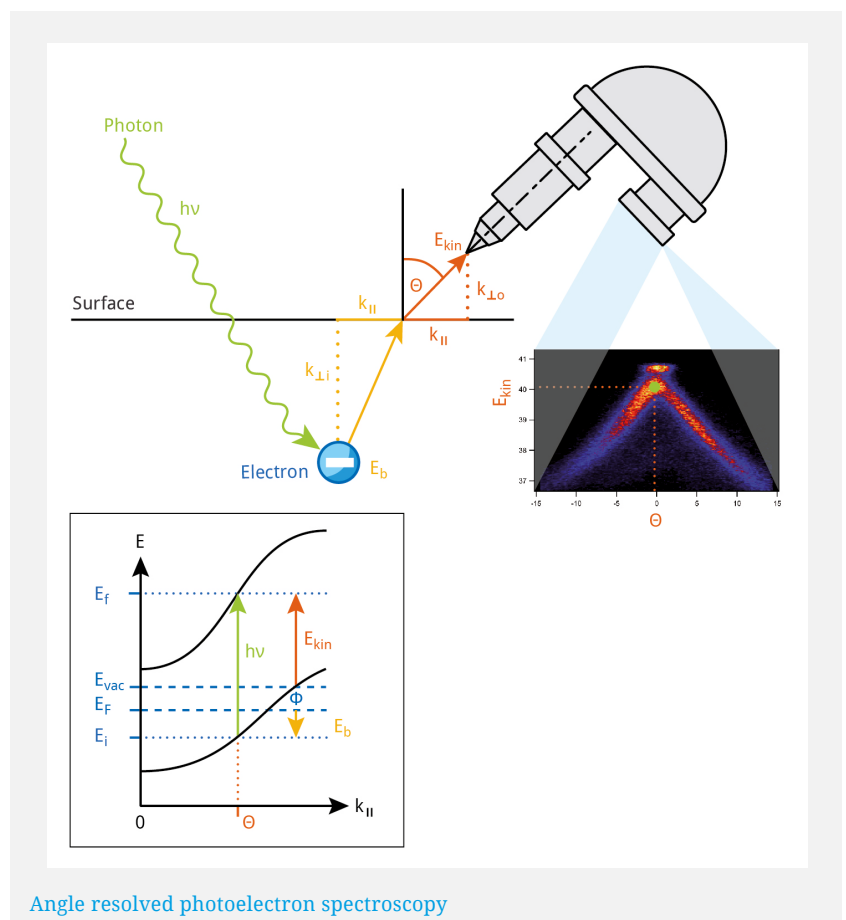
ULTIMATE PERFORMANCE AND RELIABILITY

Ultraviolet and angle resolved photoelectron spectroscopy (UPS and ARPES)

Ultraviolet and Angle Resolved Photoelectron Spectroscopy (UPS, ARPES)

Photoelectron spectroscopy (PES) is one of the most powerful and most frequently used spectroscopic techniques in solid state physics, physical chemistry and materials science. Using the photoelectric effect, PES provides a material sensitive and non-destructive probe for modern scientists to examine the chemical composition (XPS or ESCA) and the electronic structure (UPS and ARPES) of matter. By illuminating a sample with light of a certain photon energy ($h\nu$), electrons are released from a solid, using the photon energy to overcome their binding energy (E_b) and work function (Φ). The remaining energy provided by the photons is transferred into the kinetic energy (E_{kin}) of the photoelectrons. Such a transition can only occur from occupied electronic states of an energy E_i into unoccupied states of energy E_f , when the energy is conserved. On the other hand, also the wave vector (or momentum) k (k_x, k_y, k_z) has to be conserved. The surface breaks the geometry, not affecting the energy conservations rule, but affecting the momentum conservation such, that the parallel wave component $k_{||}$ is conserved after crossing the surface, but the component along the surface normal (k_{\perp}) is not conserved. Finally the electrons can be analyzed in an electron analyzer with respect to their E_{kin} (or recalculated to E_b) and to Θ (or recalculated to the parallel wave vector component ($k_{||}$)). On this basis, a 2D distribution of the electrons (number of electrons for given E_b and $k_{||}$) is measured, directly reflecting the electronic (or band) structure of the material. Such experiments in laboratory environments

require intense, small spot UV light sources of high stability for optimum performance. The intensity of the light source is the key point for fast and efficient measurements, while small spot sizes ensure measurements with highest angle (or momentum) resolution. SPECS offers a series of UV sources fitted to various demands, starting from flexible and robust UV sources for economic application to highly sophisticated UV sources for different gases and photon energies with monochromators for highest performance and energy resolution.



UVS 10/35

UV Discharge Lamp

For ultraviolet photoelectron spectroscopy on solids (UPS), the high performance ultraviolet source UVS 10/35 is ideally suited. The design of the discharge chamber results in high intensity and it also facilitates easy ignition and extremely stable operation of the discharge.

The UVS 10/35 can be mounted on any DN 35 CF flange on an analysis chamber as flange-to-sample distances are not critical. Efficient differential pumping ensures a long operating life. The He I / He II ratio can be controlled by adjusting the pressure of the gas in the discharge chamber.

Typically the source is operated using He gas in He I and He II mode. Other gases (Ne, Ar, Kr, Xe) can also be used for operation.



Power Supply

The PS-UVS20-A supplies all voltages and currents needed for the SPECS UVS 10/35 source operation. It consists of a switch mode power unit, an ignition unit and a fan control unit. The power supply operates in constant voltage or constant current mode. Before ignition the power supply operates in voltage mode. The source is ignited

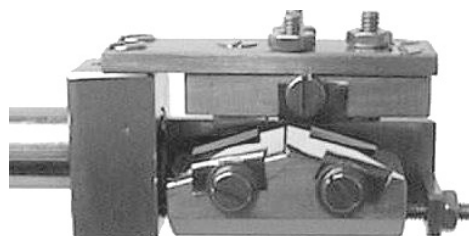
by simply pressing a push button on the front panel. The power supply also ensures fail safe operation of the UV- source. An interlock circuit turns off the high voltage applied to the source to prevent UV-source damage.



Polarizer and Accessories

The UVS 10/35 can be equipped with a polarizer unit mounted to the end of the capillary to switch from non-polarized to linear polarized UV light and to change the polarisation direction.

- Triple mirror construction
- Polarization degree > 90%
- In-situ rotatable linear polarization / switchable to nonpolarized light



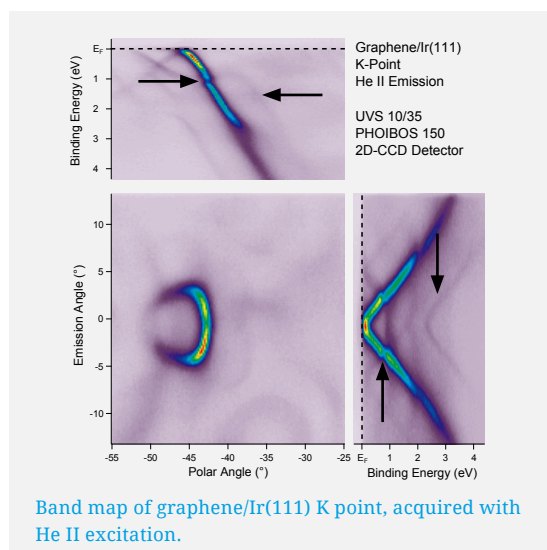
A dedicated gas inlet system, as well as an efficient differential pumping package is available.

UVS20-A power supply

UVS 10/35 UV light source

Results

Graphene adsorbed on Ir(111) shows an interesting electronic structure. Due to a mismatch between the graphene layer and the substrate unit cell dimension, a super-lattice is formed. This super-lattice induces the formation of back-folded replica bands. When these replica bands cross the original graphene band, mini gaps are formed (see black arrows).



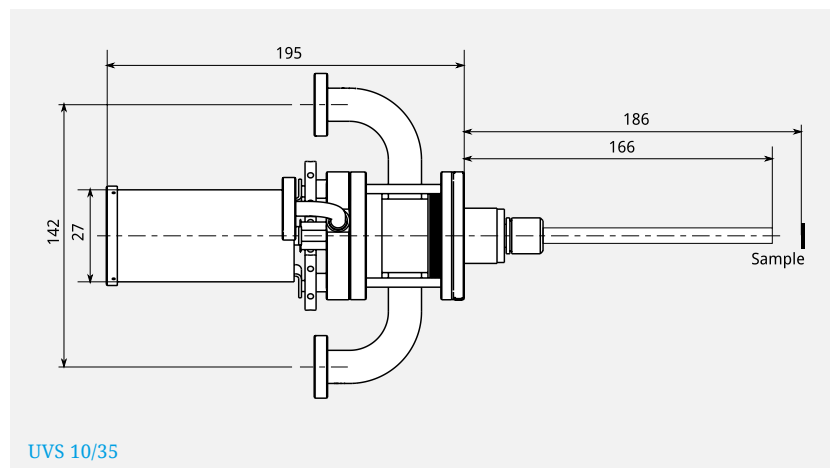
Features

- Cold discharge
- High photon flux / discharge current ratio
- Excellent and adjustable He I / He II ratio
- Differential pumping
- Easy operation / ignition
- Stable output

Technical Data

Specification	Value
Gases	He, Ne, Ar, Kr, Xe
Photon Flux	8×10^{15} photons/s*sr
Photon Current	15-40 nA
Beam Divergence	$< \pm 1^\circ$
Capillaries	Quartz (0.8 and 1.3 mm)
Mounting Flange	DN35CF
Insertion Depth	166 mm
Bakeable	up to 250 ° C

Dimensions

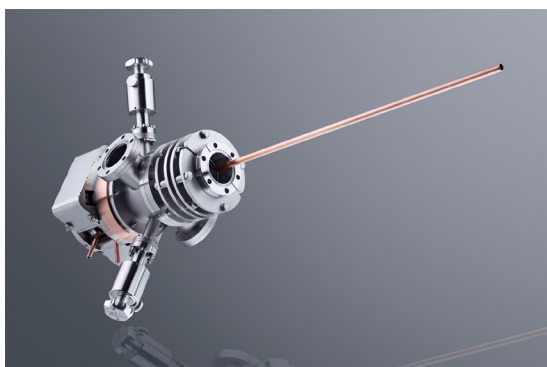


UVS 300

Duoplasmatron UV Source

The UVS 300 generates a high density plasma by guiding the electrons extracted from a hot cathode filament along the lines of a strongly inhomogeneous magnetic field towards a small discharge region (duo-plasmatron principle). The strong vacuum ultraviolet radiation is extracted from the cathode side by the combination of a metal and quartz capillary. Easy use is assured by one stage differential pumping and an integrated microvalve for a filament exchange without affecting the vacuum.

The UVS 300 allows for optimal He I and He II



operation (atomic and ionic emission lines), with best performance and highest available output on He II operation. The UV source is compatible with the SPECS TMM 304 monochromator.

SPECS offers two capillaries: a standard quartz capillary and an ETC focusing capillary (ellipsoidal transfer capillary) for small spot UPS with high photon currents.

Power Supply

The PS-UVS 300 A power supply is especially designed for the use with the UVS 300 and features high thermal and electrical stability. It supports two modes of operation, the constant voltage and constant current mode. Interlock sensors for water flow and temperature enable safe operation of the source. Indicators on the front panel assist in choosing optimal operation parameters for different modes.



Polarizer and Accessories

The UVS 300 can be equipped with a polarizer unit mounted to the end of the capillary to switch from non-polarized to linear polarized UV light and to change the polarisation direction.

- Triple mirror construction
- Polarization degree > 90%
- In-situ rotatable linear polarization / switchable to nonpolarized light

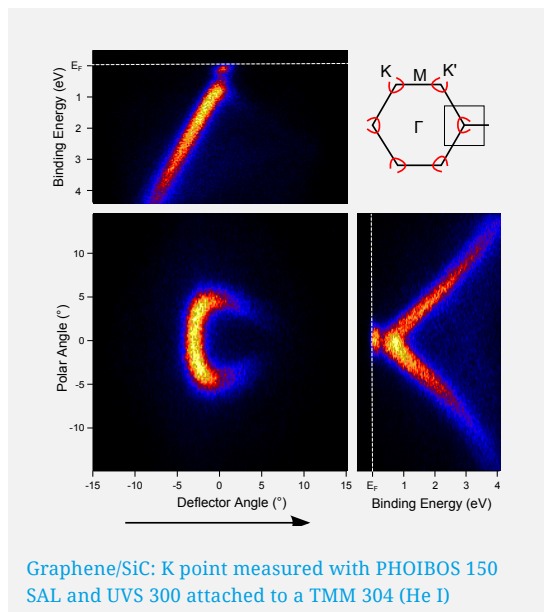
A dedicated gas inlet system, as well as an efficient differential pumping package is available.

UVS 300 power supply

UVS 300 UV source with quartz capillary

Results

Graphene is a two dimensional lattice of carbon atoms. Adsorbed on SiC, the K point is slightly shifted to higher binding energy. A band gap due to symmetry breaking is clearly visible. One side of the trifold structure is open, as along the Brillouin zone boundary, the two branches of the graphene π -band are interfering and the intensity of the photoemission signal is zero in this direction.



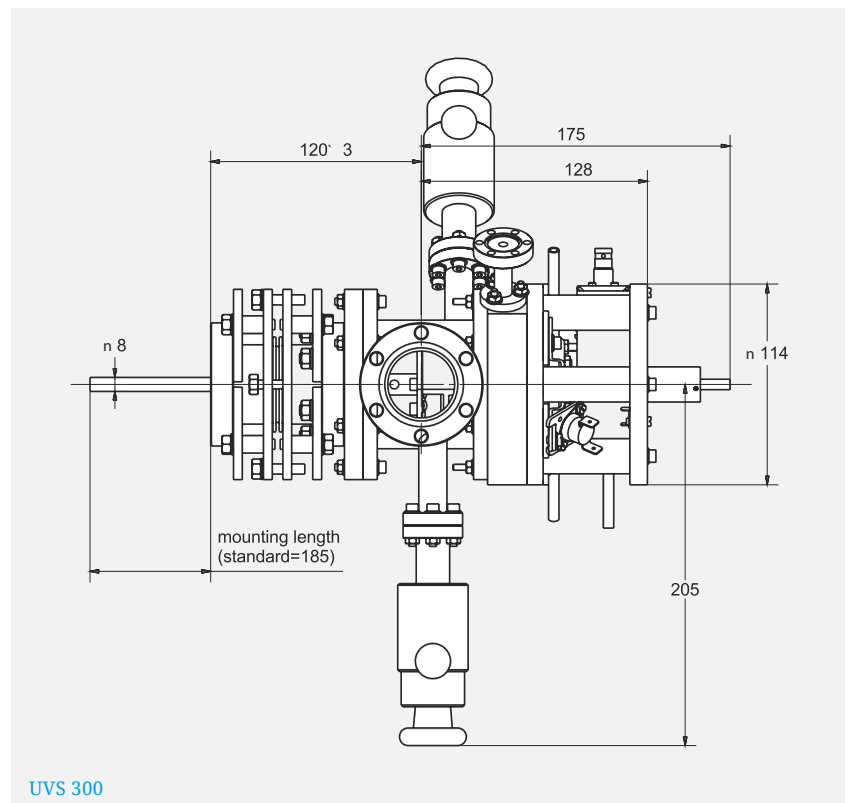
Features

- Duoplasmatron discharge
- Adjustable He I/He II ratio
- Excellent absolute He II intensity
- Single stage differential pumping
- Optional ETC for small spot size and high photon densities
- High thermal and electrical stability
- Constant voltage / current mode
- Interlocks: flow sensor, cathode temperature

Technical Data

Specification	Value
Gases	H, HeI/II
Photon Flux	$> 2 \times 10^{16}$ photons/s*sr
Photon Current	> 500 nA with ETC
Capillaries	Quartz (0.8 and 1.3 mm) and ETC
Spot Size	$< 500 \mu\text{m}$ (with ETC)
Mounting Flange	DN35CF
Operating Pressure in AC	$< 5 \times 10^{-8}$ mbar possible
Bakeable	up to 100°C (internal bakeout)
Monochromator Version	Yes

Dimensions

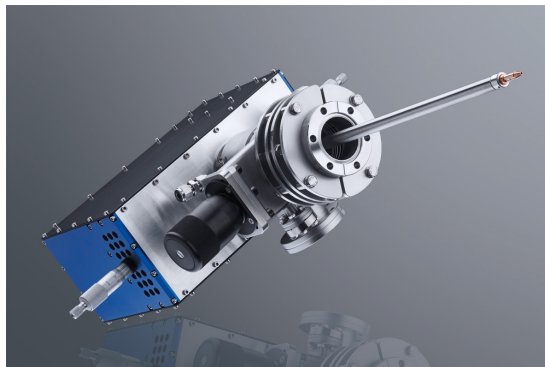


UVLS

Microwave UV Source

The UVLS is a microwave plasma-based UV light source. It is based on a filamentless design and is therefore not subject to the filament ageing of electron impact plasma UV sources. Instead the He plasma is created directly in the quartz output capillary leading to excellent coupling of the generated UV to the chamber or monochromator. This design provides long term plasma stability making the source suitable for use even with heavier gases like Ar and Xe.

The source is differentially pumped by an optional available pumping package and can be equipped with quartz and the focusing Ellipsoidal Transfer Capillary (ETC).



UVS 600 power supply

UVLS UV source with ETC capillary

Power Supply

The UVS 600 Power Supply is optimized for high stability and ease of operation. It allows for easy ignition and stable operation over long time.



Polarizer and Accessories

The UVLS can be equipped with a polarizer unit mounted to the end of the capillary to switch from non-polarized to linear polarized UV light and to change the polarisation direction.

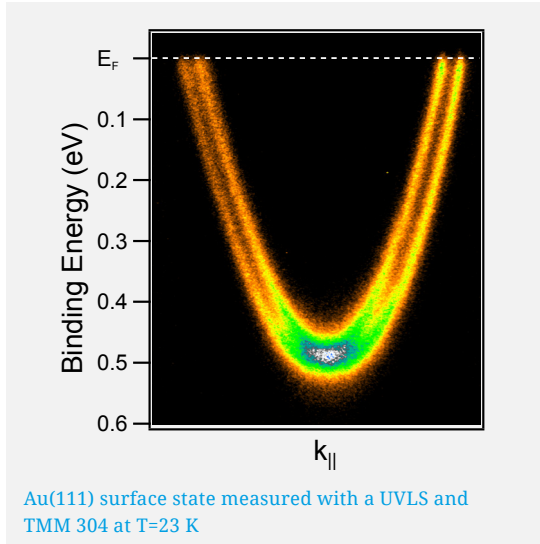


- Triple mirror construction
- Polarization degree > 90%
- In-situ rotatable linear polarization / switchable to nonpolarized light

A dedicated gas inlet system, as well as an efficient differential pumping package is available.

Results

Clean surfaces of many materials exhibit a special electronic state when sharply terminated, e.g. to UHV. The so called surface state originates from electrons on the surface of solids, which are located in a potential different from the bulk electronic structure. Especially for 3d transition metals, e.g. on Au(111), such electronic states exhibit a splitting in momentum originating from spin orbit interaction, the so called Rashba effect. As an example, for Au(111), the surface state has been measured using a PHOIBOS 150 and a monochromated UVLS in He I mode, a common test of the performance of ARPES systems.



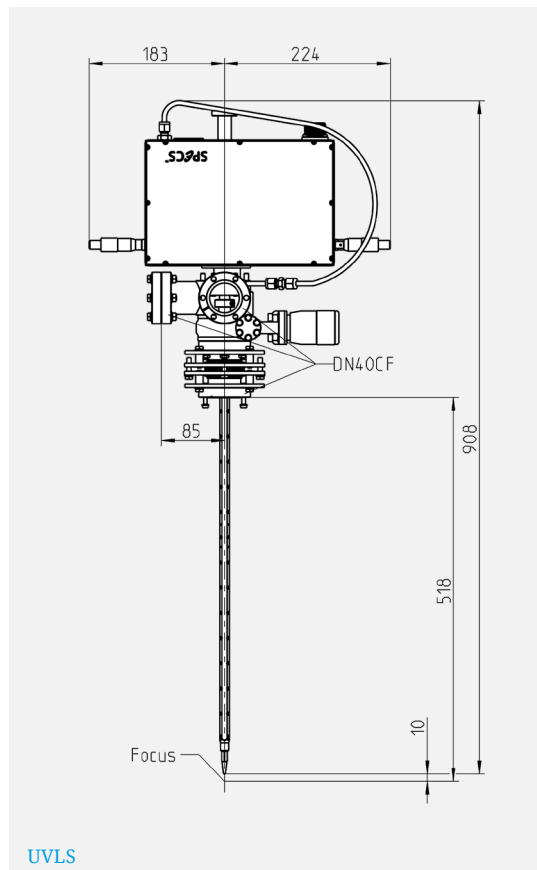
Features

- Microwave induced plasma discharge
- High photon flux $> 1.3 \cdot 10^{16}$ photons/sr·s
- Light and heavy gases due to filamentless design
- Single stage differential pumping
- Optional ETC for small spot size and high photon densities
- High stability
- Easy operation and ignition
- Interlock connection

Technical Data

Specification	Value
Gases	He, Ne, Ar, Xe
Photon Flux	$> 1.3 \cdot 10^{16}$ photons/s*sr
Capillaries	Quartz (0.8 and 1.3 mm) and ETC
Spot Size	$< 500 \mu\text{m}$ (with ETC)
Mounting Flange	DN35CF
Operating Pressure in AC	$< 5 \cdot 10^{-8}$ mbar possible
Bakeable	up to 120 °C
Monochromator Version	Yes

Dimensions



TMM 304 Monochromator

The TMM 304 is a toroidal mirror monochromator for laboratory UV sources, compatible with SPECS UVS 300 and UVLS sources. It can be equipped with two cassettes which are optimised for specific wavelength. Switching the cassettes can be performed without braking the vacuum. The light is guided towards the sample by a focusing ETC capillary resulting in small spot sizes and high photon densities.

In combination with a high performance differential pumping system UPS measurements under very good UHV conditions can be performed.

The frame is optionally available with a rotary stage to change the polarization in-situ.

Cassettes

Cassettes consists of a matched grating/mirror pair. Each cassette is optimized for a particular wavelength. Cassettes are available for HeI and HeII, as well as for Xe (with 1200 and 2400 lines/mm). The degree of polarization is >80 %. An optional polarizing cassette is also available with a resulting degree of polarization exceeding 90%.

Frame

The TMM 304 can be ordered with a fixed or rotatable frame. Both versions come with a z-retract, a rotation base and a tilt for easy beam alignment. The rotatable frame provides an additional motorized rotation around the beam axis to switch between s- and p-polarized light, without braking the vacuum.

TMM 304 cassette

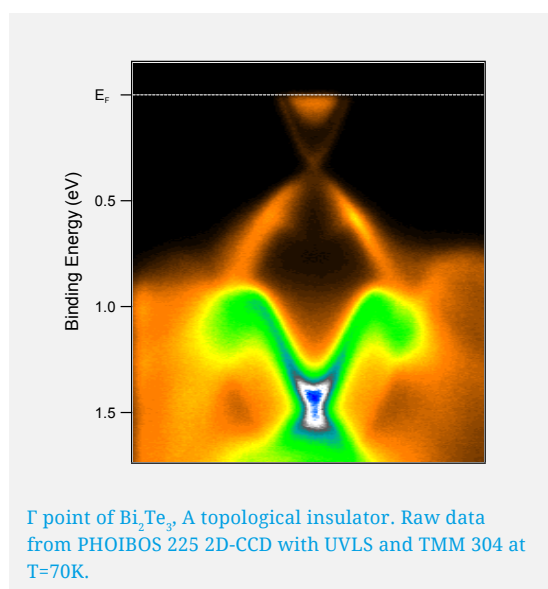


TMM 304 monochromator



Results

Topological insulators are insulating materials with surface states crossing the gap between the (bulk) valence and conduction band. Bi_2Te_3 is a well known example for this kind of materials. Its surface states have different spin states, avoiding the opening of a band gap at the touching point of these two bands. The result is a dirac cone like structure.



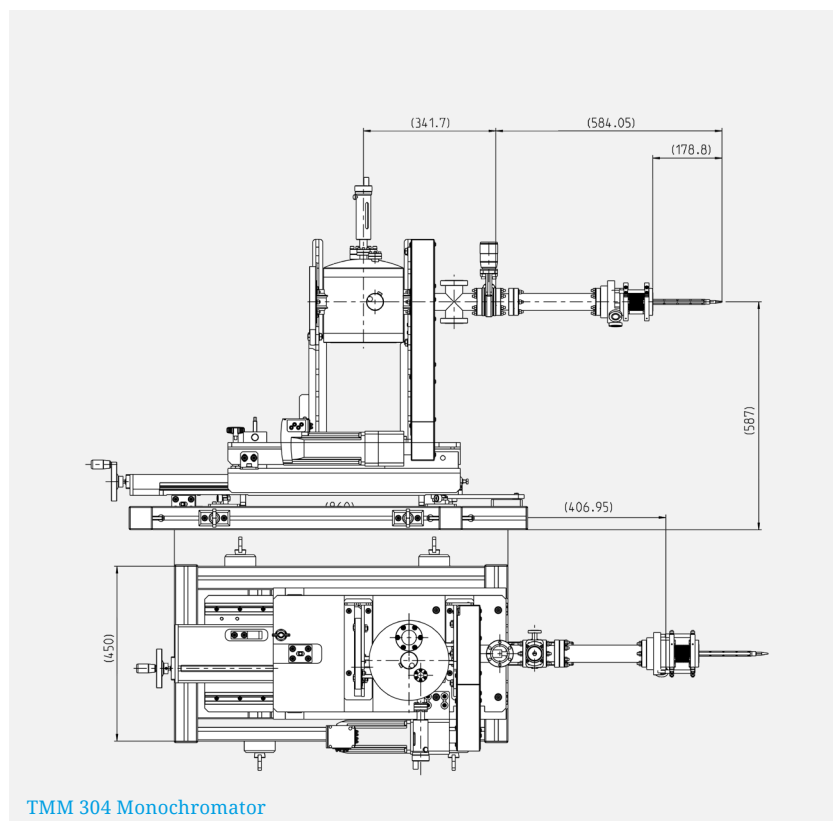
Features

- Two cassettes installed
- High photon flux
- Cassettes for HeI, HeII, Xe and polarizer
- Advanced differential pumping
- ETC for small spot size and high photon densities
- Rotatable frame for changing polarization of UV light

Technical Data

Specification	Value
Line width	< 1 meV
Photon Flux	> 1×10^{16} photons/s*sr
Spot Size	< 500 μm (with ETC)
Mounting Flange	DN35CF
Operating Pressure in AC	< 1×10^{-10} mbar possible
Bakeable	up to 120 °C
Rotatable Frame Available	Yes

Dimensions



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