

Carmina

Tunable IR Light-source

IR Light-source for the Combination with s-SNOM and AFM-IR Microscopes

- APE offers an IR light-source with an automated tuning range of up to 2.15 μm ... 15 μm . This novel laser is ideal for s-SNOM and AFM-IR applications. Due to the very large tuning range and the presence of a narrowband mode, a broadband mode and a pulsed mode, the nanoscale techniques s-SNOM spectroscopy, s-SNOM imaging and AFM-IR can be realized with this one source. One Carmina - three applications.



At a Glance

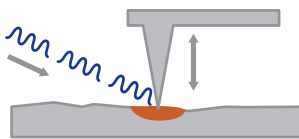
- Spectroscopy & Imaging of organic & inorganic samples with a single laser-source
- Two complementary nanoscale Mid-IR techniques covered: s-SNOM and AFM-IR
- Narrowband ($\sim 20 \text{ cm}^{-1}$) and broadband ($> 300 \text{ cm}^{-1}$) operation
- High output power levels between 5 mW and 300 mW
- Continuous sweep mode for fast scanning
- User friendly turnkey operation incl. automated wavelength tuning
- Wavelength tuning broadband: from 2.15 μm ... 15 μm (4650 cm^{-1} ... 670 cm^{-1})
- Wavelength tuning narrowband: from 5.0 μm ... 15 μm (2000 cm^{-1} ... 670 cm^{-1})

Application Examples

Spectroscopy & Imaging with a Single Light-Source

- The fully automated IR source sets new standards in terms of flexibility, sensitivity and tuning range thanks to its OPO/DFG architecture. With the unique combination of 300 cm^{-1} broadband and 20 cm^{-1} narrowband emission, the complementary nanoscale IR techniques s-SNOM Imaging, Spectroscopy and AFM-IR are now covered with a single light-source. A pulsed mode (burst mode with 50 % duty cycle) is available for AFM-IR.

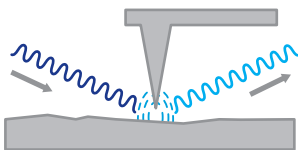
AFM-IR



- **IR pulsed mode**

Available for broadband & narrowband
Pulsed mode / burst mode with 50 % duty cycle

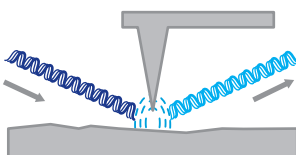
s-SNOM Spectroscopy



- **IR narrowband quasi-cw**

Narrowband mode $\sim 20\text{ cm}^{-1}$
Wavelength tuning $5.0\text{ }\mu\text{m} \dots 15\text{ }\mu\text{m}$ ($2000\text{ cm}^{-1} \dots 670\text{ cm}^{-1}$)
Fast continuous sweep mode in less than 30 seconds for scanning
from $1000\text{ cm}^{-1} \dots 1800\text{ cm}^{-1}$

s-SNOM Imaging



- **IR broadband quasi-cw**

Broadband mode $> 300\text{ cm}^{-1}$
Wavelength tuning $2.15\text{ }\mu\text{m} \dots 15\text{ }\mu\text{m}$ ($4650\text{ cm}^{-1} \dots 670\text{ cm}^{-1}$)

Carmina Broadband & Narrowband Specifications

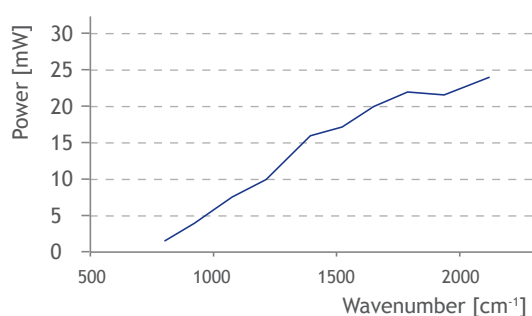
Available Configurations

	Version A	Version B	Version C
Broadband quasi-cw	■	■	■
Narrowband quasi-cw	■	■	-
Broadband Pulsed Mode	■	-	-
Narrowband Pulsed Mode	■	-	-

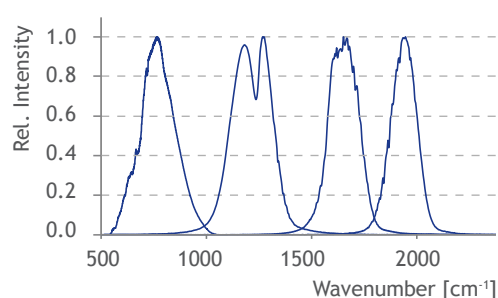
Broadband Operation

Tuning Range	2.15 μm ... 15 μm (4650 cm^{-1} ... 670 cm^{-1})
Wavelength Tuning	Fully automated, no user adjustment required
Step and Settle Time	< 2 s
Power	> 15 mW at 1600 cm^{-1}
Bandwidth Typical	300 cm^{-1} (FWTM, 10 dB level), 170 cm^{-1} (FWHM)
Beam Quality M^2	< 1.3 at 1600 cm^{-1} , typ. < 1.3 over complete tuning range
Polarization	Horizontal
Beam Diameter at Exit	Typ. 5 mm at 1600 cm^{-1}

Broadband Operation Power (typical)



Broadband Operation Spectra (typical)

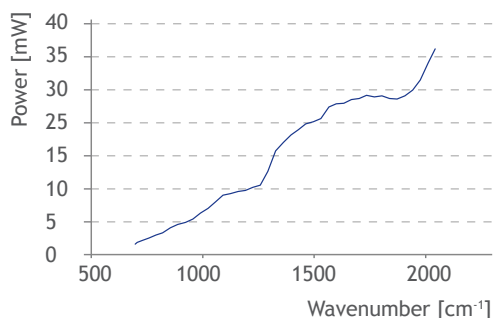


Narrowband Operation

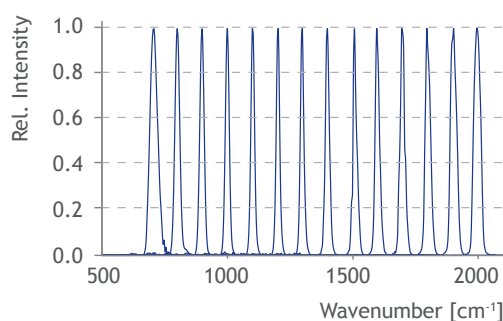
Tuning Range	5 μm ... 15 μm (2000 cm^{-1} ... 670 cm^{-1})
Wavelength Tuning	Fully automated, no user adjustment required
Step and Settle Time	< 2 s
Sweep Mode	Continuous sweep Max. speed > 30 cm^{-1}/s , speed and range software adjustable
Power	> 15 mW at 1600 cm^{-1}
Bandwidth	Typ. 20 cm^{-1} (FWHM) for 1000 cm^{-1} ... 1800 cm^{-1}
Beam Quality M^2	< 1.3 at 1600 cm^{-1} , typ. < 1.3 over whole tuning range
Polarization	Horizontal
Beam Diameter at Exit	Typ. 5 mm at 1600 cm^{-1}

...Specifications

Narrowband Operation Power (typical)



Narrowband Operation Spectra (typical)

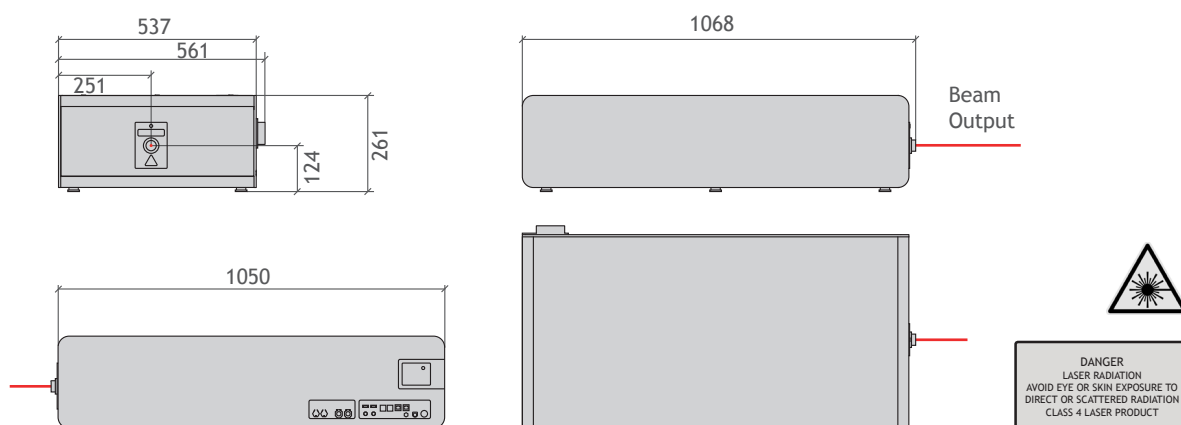


cw - Pulsed Mode Specifications

Repetition Rate quasi-cw Operation	40.5 MHz +/- 0.5 MHz
Repetition Rate Pulsed Mode	50 kHz ... > 1.5 MHz externally triggered via TTL signal on BNC
Pulse Energy	> 15 nJ at 1600 cm ⁻¹ at 500 kHz at 50% duty cycle
Pulse Duration	Duty cycle ~ 50%

Further Specifications and Requirements

Dimensions & Weight	Laser: 537 mm x 1068 mm x 261 mm; ~ 105 kg Electronics: 3U x 482.5 mm x 389.5 mm; 11 kg
Electrical Supply	110 - 240 V, 50 - 60 Hz
Cooling Requirements	Water cooling ~ 22°C (Chiller not included)
Purging Requirements	Purging gas for H ₂ O and CO ₂ removal (Drying unit not included)



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