



Levante Emerald^{NSP}

The Levante Emerald^{NSP} is a widely tunable fully automated high power NIR light source of ps pulses. It is based on a synchronously pumped optical parametric oscillator (OPO), with an external green ps laser as pump. The OPO is adaptable to work with pump pulse widths between 2 ... > 20 ps and pump powers from 2 ... 20 W for an output power of up to 6 W. The pulses of the output beams are close to transform limit and of high beam quality. The Levante Emerald^{NSP} exhibits a robust mechanical design on a solid steel baseplate enabling stable long term operation as well as excellent beam pointing stability.

New automated Version

The Levante Emerald^{NSP} has been newly developed featuring full automation, i.e. software controlled tuning. This is made possible by its entirely new control electronics, internal diagnostics, and Control Software conveniently packaged in a new housing.

Hence handling has never been easier. The Control Software on the PC is equipped with a Standardized Software Interface (using TCP / IP). The OPO can easily be integrated into larger experimental setups and software controlled environments.

The new Levante Emerald^{NSP} is based on APE's long standing experience in developing and manufacturing fully automated OPOs.

- New fully automated tuning with Windows-based Control Software: Simply enter the desired wavelength into the software
- Internal diagnostics for power and wavelength
- Two tunable output beams with different colors (Signal and Idler)
- Signal and Idler beam overlapped in space and time | Beam separator included
- Ideal 2 ps pulse width for Coherent Raman imaging
- Remote access available for fast and easy customer support and error diagnosis

fixed wavelength green pumped ps OPO

Tuning - Sweep mode

The actual OPO Signal wavelength and bandwidth is measured by an internal real-time high resolution spectrometer, and the power by calibrated photo-diodes. To tune, the user simply enters the desired wavelength into the Control Software of the OPO.

For fast tuning over a certain wavelength range a sweep function has been added. It allows tuning from a set start wavelength to a set end wavelength automatically in short time, either with a predefined hold at each spectral step, or with advance for each step on a software trigger.

Ideal for multi-color experiments / multiphoton microscopy

Because of the synchronous pumping, the Signal and Idler pulses of the Levante Emerald^{NSP} are generated jitter-free with respect to each other as well as the pump pulse. Signal and Idler are available at the same time¹⁾. Since they are coupled out of the OPO collinearly, the Signal and Idler pulses have an intrinsically perfect spatial and temporal overlap in the output beam of the system.

The photon energy difference between Signal and Idler is continuously tunable, which makes the Levante Emerald^{NSP} an ideal system for multi-color excitation experiments, such as e.g. SRS (Stimulated Raman Scattering), or CARS (Coherent Antistokes Raman Scattering). Even more combinations of jitter-free pulses with different wavelengths are available when using a pump laser which also offers (preferably undepleted) green pulses at the fundamental wavelength.

Using the APE line of HarmoniXX frequency converters as an add-on, also wavelengths down to 190 nm can be generated, enabling a range of further experiments e.g. in biology, or materials science.

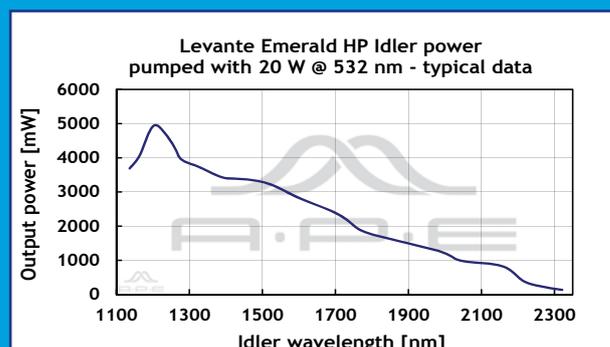
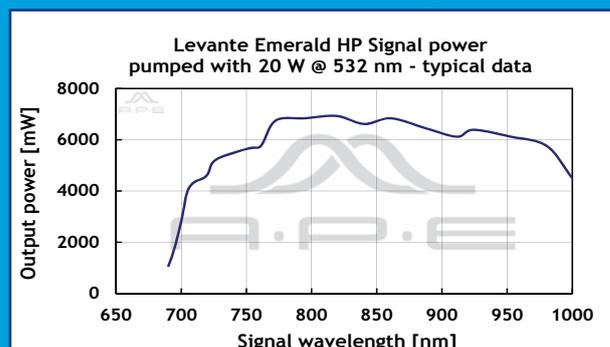
Short ps Version

The Levante Emerald^{NSP} 2 ps (pumped by the Emerald Engine with 2 ps pulses) offers an optimized pulse width with maximum spectral bandwidth in the Raman fingerprint region without compromise in resolution for highest signal levels. Its high efficiency in non-linear processes makes the Levante Emerald^{NSP} 2 ps an ideal tool for applications such as CARS (Coherent Antistokes Raman Scattering) and SRS (Stimulated Raman Scattering) imaging applications.

Compared to the 6 ps version of the Levante Emerald^{NSP}, the Levante Emerald^{NSP} 2 ps has shown improvement in CARS signals by a factor of 10, and in SRS signals by a factor of 2.5. Also signals of SHG or Multi Photon Fluorescence are much improved.

The Levante Emerald has been successfully used for SHG imaging. Important wavelengths for MPE (Multiphoton Excitation Microscopy) are directly available, such as e.g. 950 nm for GFP (green fluorescence protein) or 1160 nm for RFP (red fluorescence protein).

The Levante Emerald is also available as Levante Emerald HP accepting pump powers larger than 4 W where pump powers beyond 20 W green have been successfully qualified, allowing an output power of the OPO in the range of 6 W at 800 nm wavelength.



1) The wavelengths of Signal and Idler are dependent on each other following the relation $\frac{1}{\lambda_{\text{Signal}}} = \frac{1}{\lambda_{\text{Pump}}} + \frac{1}{\lambda_{\text{Idler}}}$

Power Scaling

An OPO is especially suited for power scaling because it uses a parametric process for operation - compared to a laser process with intrinsic heating due to the quantum defect - where there is no intrinsic heat generated by the parametric process in an OPO.

Please ask for adaptations to pump powers other than mentioned in this datasheet.

The Levante Emerald^{NSP} HP is ideally suited for high power pumping of harmonic generators (such as the HarmoniXX) for high output power especially in the UV wavelength range. For a complete system emitting in the UV, please see APE's datasheet "High power tunable ps UV source".

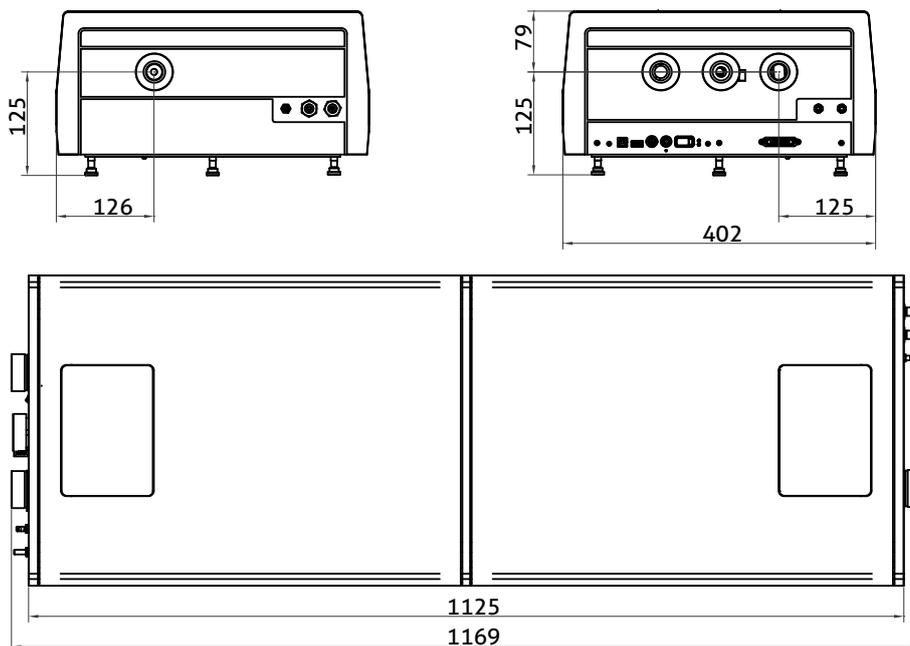
Remote Access

A TCP / IP interface and LAN allow for remote access to log files as well as remote service.



pump laser not depicted

Dimensions (in mm)





fixed wavelength
green pumped ps OPO

Specifications

Pump laser	Emerald Engine ¹⁾	532 nm 6 ps	Paladin ²⁾
	Levante Emerald ^{NSP} 2 ps	Levante Emerald ^{NSP}	Levante Emerald ^{NSP} HP
Pump laser parameters	516 nm 3 W approx. 2 ps	532 nm 4 W approx. 6 ps	532 nm > 20 W approx. 15 ps
Tuning range manual	640 ... 960 nm 1120 ... 2030 nm	690 ... 990 nm 1150 ... 2300 nm	690 ... 990 nm 1150 ... 2300 nm
Tuning range automated	660 ... 960 nm	720 ... 990 nm	720 ... 990 nm
Output power	> 0.7 W @ 800 nm > 0.4 W @ 1250 nm	> 0.9 W > 0.6 W	> 6 W @ 800 nm > 3.5 W @ 1250 nm
Pulse width	approx. 2 ps ³⁾	approx. 5 ... 6 ps	approx. 12 ... 15 ps
Spectral bandwidth	< 1 nm (10 cm ⁻¹)	typ. 0.3 ... 0.4 nm (Signal)	< 0.1 nm (Signal)
Photon energy difference			
Signal - Idler	1440 ... 9000 cm ⁻¹	1400 ... 10000 cm ⁻¹	1400 ... 10000 cm ⁻¹
Signal - Laser Fundamental	720 ... 5900 cm ⁻¹	700 ... 5000 cm ⁻¹	-
	(when 1032 nm beam available from pump laser)	(when 1064 nm beam available from pump laser)	
Time bandwidth product		typ. 0.6	
Repetition rate	approx. 80 MHz (depending on the repetition rate of the pump laser)		
Beam quality M ²	< 1.2 (typ. 1.1)		
Polarization	linear / horizontal		
Computer interface	Standardized Software Interface (using TCP / IP)		

The Levante Emerald^{NSP} and the Levante Emerald^{NSP} HP are delivered with a removable Signal / Idler beam separator.

1) APE Emerald Engine, based on NKT aeroPULSE

2) Coherent PALADIN Advanced 532-20000

3) @ approx. 2 ps pump pulse width

Options

- Modulator for SRS and heterodyne CARS (AOM or EOM)
- Detector / Lock-in amplifier module optimized for video rate Stimulated Raman Scattering (SRS) Microscopy
- HarmoniXX harmonic generator (SHG, THG, FHG, DFG)
- Autocorrelator

Contact:

APE Angewandte Physik & Elektronik GmbH
Plauener Str. 163-165 | Haus N | 13053 Berlin | Germany
T: +49 30 986 011-30 | E: sales@ape-berlin.de | www.ape-berlin.de

**PHOTO
TECHNICA** フォトテクニカ株式会社
www.phototechnica.co.jp
〒336-0017 埼玉県さいたま市南区南浦和 1-2-17
TEL:048-871-0067 FAX:048-871-0068
e-mail:voc@phototechnica.co.jp

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