

# Products 2008



Femtosecond Regenerative Amplifiers



Femtosecond Fiber Oscillators



Optical Parametric Amplifiers



STORC Harmonic Generators



Transient Absorption Pump/Probe Systems



Sum Frequency Generation Spectrometers



20 Years Serving the Femtosecond Laser Community

**Clark-MXR, Inc.**

*First in Ultrafast*

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# Message from the President

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My name is Bill Clark and I am the President, CEO, and a founder of Clark-MXR, Inc. I hope you are reading this brochure because one of over 250 scientists worldwide who are using our products recommended you contact us.

My objective for the past 20 years of serving the ultrafast laser community has been to stay a small, independent and responsive company with a focus on this unique ultrafast laser system technology. I strongly believe that it is not the company name but rather a tightly-knit group of excellent people dedicated to serving you that is your best guarantee of success with the products you buy - and for the following reasons:

- 1.) You work with the people who can make things happen for you, including me.
- 2.) Well-established companies - ones that have been functioning in the field for more than 5 years - are generally well run and have a segment of the market that has bought, likes and endorses their product. These companies are less likely to be subject to the vagaries of the market that can impact a fledgling start-up.
- 3.) A privately-held company is not driven by the whims of Wall Street, and so is in a better position to make decisions that have long-term benefit to its customers. Thus, for example, the very first systems we delivered are still in use today and are still being supported by us.
- 4.) We recognize that we succeed - not when you buy our product - but only when you are successful with it. Because only then will you be willing to recommend us to your associates.

Our products are not "all things to all people." Our obligation to you is to help you make a well-informed decision. To that end, if I can be of any assistance, please do not hesitate to contact me directly at [clark@cmxr.com](mailto:clark@cmxr.com).

And thank you for including us in the list of companies that you are considering to supply your equipment needs.

Sincerely,

A handwritten signature in black ink that reads "William Clark". The signature is written in a cursive, slightly slanted style.

William Clark Ph.D.

President and CEO



## Stability

---

### *A constant to pair with all your variables...*

Imagine a source that maintains its operating parameters through the course of your work.

Imagine a source that maintains those parameters for days or weeks.

Imagine the productivity and consistency of the results you could get.

Now imagine the satisfaction of your work.

### *You're not imagining things!*

The CPA-Series is the **stable source** for your femtosecond laser needs.

### *How do we test laser stability?*

Our "Shaketest" puts our lasers through the most vigorous stability testing in the industry. Using the brute force of a 10 lb weight attached to an electric motor and affixed to the top of our laser system, the laser is subjected to extreme vibration conditions at a force of nearly 2.5 Gs. Following our test, output must remain consistent with pre-testing levels for the laser to pass this inspection.

### *See it for yourself.*

A short digital movie of our shaketest is available from your Clark-MXR Representative.

## Reliability

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*Reliability isn't just a word. Its a standard we live up to, every day, by providing lasers that:*

- Work when you're ready to work.
- Let you spend your morning working on your project, instead of working on the alignment of your source.
- Allow you to leave your lab for lunch and return to find the source is still operating the way you left it.
- Operate unchanged the rest of the afternoon, into the night, and over the next several days.
- Or restart the same way again when you begin your workday.
- Imagine the signal you can extract from the noise when you can rely on the stability of your system to remain unchanged over days instead of several minutes.

*The CPA-Series is the **reliable** source for your femtosecond laser needs.*

*In the race to the publisher, the patent office, or to meet your production deadline, which source will you rely upon?*

## Simplicity

---

*Spend your time on your research instead of equipment maintenance.*

- Works simply by turning it on.
- Doesn't require daily or hourly realignments.
- Give yourself more time to get the important things done!

*The CPA Series is the simple choice for your femtosecond laser needs.*

*In the day-to-day running of your experiments, will you choose simplicity over complexity?*



## FAQs About Clark-MXR

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While our products may seem very similar to others on the market, there are differences that can have a significant impact on your future success. Because we are scientists by training, we believe we should “walk the talk” - answering up-front the questions you ask.

**Question:** *How old is the company?*

**Answer:** Going back to the earliest start date, the company is 18 years old.

**Question:** *What is its expertise?*

**Answer:** The Company’s expertise is in the manufacture and use of ultrafast lasers (lasers that produce pulses of light with pulse widths of less than about 10 ps).

**Question:** *How large is the company?*

**Answer:** About 40 people worldwide.

**Question:** *How many products are in use worldwide?*

**Answer:** Clark-MXR, Inc. has a worldwide installed base of over two hundred ultrafast laser systems – about evenly distributed in number between North America, Europe, and Japan. Clark-MXR also has systems in China, Singapore, South Korea, Australia, Brazil, Israel, etc.

**Question:** *How does the company support its products?*

**Answer:** Clark-MXR, Inc. supports its products out of the home office just outside of Ann Arbor, Michigan and from local offices worldwide. Support is provided by onsite visits, phone, and e-mail - depending on your needs and preferences.

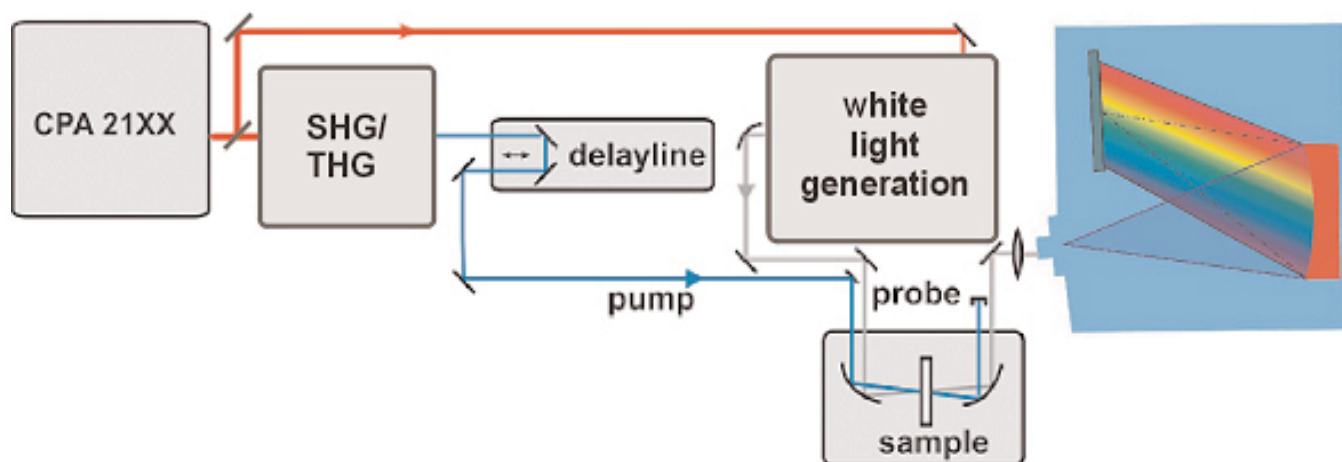
**Question:** *How many service people does the company have?*

**Answer:** About 8 people worldwide.

# TAPPS

TAPPS is a complete pump/probe transient absorption system designed to assist scientists in understanding the deactivation dynamics of excited states. Applications of this spectroscopic technique extend from the fundamental studies of energy and electron transfer processes in physics, chemistry and biology to the design of logic gates in molecular electronics.

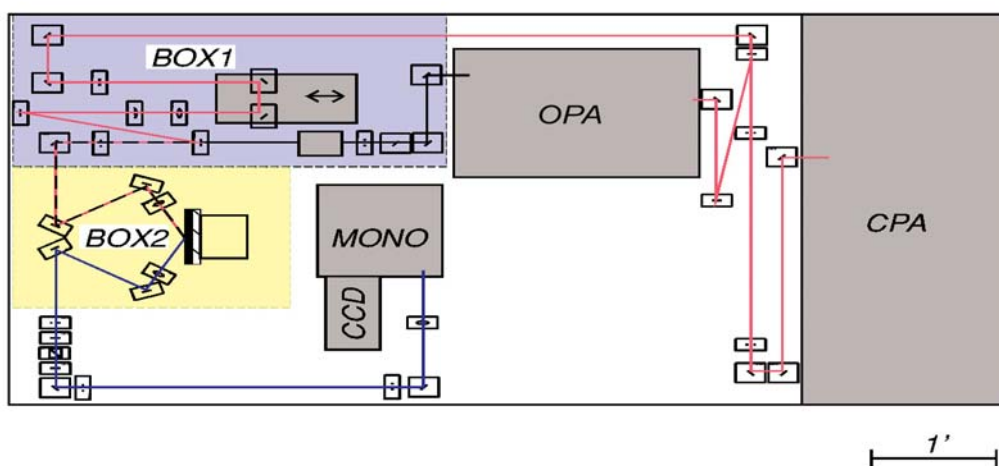
- All-in-one box set-up for measuring transient absorption
- Compact version optimized for ease-of-use
- UV pump (CPA w/ SHG, THG) for highest compactness
- Probe wavelength coverage: 450 - 900 nm from Sapphire White Light Continuum
- Standard temporal window 1.6 ns
- 200 fs temporal resolution
- Chirp compensation
- Provides full 3D data set in 30 minutes
- Repetition rate: optimized for the kHz performance from a CPA-21xx system from Clark-MXR
- Standard detection sensitivity:  $2 \times 10^{-4}$
- Option with reference channel



# Sum-Frequency Generation Spectrometer

## Multiplex IR-Visible SFG, key features:

- Measure FAST - acquire 1000 spectral points in the time you would otherwise measure just one point in "traditional" scanning SFG setup. This allows for real-time monitoring of surface concentrations with submonolayer sensitivity. Alternatively this provides enough time to register a weak SFG signal even if the sample is short-lived.
- Look WIDE: Simultaneously monitor multiple peaks and their evolution in real time over  $200\text{ cm}^{-1}$ ; not just the amplitudes, but also bandwidths and peak shapes in general; record minutes of "vibrational spectral movie" of your process.
- A rugged femtosecond radiation source, time-tested in an industrial environment allows you to spend time on your experiment, instead of laser alignment.
- Powerful IR beam capable of overcoming strong absorption and reaching interfaces covered with water, e.g. in electrochemical cell.
- Powerful visible beam: split out some and use it to provide a pump with SFG signal serving as a probe for pump probe experiment with picosecond time resolution.
- Unique sample positioning system allowing for equally rapid change of similar samples and very different samples and whole sample cells - several research groups can share one installation reconfiguring it for new experiment in just a few minutes.
- Quickly change from vertical sample orientation (good for flat solid samples) to horizontal orientation (suitable for electrochemical cells).
- Choose between copropagating IR-Visible beam geometry and on-sample crossing geometry - the former allowing for simple optical alignment suitable for less experienced researchers; the latter if stray nonlinear optical effects have to be completely eliminated.
- Conveniently fits on 4 x 8 foot table leaving extra space for your specific equipment.



Schematic layout of SFGS



### **SFG spectroscopy:**

- Specificity: probes surface layers but not the bulk of the substrate.
- Sensitivity: readily detects surface concentrations less than a monolayer.
- Uniqueness: the only optical probe highly sensitive to the surface symmetry, molecular orientation and disorder. Determine the tilt of surface molecules. Can detect isomerisation such as kinking of molecular chains, surface disorder under pressure, surface disorder due to chemical reaction, 2D phase-transitions and the like.
- Reach: get to interfaces buried under layers of reasonably transparent material, enclosed in vacuum and liquid cells, and easily relay the detected signal away from dangerous areas without compromising sensitivity.

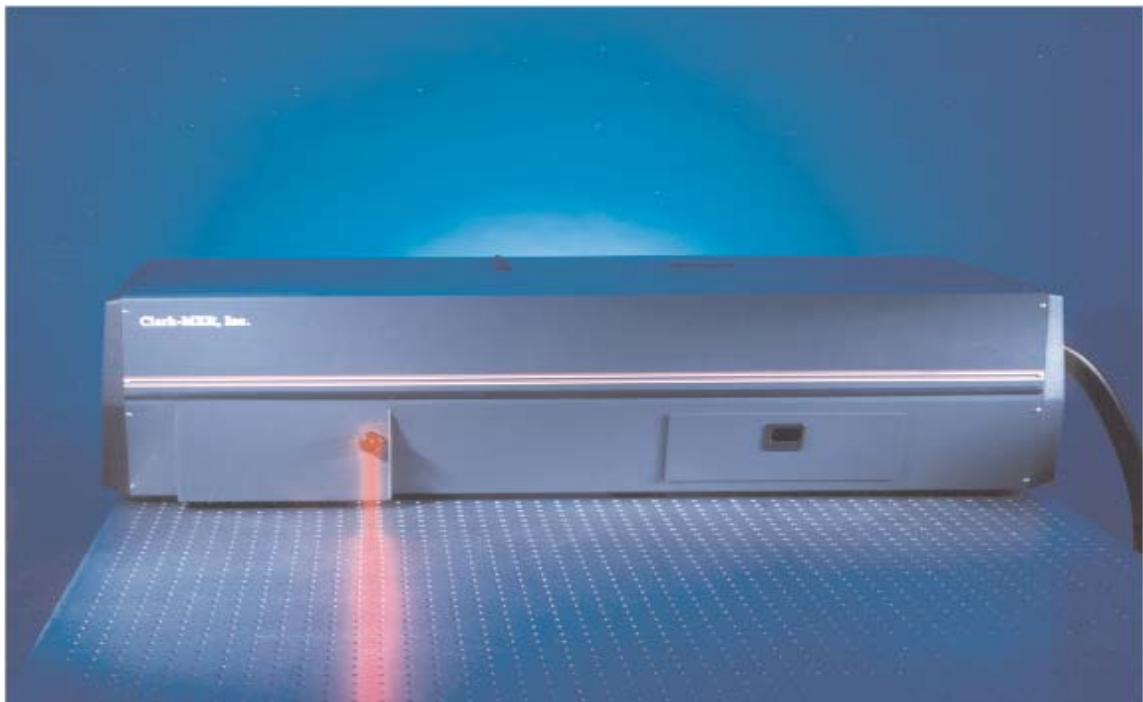
### **SFG - Vibrational Spectroscopy with a Twist**

Vibrational spectroscopy is a well-established tool of probing the composition and other properties of various materials. It relies on the fact that for many substances their respective vibrational spectra represent a very characteristic and thus reliable “fingerprint.” Conventional vibrational spectroscopy is performed by measuring the absorption of infrared radiation in the sample. However this well-established method does not work very well for the species on surfaces. IR absorption occurs not only on the surface but in the bulk of the substrate as well. Recording the spectra of thin surface layers thus presents a problem since the amount of absorbing substrate bulk material is large. SFG is intrinsically surface-sensitive. Since the amount of matter in surface layers is usually small, it is highly desirable to use the most sensitive detector available. Detectors of infrared, where the vibrational transitions occur, are usually inferior in terms of sensitivity and dynamic range when compared to visible light detectors. SFG vibrational spectroscopy is unique in that it combines unparalleled surface sensitivity with the ability to generate a response at the visible. This is achieved by overlapping intense infrared and visible radiation on the probed surface. As a result, a nonlinear polarization is induced which leads to radiation at the visible sum frequency. If the infrared radiation is in resonance with the transition in the sample, SFG intensity is substantially enhanced. Plotting SFG intensity vs. IR frequency will thus produce a vibrational spectrum. To record this spectrum one either has to scan IR frequency over the region of interest (old way) or use broadband IR and obtain the spectrum by dispersing broadband visible response with a spectrograph (our way). Admittedly SFG is rather inefficient so high intensity pulsed visible and infrared radiation is required. However this pulsed radiation arrangement results in the added benefit of turning broadband SFG into a very fast vibrational spectral probe, making it an extremely powerful and versatile tool for pump-probe experiments. Instead of recording just a single parameter at various delays with respect to the pump pulse it now becomes possible to record the whole spectra.

# CPA-Series Regenerative Amplifiers

Clark-MXR CPA-Series Regenerative Amplifiers are fully integrated systems including:

- Complete computer control
- Telecom diode-pumped fiber oscillator with 5 year warranty
- Pulse stretcher
- Regenerative amplifier
- KHz pump laser
- Pulse compressor
- Built-in diagnostics
- Active hydrothermal stabilization
- Smallest footprint in the industry
- Drift-free, NO-TWEAK™ performance
- Transportable amplified laser system
- Ideal for pumping OPAs
- Ideal for ultrafast micromachining



Our field-proven CPA-Series Regenerative Amplifiers redefine user-friendliness in the only fully integrated system on the market today - with complete control of important functions via the included touch screen controller or from any Windows-Based computer with a network connection. The embedded software provides access to laser performance parameters such as power output, pulse width, pump power, timing, and selection of single pulse or groups of multiple pulses. A suite of diagnostics is included to monitor laser performance. The simple, intuitive, user-friendly interface provides both status information and control from external devices. A software development kit is also available for interfacing with your existing application-specific, custom software.

The system includes everything you need to generate high peak power femtosecond pulses in one box (i.e. seed laser and its associated diode laser pump, pulse stretcher, TiS regenerative amplifier and its associated pump laser, and pulse compressor). It is fully compatible with NOPA visible and IR-OPA optical parametric amplifiers (OPAs) and STORC Harmonic Generator. For pump-probe experiments requiring two or more synchronized and independently-tunable colors, the CPA output beam can split to pump as many as four NOPAs that are synchronized to less than 1 femtosecond timing jitter.

The CPA-2101 is also available with transform-limited picosecond pulsewidth option.

### Warranty

1 year parts and labor. Oscillator parts, including the diode pump laser, are warranted for 40,000 hours or five years, whichever comes first. For details, please contact our sales department at [sales@cmxr.com](mailto:sales@cmxr.com).



This product is protected under US patent numbers: 5,530,582, 5,572,358, 5,592,327, 5,594,246

# IMPULSE™

## > 20-Watts Average Power Ultrashort-Pulse Laser

- Direct diode-pumped Yb-fiber oscillator/amplifier design
- All-diode pumped, all-solid state construction
- Robust, one-box design
- >20 Watts average power @ 2 MHz
- Repetition rate variable from 2 KHz to 25 MHz\*
- High beam quality
- Low noise, cw-pumped
- High stability and longevity
- Computer control
- Ideal for:
  - Micromachining
  - Photopolymerization
  - Direct-write waveguides
  - High S/N pump/probe
  - OPA/NOPA pumping



**IMPULSE™** is an all-diode & direct-diode-pumped (A&DDP) Yb-doped fiber oscillator/amplifier system capable of producing variable pulse energies up to 10 microjoules at repetition rates between 500 KHz and 2 MHz (up to 20 Watts average power output at 2 MHz.) The repetition rate is further adjustable up to 25 MHz at a constant 20 watt average power output (i.e. reduced pulse energy above 2 MHz.) This average power is more than an order-of-magnitude higher than has traditionally been available in a one-box ultrashort pulse laser design. **IMPULSE™** is based on a revolutionary new concept in mode-locked oscillator/amplifier technology.<sup>1</sup> The use of a Yb-doped fiber-oscillator/fiber-amplifier design combines the low noise performance associated with solid state operation with the high spatial mode quality of fiber lasers.

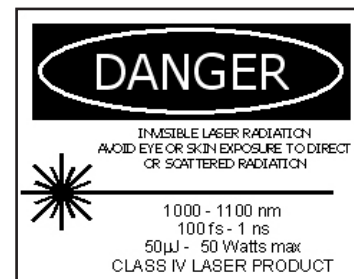
**IMPULSE™** is a compact (40.38" x 28.13" x 10.34" with 32" x 22" x 49" control cabinet), robust source of femtosecond to picosecond pulses with the ease-of-operation, stability and reliability you would expect from a fiber source. Applications include multi-photon photopolymerization and waveguide writing, harmonic generation, and OPA/NOPA wavelength conversion for high S/N, and rapid data acquisition in pump/probe experiments.

\*Optional single-shot to 500 KHz available.

### Warranty

1 year parts and labor. Oscillator parts, including the diode pump laser, are warranted for 40,000 hours or five years, whichever comes first. For details, please contact our sales department at [sales@cmxr.com](mailto:sales@cmxr.com).

<sup>1</sup> Patent Pending



## CPA Overview

|                                    | CPA 2101   | CPA 2110   |
|------------------------------------|--|--|
| <b>Femtosecond Version:</b>        |  |  |
| Pulse energy:                      | >0.8 mJ at repetition rate = 1kHz                            | >0.8 mJ at repetition rate= 1kHz, > 600 $\mu$ J at at repetition rates between 1 kHz and 2 kHz |
| Pulsewidth:                        | <150 fs  | <150 fs  |
| TBWP:                              | <1.4x transform limit (sech <sup>2</sup> )                   | <1.4x transform limit (sech <sup>2</sup> )   |
| <b>Picosecond (Option):</b>        |  |  |
| Pulse energy:                      | > 0.6 mJ at repetition rates = 1 kHz                         |  |
| Linewidth:                         | < 8 cm <sup>-1</sup>   |  |
| TBWP:                              | <1.2 x transform limit (Gaussian)                            |  |
| <b>Oscillator Output (Option):</b> |  |  |
| Oscillator wavelength:             | 1550 nm  | 1550 nm  |
| Power output:                      | > 10 mW 1550 nm  | > 10 mW 1550 nm  |
| Repetition rate:                   | 30 MHz nominal   | 30 MHz nominal   |
| <b>General:</b>                    |  |  |
| Wavelength:                        | 775 nm   | 775 nm   |
| M <sup>2</sup> :                   | < 1.5  | 1.2 +/- 0.1  |
| Repetition rate:                   | User-adjustable up to 1 kHz                                  | User-adjustable up to 2 kHz  |
| Polarization:                      | Linear, horizontal   | Linear, horizontal   |
| Energy stability:                  | < 1 % rms  | < 1 % rms  |
| Beam diameter: (FWHM)              | 4 - 6 mm   | 4 - 6 mm   |
| <b>Physical Dimensions:</b>        |  |  |
| Laser head:                        | 48"L x 20" W x 12" H   | 48"L x 20" W x 12" H   |
| Power supply:                      | 24"L x 23" W x 38" H   | 24"L x 23" W x 38" H   |
| <b>Utility Requirements:</b>       |  |  |
| Electric:                          | 110 VAC, 60 or 50 Hz, 10 A and<br>208 VAC, 60 or 50 Hz, 40 A | 110 VAC, 60 or 50 Hz, 10 A and<br>208 VAC, 60 or 50 Hz, 40 A                                   |
| Water:                             | Tap water, 4 gpm, 15-20°C,<br>30-50 psi                      | Tap water, 4 gpm, 15-20°C,<br>30-50 psi  |

| CPA 2161   | CPA-2210   | IMPULSE  |
|--|--|--|
| Constant average power of 2.5 Watts at 3 kHz to 6 kHz (Customer chosen factory setting.) | >2 mJ at repetition rates = 1 kHz, >1.5 mJ at repetition rates between 1 kHz and 2 kHz | User variable between 100 nJ and 10 $\mu$ J (>0.8 $\mu$ J @ 25 MHz, >10 $\mu$ J @ 2 MHz) |
| <150 fs  | <150 fs  | <250 fs <sup>1,3</sup>   |
| <1.4x transform limit (sech <sup>2</sup> )   | <1.4x transform limit (sech <sup>2</sup> )   | <1.2x - 1.5x transform limit   |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
| 1550 nm  | 1550 nm  |  |
| >10 mW 1550 nm   | >10 mW 1550 nm   |  |
| 30 MHz nominal   | 30 MHz nominal   |  |
|  |  |  |
| 775 nm   | 775 nm   | 1035 nm +/- 10nm   |
| 1.2 +/- 0.1  | 1.2 +/- 0.1  | 1.2 +/- 0.2 <sup>3</sup>   |
| User-adjustable up to 6 kHz  | User-adjustable up to 2 kHz  | User-adjustable 200kHz - 25MHz <sup>2</sup>  |
| Linear, horizontal   | Linear, horizontal   | Linear, horizontal   |
| < 1 % rms  | < 1 % rms  | < 1 % rms <sup>1,3</sup>   |
| 4 - 6 mm   | 4 - 6 mm   | < 6mm  |
|  |  |  |
| 48"L x 20"W x 12"H   | 48"L x 20"W x 12"H   | 32" x 18" x 8"   |
| 24"L x 23"W x 38"H   | 24"L x 23"W x 38"H   | 16" x 17.5" x 15"  |
|  |  |  |
| 110 VAC, 60 or 50 Hz, 10 A and 208 VAC, 60 or 50 Hz, 40 A                                | 110 VAC, 60 or 50 Hz, 10 A and 208 VAC, 60 or 50 Hz, 40 A                              | 110-280 VAC, 20 Amps   |
| Tap water, 4 gpm, 15-20°C, 30-50 psi   | Tap water, 4 gpm, 15-20°C, 30-50 psi   | N/A  |

1 Dependent on repetition rate  
2 Optional: single shot - 500 kHz  
3 See Clark-MXR, Inc. for details

# NOPA

- **Optimized to be pumped by the CPA-Series Regenerative Amplifier.**
- **Pulses as short as 10fs proved by developer<sup>1</sup>**
- **Near TEM<sub>00</sub> output mode**
- **Compact, user-friendly design**
- **White light continuum seeded for high temporal stability**

NOPA™ is a white light continuum seeded optical parametric amplifier (OPA) able to generate tunable extremely short pulses of light when pumped by our CPA-2101 Regen Amp. To match the need for extremely short, usable pulses, Clark-MXR, Inc., in cooperation with Professor Eberhard Riedle<sup>1</sup>, developed a series of NOPAs™ that require only 200μJ, 150 fs pulses at 775nm for pumping and are optimized to ensure high spatial beam quality.

The standard version of the NOPA™ delivers sub-30fs pulses from 450-700 nm and sub-50fs pulses from 870-1600nm with energies up to 8μJ per pulse without changing optics. A lower-priced version, the NOPA™ *slim*, offers up to 7μJ, sub-30fs pulses from 470 to 700 nm. For the most demanding users, the NOPA™ *plus* delivers no-gap tuning from 450 to 1600 nm. With up to 8μJ per pulse, this unit provides sub-30fs pulses from 450 to 870nm and sub-50fs pulses from 870 to 1600nm. Options for tuning into the UV are also available.



<sup>1</sup>T. Wilhelm, J. Piel, and E. Riedle, Institut für Medizinische Optik, Ludwig-Maximilians-Universität München, München, Germany. OPTICS LETTERS, VOL. 22, No. 19, October 1, 1997, P. 1494.

# NOPA *Pal*

- Dispersion free autocorrelator for characterizing NOPA pulses
- Tested for pulse lengths between 10 - 150 fs
- Wavelength range: 420 - 1600 nm
- Repetition rate: 100 Hz - 10 kHz (100 - 200 kHz on request)
- Scan rate / update of fitted pulse length: 2 Hz
- Simple alignment
- Labview program for control and measurement
- Extremely compact design (240 mm L x 170 mm W x 90 mm H)

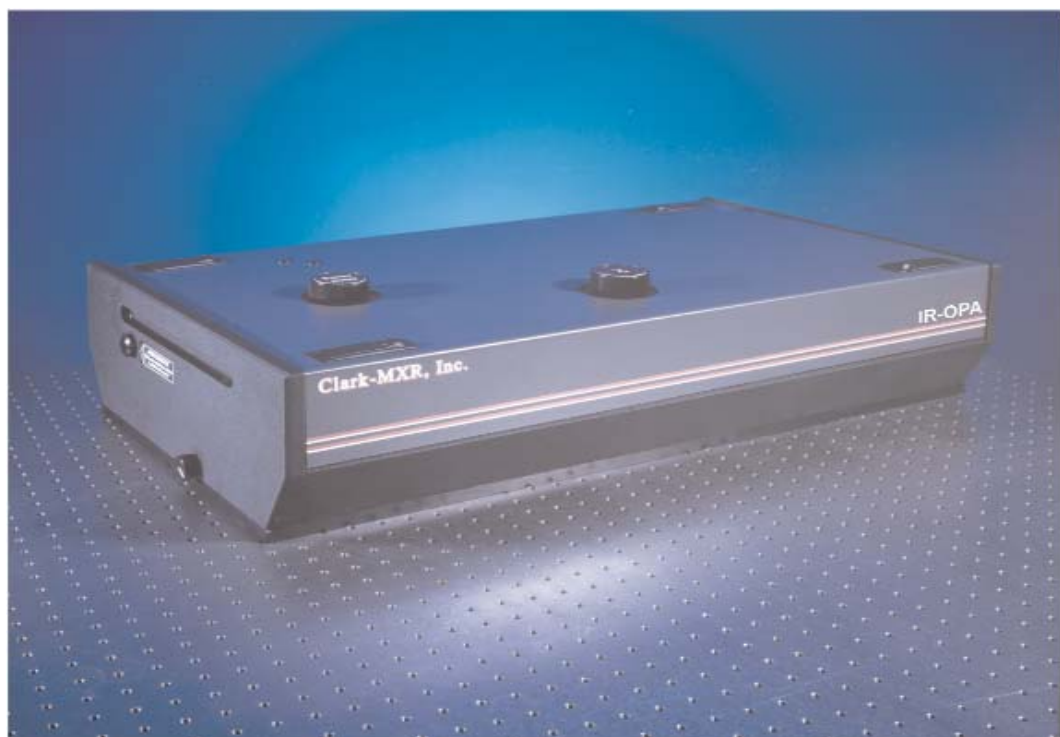


1 I. Z. Kozma, P. Baum, U. Schmidhammer, S. Lochbrunner, and E. Riedle Rev. Sci. Instrum. 75, 2323 - 2327 (2004)

## IR-OPA

- **Optimized to be pumped by a CPA-Series Regenerative Amplifier.**
- **Near TEM<sub>00</sub> output mode**
- **Compact, user-friendly design**
- **White light continuum seeded for high stability**
- **User-extendable to 15 $\mu$ m**

IR-OPA (InfraRed Optical Parametric Amplifier) is a white-light continuum seeded optical parametric amplifier (OPA) operated with a 775nm-femtosecond pump pulse from the Model CPA-2101 Amplified Ti Sapphire laser system. A combination of continuum generation and parametric amplification allows the user to continuously tune the output wavelength from 1.5 $\mu$ m to 2.5 $\mu$ m with no change in optics. Pumped with 1 mJ energy per pulse in sub-150fs pulsewidths at 775nm, 1 KHz repetition rate, the IR-OPA produces more than 100 $\mu$ J energy per pulse at 1.58 $\mu$ m in sub-150fs pulsewidths. There are three stages in the optical configuration: a white light continuum generator, a pre-amplifier and a power amplifier. Optical delays ensure exact synchronization between the three stages. A fresh pump beam coupled with optimized pumping levels and focusing for each stage ensures high spatial beam quality at the system output. Near Transform-limited performance is achieved from the IR-OPA.



# TOPAS Traveling Wave Optical Parametric Amplifier

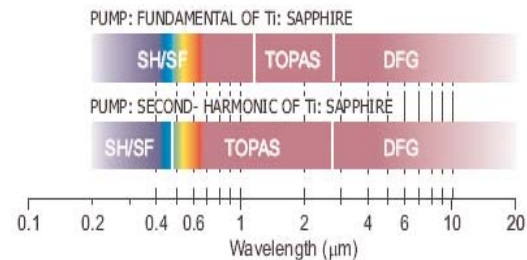
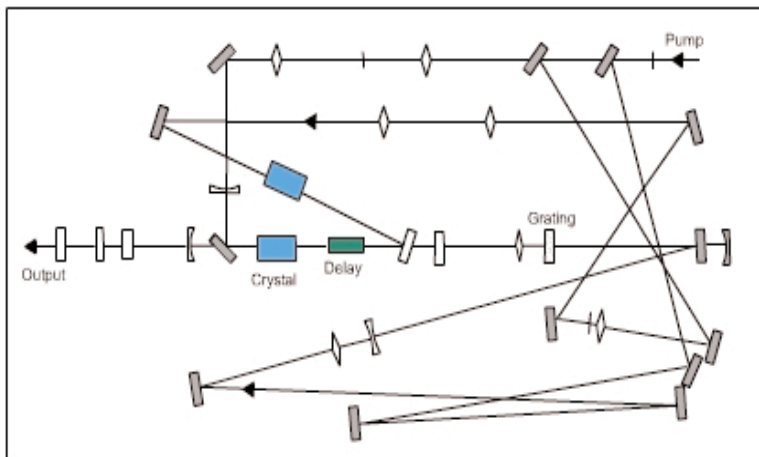
- Traveling wave ginele crystal, four amplification stage configuration
- Energy conversion up to ~30 - 50%
- Angular tuning limited by crystal transparency range only
- Grating frequency selector
- Upgradability for pump energy, wavelength and pulse width
- Computer controlled operation throughout wavelength range
- Upgradability for pump energy, wavelength and pulse width
- Optional frequency mixers



TOPAS has attracted world-wide interest due to its flexibility, very large tuning range and the possibility of up-scaling to a high power output.

Differect frequency mixing schemes allow for continuous tuning across the entire accessible wavelength range of 189 to 20 microns by simply entering a desired wavelength in a computer.

The TOPAS can be operated in both the femtosecond and picosecond mode, or converted between them. Energy conversion up to 20-40% is possible in the fundamental. An important feature of TOPAS design is that it can be matched to pump sources with peak power ranging over an order of magnitude. There are no limitations for pulse repetition rate up to several kilohertz. The ability to vary repetition rates makes it easier to optimize performance.



# Optical Parametric Amplifiers (OPAs)

| Specifications                  | IR-OPA  | TOPAS            | OPUS   |                                     |                                     | NOPA  |   |   |
|---------------------------------|---|------------------|--|-------------------------------------|-------------------------------------|---|---|---|
| Pump Specifications:            | 0.8 mJ, 150 fs, Near TEM <sub>00</sub> @1kHz, 770nm | 0.2 mJ           | .02 - .04mJ range, near TEM <sub>00</sub> @ 1 kHz, 775 nm. Specifications listed below are for a pump energy of 300μJ from a CPA-2XXX. |                                     |                                     | 0.2 mJ, 150 fs, Near TEM <sub>00</sub> @1kHz, 775nm |   |   |
| <b>Fundamental Output:</b>      |   |                  | <b>Vis SHG</b>   | <b>Near-IR Signal / Idler</b>       | <b>Mid-IR DFG</b>                   | <b>NOPA slim</b>                                    | <b>NOPA</b>                                   | <b>NOPA plus</b>                              |
| Wavelength Range:               | 1.15μm - 2.5μm                                      | 189-20000        | 0.58 - 1.1 μm  | 1.1 - 2.5 μm                        | 2.7 - 20 μm                         | 470nm-700nm   | 450nm-700nm<br>870nm-1600nm                   | 450nm-870nm<br>870nm-1600nm                   |
| Energy Per Pulse:               | >100μJ @ 1.5μm (signal)                             |                  | > 20 μJ at peak of tuning curve  | > 60 μJ at peak of tuning curve     | > 1 μJ at peak of tuning curve      | up to 7 μJ  | up to 8 μJ                                    | up to 8 μJ                                    |
| Pulsewidth:                     | <150fs @ 1.30μm                                     | 150 fs 189-20000 | (FWHM) <200fs  | (FWHM) <200fs                       | (FWHM) <200fs                       | <30fs   | <30fs<br>(450-700nm)<br><50fs<br>(870-1600nm) | <30fs<br>(450-870nm)<br><50fs<br>(870-1600nm) |
| Shot-to-Shot Noise:             | <±3%  |                  |  |                                     |                                     |   |   |   |
| Polarization: Signal:<br>Idler: | Linear, Vertical<br>Linear, Horizontal              |                  |  |                                     |                                     |   |   |   |
| Pulse Instability:              |   |                  | < 1 % rms for all wavelength ranges  | < 1 % rms for all wavelength ranges | < 1 % rms for all wavelength ranges |   |   |   |
| Footprint:                      | 15" x 32.5" x 9"                                    |                  | 15.7" x 23.6" x 7.9"   | 15.7" x 23.6" x 7.9"                | 15.7" x 23.6" x 7.9"                | 9" x 32.5" x 9"                                     | 15" x 32.5" x 9"                              | 15" x 32.5" x 9"                              |

# STORC Harmonic Generation System

STORC is a 2nd and 3rd harmonic generation device. The unit is comprised of a STORC head and a hand held unit. The hand held unit provides simple electronic tuning between wavelengths. All output beams propagate along the same vector path.

|                               |  |
|-------------------------------|--|
| Other performance parameters: |  |
| Polarization:                 | SHG Linear, vertical<br>THG Linear, horizontal |
| Spatial Beam Profile:         | Near TEM <sub>00</sub>                         |



| VERSION                 |      | SHG    | SHG/THG |        |
|-------------------------|------|--------|---------|--------|
| HARMONIC SUB-UNIT       |      |        | SHG     | THG    |
| Conversion              | (fs) | >30%   | >30%    | >10%   |
| Pulsewidth <sup>2</sup> | (fs) | <1.5 X | <1.5 X  | <3.0 X |
| Stability <sup>2</sup>  |      | <1.5 X | <1.5 X  | <2.0 X |
| Wavelength (nm)         |      | 387    | 387     | 258    |

NOTE:

<sup>1</sup> Assuming pump source is the Clark-MXR, Inc. Model CPA-Series

<sup>2</sup> As a function of pump performance.



## Customer Service and Warranties

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# What makes your customer service experience with Clark-MXR, Inc. superior?

### 1. People.

When you contact us, you get *Real, Live People* answering the phones and your questions. No huge call centers with self-diagnosis menus you have to work through, only to find that your answer isn't there. Instead you talk to a human being who is an expert on our lasers, cares about your problem, and can actually *help* you with it.

### 2. Expertise.

Technicians in our service department possess a combined total of 40 years of hands-on laser experience, and extensive ongoing training on our products as they develop.

### 3. Promptness.

When you call or email our service department, you are contacted by experts in a timely manner. Response times are *always* within 1 business day of your contact. Because we don't think you should have to wait a week for someone to get back with you.

### 4. World-wide coverage.

Clark-MXR, Inc. is a global corporation. That means that wherever you are, we'll be there for you. Our service department covers the globe to give you the best support money can buy.

### 5. The best warranty in the business...

...including 1 year parts and service on Optical, Electrical and Mechanical parts (excluding consumables), and 5 years on our diode laser and fiber oscillator parts. (See your Clark-MXR Representative for complete details.)

# Why is our service so superior?

## 1. Because we believe in our product.

We've spent years creating the most stable, reliable femtosecond laser product on the market. It only makes sense to offer the best service in the industry to go with it. It just wouldn't be right to do anything else.

## 2. Because femtosecond lasers are **all we do**.

You can't be an expert at everything and still do it all well. Recognizing this, we chose to specialize in the manufacture, service, operation and repair of femtosecond laser products *exclusively*. By specializing, we've become the experts in the industry, and the company at the cutting edge, marketing new developments as they arise in the field.



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