

NovaLine Lithography Lasers and EUV Sources



LAMBDA PHYSIK®

Step into the Future of Deep UV Lithography

Lambda Physik has over 30 years of experience developing and manufacturing more than 10,000 lasers. Our photolithography lasers (available in 248 nm, 193 nm and 157 nm wavelengths) are designed with the customer in mind, incorporating the latest laser technology and matching performance with reliability, ease of operation, and maintenance.

Continual, aggressive research and development, state-of-the-art manufacturing processes, modular component engineering, and some of the most talented engineers and technicians in the industry reflect the commitment of Lambda Physik to our customers and the advancement of microlithography. Our NovaLine, lithography lasers, available in three wavelengths, are built to withstand the stringent requirements of the semiconductor industry.

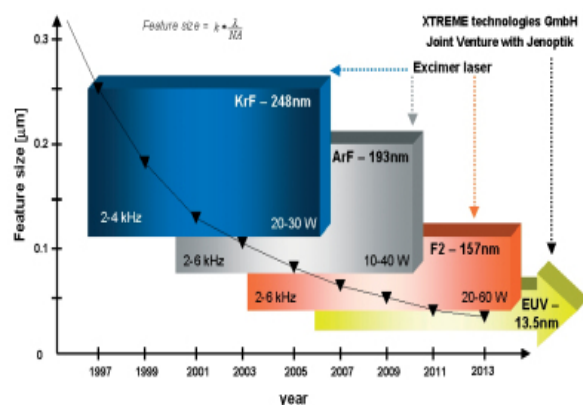
Step into the future with the global leader in pulsed DUV and EUV light source technology with a choice of four wavelengths: 248 nm, 193 nm, 157 nm and 13.5 nm. Experience the high performance and superior service that will make you a leader in microlithography.

Technology – A Step Ahead

The Lambda Physik litho team produces NovaLine lasers, which are setting new standards of performance, with stable 2 kHz operation at 248 nm (30 W semi line-narrowed, 20 W line-narrowed); 4 kHz operation at 193 nm (40 W semi line-narrowed, 20 W single oscillator ultra line-narrowed - SOUL technology -); and the innovative 157 nm laser with up to 4 kHz repetition rate and 20 W of output power, enabling optical lithography down to 50 nm. Lambda Physik was the first to produce 193 nm production-quality lasers and was the first to provide an R&D 157 nm litho laser for material testing. These advances in technology are complemented by the NovaLine series unique modular design, incorporating Lambda Physik patented NovaTube, NovaPowerSwitch, and the finest optical elements.

Committed to provide leading edge technology for lithography beyond 157 nm, Lambda Physik with Jenoptik LOS has formed the joint venture XTREME technologies – a company specializing in developing and manufacturing extreme ultraviolet (EUV) sources with 13.5 nm radiation for next generation lithography. At XTREME technologies the important technologies of EUV sources - Gas Discharge Produced Plasma (GDPP) sources as well as Laser Produced Plasma (LPP) sources - are investigated for future lithographic applications.

Lambda Physik Lithography Roadmap



LAMBDA PHYSIK®

Driving the Pulse of UV Technology

NovaLine Modules for Dependable, Easy Operation

Lambda Physik lasers have an advanced modular design that reduces the need for replacement parts, decreases the cost of consumables, and provides exceptional reliability for industrial operation. All mechanical, electronic, and optical modules offer easy maintenance and integration for microlithography applications. Maintenance access is on one side of the NovaLine unit, allowing a smaller footprint to provide more valuable cleanroom floor space and easy servicing. NovaLine has an internal computer that provides all the necessary diagnostic information required to ensure highly stable, trouble-free operation.



NovaLine K2000 Series

DUV microlithography has become the process of choice for the mass production of today's advanced chip generations. The DUV scanners have yet to make another step to an even higher numerical aperture (NA), expanding the application of DUV further down to the 130 nm design rule and beyond. Lambda Physik supports the ongoing progress of the DUV scanners by supplying lasers which meet the demands of the semiconductor fabrication industry for optical performance, reliability, and cost effectiveness. Lambda Physik has succeeded in further increasing the NovaLine series efficiency and higher spectral purity with the K2000 Series. As a result, the lifetime of both the laser discharge unit and the optical components are increased, leading to significantly lower operating costs. The NovaLine K2000 Series features:

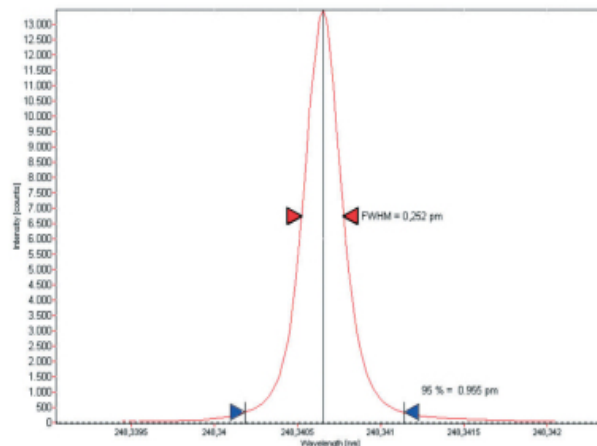
- **Highest output power available at reliable 2 kHz repetition rate, enabled by NovaTube all-metal/ceramic tube technology to maximize throughput**
- **Highest spectral purity available with less than 0.4 pm bandwidth, FWHM, achieved by our patented resonator to maximize the optical contrast of high-NA imaging lenses**
- **Solid state pulser NovaPowerSwitch delivers high consistency and high MTBF performance and comes with a lifetime guarantee**
- **PowerLok® actively stabilizes the output power; it is enhanced by our solid state pulse power module, and tight exposure control is achieved to optimize exposure latitude**
- **NovaLine features complete data-logging capabilities to schedule maintenance and support e-diagnostics and troubleshooting**



NovaLine K2005

- The Perfect Match for High Numerical Aperture DUV Scanners

The line-narrowed model K2005 offers extremely narrow linewidth of less than 0.4 pm, FWHM, with 95 percent of the energy within a wavelength interval of less than 1.25 pm. In addition to the width at half maximum (FWHM), the spectral distribution of the laser output determines the contrast of the imaging lens. Based on the patented PCR resonator, the K2005 produces an extremely narrow output spectrum to optimize performance of advanced DUV lithography scanners with numerical apertures as high as 0.8.



Output spectrum of the NovaLine K2005 laser measured by a high resolution grating spectrometer.

NovaLine K2010

- Cost-Effective, Reliable Source for DUV Scanners

NovaLine K2010 lasers are installed in quantities on the manufacturing floor. High reliability and low CoO has allowed Lambda Physik to steadily grow a customer base for this laser. The lasers operate with 2 kHz and 20 W output power. The bandwidth of 0.6 pm makes the K2010 compatible with most OEM DUV scanner systems.

NovaLine K2020

- High Power, Low Operating Cost

The K2020 model has been designed for high throughput DUV scanner systems using a catadioptric imaging lens. This laser system, with a bandwidth of about 50 pm, provides high efficiency and significantly lower operating costs. The resonator is optimized for the relaxed bandwidth requirement. As a result, the output power is increased to 30 W and the overall operating cost of this DUV laser is reduced. Optimization of the NovaTube and discharge circuitry provide highly stable output with a standard deviation of less than 1 percent at 2 kHz repetition rate. PowerLok, a Lambda Physik proprietary energy control system, stabilizes the exposure dose with an accuracy of typically ± 0.25 percent.

Laser Model	K2005	K2010	K2020	Units
Wavelength	248	248	248	nm
Spectral Bandwidth (FWHM)	< 0.4	< 0.6	< 100	pm
Spectral Purity (95% Energy Integral)	< 1.25	< 2.0	-	pm
Repetition Rate	2	2	2	kHz
Power	20	20	30	W
Pulse Energy	10	10	15	mJ
Dose Energy Stability	< +/-0.35	< +/-0.5	< +/-0.5	%
Gas Lifetime	>200 million	>200 million	>100 million	Pulses
	7 days	7 days	5 days	Days
Laser Tube Lifetime	> 4 billion			Pulses
Cabinet Size (l x w x h)	1826 x 830 x 1548			mm ³
Weight	1075			kg