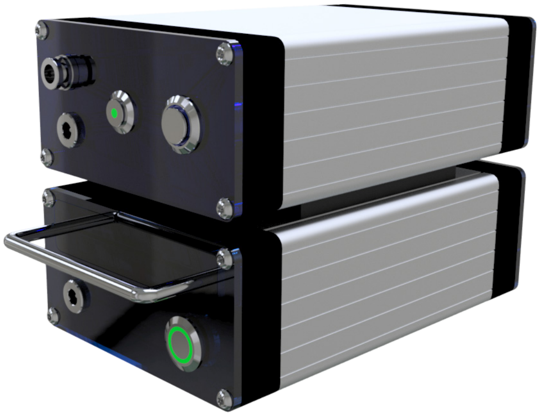
Photonics Cygnus
Light Processing

π^2-CYGNI

美国实验室新一代VUV光刻系统

特点

- *新一代VUV光源：172 nm*
- *同类最佳的输出强度*
- *杰出的光束均匀度：可用光圈的3%*
- *灯泡寿命更长：最多曝光30,000次*
- *瞬间启动*
- *紧凑，坚固，便携*
- *标准化附件安装系统：一个灯泡，多种应用*
- *操作简单、易用*
- *环保*



π^2-CYGNI
VUV Light Source with Hard-Contact Masked Flood Exposure Accessory

应用

- *高分辨率光刻*
- *光烧蚀*
- *光解光催化过程*
- *表面能改性*
- *臭氧产生*
- *低损伤原子级表面清洁*
- *增强薄膜附着力*

高功率平面真空-紫外光在光处理中释放了新的可能性

Never before has there been a lamp which combines high power, exceptional uniformity, and versatility in an efficient and compact modular form fact - *at 172 nm!* The revolution begins with the introduction of the π^2-CYGNI series of vacuum-ultraviolet light processing systems.

172纳米 新的加工原理

The low output power of traditional 172 nm sources has prevented the widespread use and application of this wavelength, both in research and production environments. The π^2-CYGNI overcomes this barrier and is revealing the true power of 172nm - driving new chemistries, reaction regimes, and processing techniques. Ultraviolet is not just for photolithography and curing anymore!

全新能量驱动方式

UV arc lamps provide high average power. Excimer UV sources provide high photon flux. The π^2-CYGNI provides both high average power *and* high photon flux - without the need for active or external cooling. This unique combination of high power and high photon flux is harnessed in a package that fits in the palm of your hand, yet drives large-area reactions and processes not achievable by other light sources.

A New Form Factor in Lamp Technology

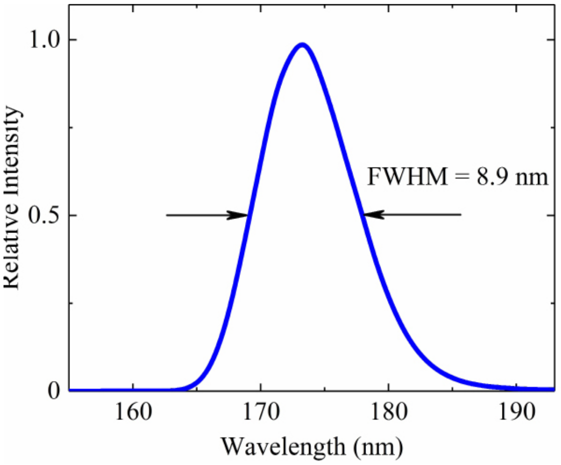
The heart of each π^2-CYGNI is an ultra-thin (<4 mm) planar microcavity discharge lamp. Broad-area emission provides superior uniformity compared to traditional arc-discharge lamps, while simultaneously eliminating the need for complex condensing, collimating, and homogenizing optics.

Ultraviolet is Now Green

Prior to the π^2-CYGNI, ultraviolet light production typically meant toxic materials, low conversion efficiency, and high equipment cost. π^2-CYGNI smashes these barriers by providing a solution which is environmentally friendly and energy efficient. No toxic materials are utilized in the manufacture and construction of π^2-CYGNI, and the utilization of π-CYGNI in production processes provides potential for reducing chemical waste streams and water consumption. All at a fraction of the cost of other 172 nm sources.

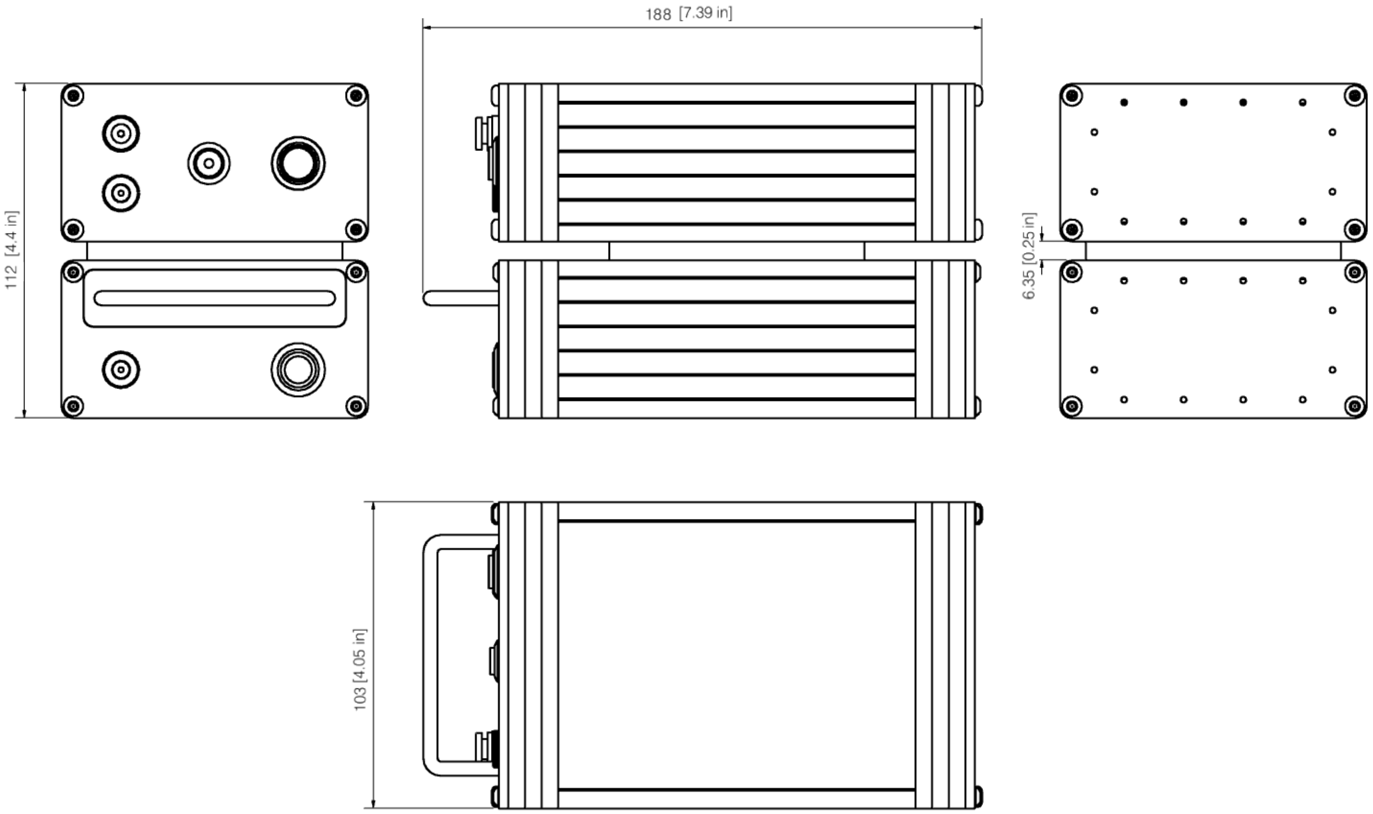
π^2-Cygni SYSTEM SPECIFICATIONS

Output intensity	> 10 mW/cm^2
Intensity uniformity over clear aperture	< 3%
Peak output wavelength	172 nm
Full width at the half maximum (FWHM)	8.9 nm
Light emitting area	43 mm x 43 mm
Warm up time (from 0 to 95%)	< 2 s
DC input voltage	12 V
Power supply input voltage	110-220 V / 50-60 Hz
Nitrogen/Argon flow rate*	0.5-1 SCFM
Lifetime	> 5000 hours
Power consumption	< 25 W
Transmitting environments:	Nitrogen, Argon, UV grade fused silica, High vacuum



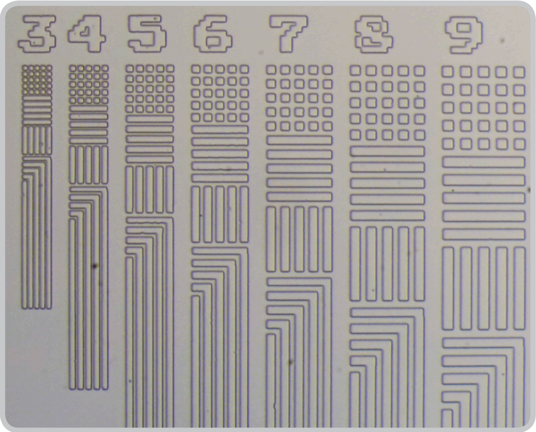
VUV Lamp Output Spectrum

Note: Dry nitrogen or Ar purging is required for operation



EXAMPLE PROCESS APPLICATION: ORGANIC POLYMER PHOTOLITHOGRAPHY

The π-Cygni eliminates the need for specific resist chemistries - because of the high-energy of the light (7.2eV per photon), practically any organic polymer can now be utilized as a photoresist! π^2-CYGNI's 172nm allows for higher resolution imaging, the use of simple and inexpensive resists, and the elimination of alkali waste generated by traditional DNQ-based resist systems.



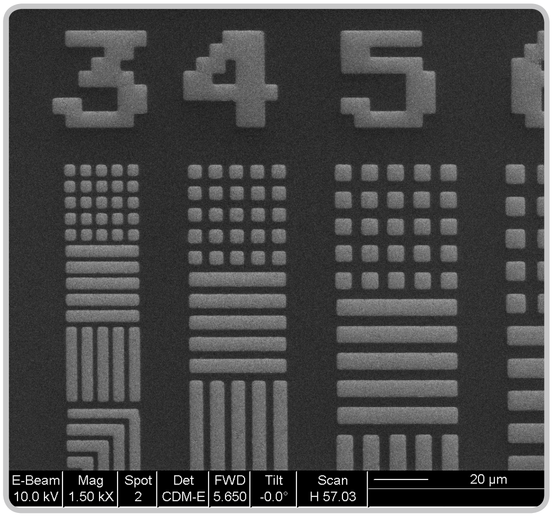
Optical micrograph of acrylic sheet exposed through a photomask for 90 s. Numbers on top represent feature size in μm

New Resists, New Possibilities

Rethink traditional photoresists. Because of the nature of the exposure mechanism, a photosensitizer is no longer needed. Simply put, the π^2-CYGNI breaks down organic polymer chains until they become volatile and evaporate - *there is mass reduction of the exposed polymer*. This process is universal - practically all organic polymers can now be used as a photoresist, even in bulk form.

Dry/Positive/Negative Processing - You Decide!

The image is generated during the exposure due to the mass reduction of the organic film, thus eliminating the need for a separate developing step. The resulting height contrast is sufficient for some processes, reducing process time and waste generation.



SEM image of 200 nm thick PMMA photoresist on Si substrate exposed through a photomask for 40 s. Numbers on top represent feature size in μm

To meet more demanding applications, the organic polymer may be further processed after exposure to increase resolution. However, unlike traditional resists, the tone (positive or negative) is determined by the developing solution, not a sensitizer. In addition to mass reduction and evaporation, cross-linking occurs in the polymer during exposure as the chain length is reduced. This cross-linking changes the solubility of the polymer in specific solvents - alcohol-based developing solutions generate positive-tone images, while acetone and similar solvents generate negative-tone images.

Unmatched Single-Exposure Resolution

Shorter wavelength = higher resolution. The π^2-CYGNI offers the potential for a 50% improvement in resolution over I-line lithography.

Example Process Times

Material	Modification Type	Depth	Exposure Time
PMMA Phortoresist	Photoablation	> 200 nm	40 s
Bulk Acrylic	Photoablation	> 350 nm	90 s
Bulk PDMS	Glassification	-	30 s