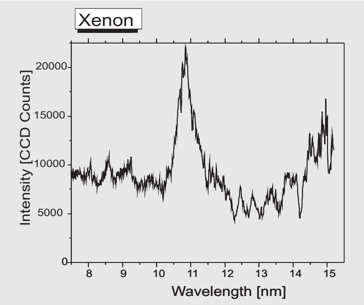
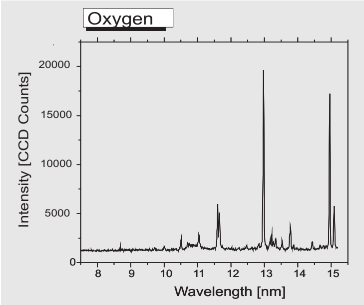
Table-Top EUV Source

A laser-based plasma source for generation of EUV radiation at 13 nm was developed at the Laser-Laboratorium Göttingen. The EUV emitting plasma is produced with the help of a Nd:YAG laser (Innolas, 1064nm, 750mJ, 6ns) that is focused into a pulsed gas jet. The alternate use of xenon or oxygen as target gas accomplishes either an intense broad-band or a less intense narrow-band line emission at 13 nm, respectively.



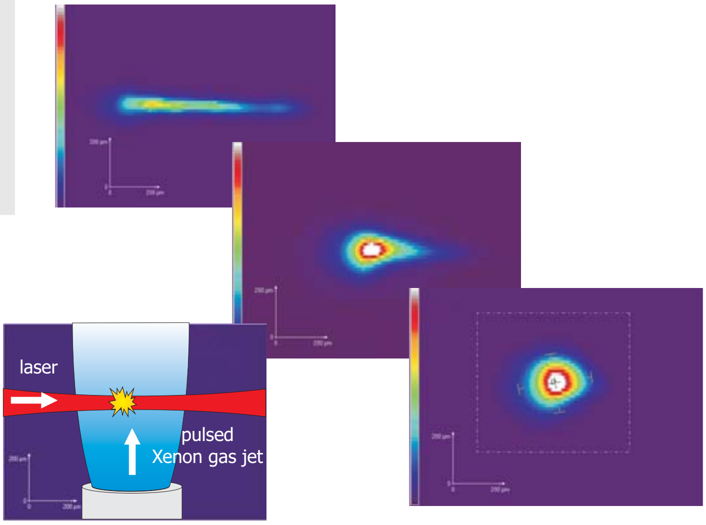


The system can be used both for metrology, e.g. for characterisation of EUV optics and sensoric devices, or for fundamental investigations on material interaction.

Specifications:

- Wavelength (Xe target): 7 - 20nm
- Pulse energy: 3.5mJ (4πsr, 2%BW)
- Conversion eff. (Xe): 0.45%
- Pulse length: 6ns
- Plasma shape: nearly spherical, 300µm
- Pulse-to-pulse-stability: 10%
- Positional stability: 10%

▶ **EUV plasma monitored with a pinhole camera for different positions of the laser focus:**



▶ Advantages

- High EUV energy (3.5mJ)
- Minimum gas consumption (gas pulse: 1ms)
- Table- top system

▶ Applications

- Metrology
- Optics testing
- Fundamental studies on material interaction

Dr. Klaus Mann
kmann@llg.gwdg.de
Phone: +49-(0)551-5035-41

Laser-Laboratorium Göttingen e.V.

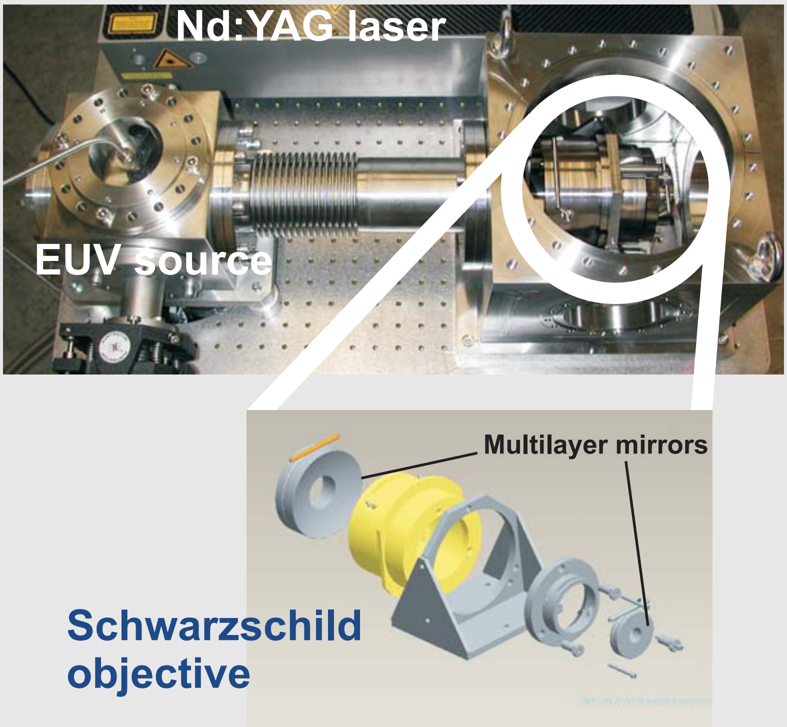
Laser-Laboratorium Göttingen e.V.
Hans-Adolf-Krebs-Weg 1
D-37077 Göttingen

www.llg.gwdg.de

EUV Schwarzschild Objective

Within the scope of the BMBF project KOMPASS a modified Schwarzschild objective for 13.5 nm was designed and adapted to the table-top EUV source. The optics consist of two spherical ULE substrates mounted in a separate vacuum chamber, providing a numerical aperture of 0.44 and a demagnification factor of 10 with respect to the plasma source. The substrates were coated with high reflectivity Mo/Si multilayers by Fraunhofer IOF/Jena.

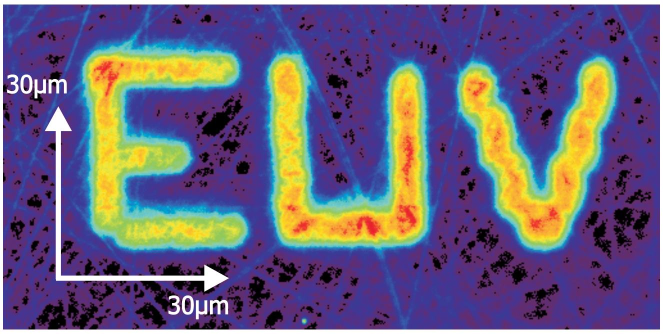
With the help of this compact EUV source and optics system a focal spot with a diameter < 30µm at energy densities of several mJ/cm² can be generated. Thus, using mask projection, direct structuring of different materials is possible. One example is the direct writing of colour centres in LiF crystals with a spot size of 5µm.



▶ **Mo/Si multilayer mirrors**

Specifications:

- **Numerical aperture 0.44**
- **Demagnification 10x**
- **Spherical ULE substrates**
- **Mo/Si multilayer coating (Reflectivity @ 13.5nm > 65%)**
- **Focus diameter <30µm**



▶ **Direct writing of colour centres in LiF crystal by raster-scanning an EUV spot (5 µm diameter)**

Dr. Klaus Mann
kmann@llg.gwdg.de
Phone: +49-(0)551-5035-41

Laser-Laboratorium Göttingen e.V.

Laser-Laboratorium Göttingen e.V.
Hans-Adolf-Krebs-Weg 1
D-37077 Göttingen

www.llg.gwdg.de