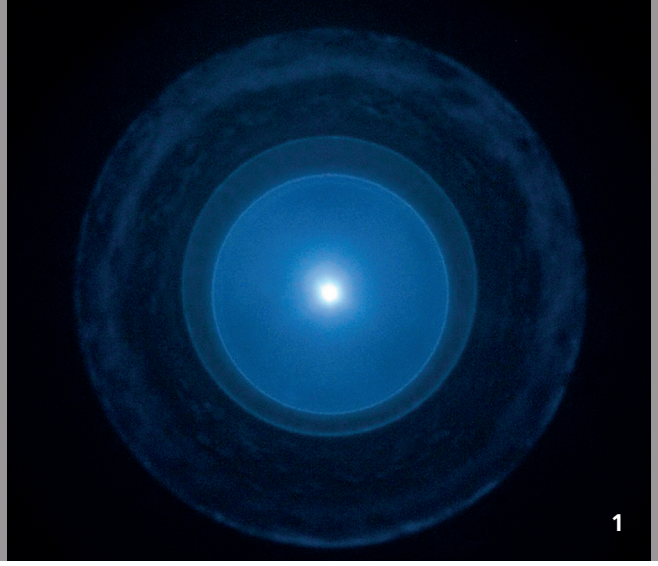

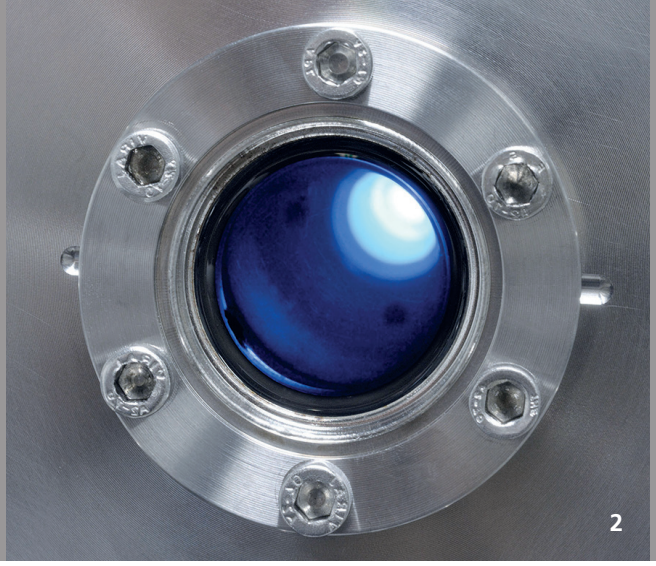

BRILLIANT RADIATION SOURCE FOR X-RAY MICROSCOPY AT 2.88 NM

Task

Microscopy with soft X-ray radiation (XUV) in the spectral range of the water window (wavelengths between 2 and 5 nm) is suitable as a high-resolution, imaging method for the investigation of aqueous biological samples or of the self-organization of nanoparticles in the field of medicine and colloid chemistry. Unlike light microscopes, X-ray microscopes provide the required resolution in the sub-nm range.

Furthermore, in contrast to electron microscopy, the sample preparation is less complex in X-ray microscopy, which makes a significantly higher throughput possible. The most important characteristic of the light source for an X-ray microscope is the brilliance, which essentially determines the exposure time.

Method

In the past, an X-ray microscope with a discharge source was already demonstrated. For this source, nitrogen is used as the emitter gas, which exhibits the intense, monochromatic $1s^2$ - 1s2p transition of helium-like nitrogen ions at 2.88 nm. By extending the operating parameter range, researchers at ILT have been able to increase the brilliancy at 2.88 nm substantially when operated at significantly higher neutral gas pressures.

Results

In the new operating mode, the source can generate an average brilliance of $L = 2.5 \times 10^{10}$ Ph μm^{-2} sr^{-1}. This is approximately a factor of six higher compared to the prior state-of-the-art, and, thus, ranks among the peak values for plasma-based radiation sources for X-ray microscopy.

Applications

The X-ray microscopes can be used, for example, to investigate:

- aqueous biological samples
- nanoparticles in the field of colloid chemistry for the observation of the growth of nanoparticles
- nanoelectronics as organic semiconductor materials at a resolution in the range of 50 nm
- processes for 2D and 3D (tomography) imaging at high local resolution

This project has been financially supported by the Fraunhofer-Gesellschaft.

Contact

Alexander von Wezyk M.Sc.
Telephone +49 241 8906-376
alexander.von.wezyk@ilt.fraunhofer.de

Dr. Klaus Bergmann
Telephone +49 241 8906-302
klaus.bergmann@ilt.fraunhofer.de

1 Picture of the radiation source in the visible spectral range.

2 View of the radiation source through a window.

Fraunhofer Institute for Laser Technology ILT, www.ilt.fraunhofer.de
DQS certified by DIN EN ISO 9001, Reg.-No.: DE-69572-01