

Why Fraunhofer IAF?

Together with national and international partners from science and industry, Fraunhofer IAF plays a major role in the research and development of SDLs for various applications. Thanks to the expertise of its researchers, its large network and its unique research infrastructure, the institute offers services along the entire semiconductor value chain: from design and material growth to device development and module construction.

In addition, Fraunhofer IAF has decades of experience in carrying out complex international research projects and collaborating with customers from industry and small and medium-sized enterprises. This enables an equally efficient and flexible cooperation in the application-oriented research and development of innovative optoelectronics as well as in the customized implementation of orders.

What we offer:

- Development of SDLs for the 2–3 μm wavelength range according to customer specifications
- Epitaxial growth of III-V SDL heterostructures
- Development and manufacturing of SDL components from prototype to small series production
- Development and manufacturing of high-power, single-frequency or broadly tunable single-frequency SDL modules

Would you like to learn more about our research activities and services in the field of SDLs? We will be happy to present our work and various cooperation opportunities to you in person.

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Optically pumped SDLs for the 2–3 μm
wavelength range

Narrow-linewidth semi-
conductor disk lasers
(SDLs)



Single-frequency SDL module for QFC pumping

Semiconductor disk lasers for the 2–3 μm wavelength range

Optically pumped semiconductor disk lasers (SDLs) developed by Fraunhofer IAF exhibit excellent beam quality, high output powers and stable, low-noise laser output. We realize modules customized for different applications in the field of quantum communications, metrology, and medical technology.

High power, wavelength accuracy, broad tunability

Fraunhofer IAF develops GaSb-based SDLs for the 1.9–2.8 μm wavelength range. These SDLs exhibit an excellent beam quality, high output power and a stable, low-noise laser output. High power laser modules (with multimode emission spectra) are available as well as broadly tunable lasers and single-frequency lasers with very narrow emission linewidth (100 kHz range) and a stable, mode-hop free long-term operation.

Fields of application

- Pumping of nonlinear crystals for quantum frequency conversion (QFC)
- Pumping of solid-state materials (Ho-, Cr-doped)
- Precision metrology
- Medical technology

As the emission wavelength of these relaxation-oscillation-free class A lasers can be precisely tuned, they are ideally suited for extra-cavity or intra-cavity pumping of solid-state lasers or non-linear optical crystals as well as for measurement technology or quantum optics.

Pump laser for quantum frequency conversion

As part of the HIFI consortium, Fraunhofer IAF is developing tailored single-frequency SDLs specifically designed as a powerful, low-noise pump source for quantum frequency converters (QFCs). Their emission frequency can be fine-tuned in the GHz range and the laser can be locked to an appropriate wavelength standard to meet the rigorous requirements of QFCs regarding absolute wavelength accuracy.



SDL technologies

Apart from turn-key laser modules, Fraunhofer IAF offers services in the context of SDL design, epitaxy, mounting or characterization.

SDL variants and properties

Fraunhofer IAF's SDLs are customized depending on the application. In total, we offer SDL modules with the following properties:

	High-power SDL	Single-frequency SDL	Broadly tunable single-frequency SDL
Central emission wavelength	1.9–2.8 μm	1.9–2.8 μm	1.9–2.8 μm
Emission spectra	Multimode (15–25 nm width)	Single-frequency, narrow line-width (100 kHz range); stable mode-hop free long-term operation	Single-frequency, narrow line-width (100 kHz range); stable mode-hop free long-term operation
Optical power	1–4 W	0.1–1.5 W	0.1–0.4 W
Beam quality	$M^2 < 3$, $M^2 < 1.6$ possible	$M^2 < 1.2$	$M^2 < 1.2$
Fine tuning		Few GHz mode-hop free fine tuning	Few GHz mode-hop free fine tuning
Coarse tuning		Wavelength fixed at assembly	20–30 nm
Operation mode	CW or pulsed (optional)	CW	CW
Polarization	optional: linear	linear	linear