# Optics Colloquium Winter Term 2018/19

Prof. Buse, Prof. Rohrbach & Prof. Zappe – Microsystems Engineering

## High-Power Fiber Lasers

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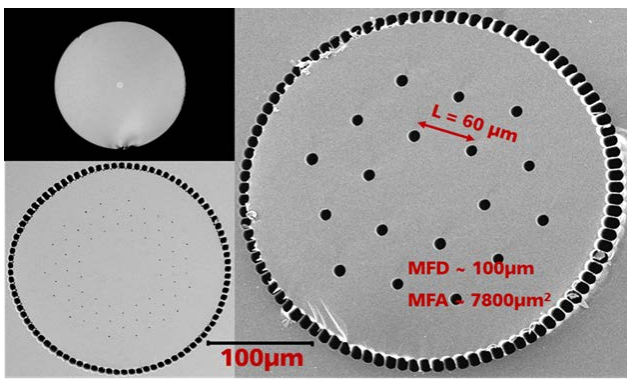


*Fibers with tailored photonic structures allow large single-mode cross sections, generating laser light of excellent beam quality and ultra-high power.*

In the past years rare-earth-doped fiber lasers have emerged as an attractive and power scalable solid-state laser concept due to the outstanding thermo-optical properties of an actively doped fiber. Using advanced fiber designs, in continuous-wave (cw) operation output powers exceeding the 10 kW-level with diffraction-limited beam quality have been demonstrated. In the pulsed regime average powers in the order of several hundred Watt even for few cycle pulses based on fiber lasers have been reported.

However, power and energy scaling of cw and pulsed single-mode fiber lasers and amplifiers are restricted due to nonlinear pulse distortions, which are enhanced by the large product of light intensity and interaction length inside the fiber core. In addition, transverse mode instabilities are observed, which degrade the beam quality emitted by high-power fiber laser systems once a certain average power threshold has been reached. Most recently, strategies have been developed to mitigate or even, ideally, to overcome these limitations – enabling a further power scaling of fiber lasers and amplifiers. These strategies are based on a combination of advanced large mode area fiber designs and coherently coupled multi-channel laser and amplifier architectures.

In this contribution the state of the art of science and technology in fiber lasers and amplifiers is reviewed. The prospects for future developments using advanced fiber designs in combination with modern laser and amplifier architectures are discussed.

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