26) Téma: **Optimization of laser wake-field electron beam for table-top FEL**

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Abstract: Laser wake-field acceleration (LWFA) opens a new way to deliver high-brightness electron beams for different applications, in particular to develop a compact hard X-ray free-electron laser (FEL). In order to reach this goal, there are a few challenges connected to obtaining required electron beam parameters for the FEL operation, based on the "Self-Amplified Spontaneous Emission" (SASE) regime. Existing experimental results show that the LWFA electron beam parameters can be optimized by controlling the laser and plasma parameters. Another important question is how to preserve the beam quality (emittance, bunch charge and energy spread) in an electron beam transport for the laser-based FEL. The electron beam degradation in the dedicated beam transport is caused by collective and nonlinear effects. This thesis addresses questions about optimizing the laser-plasma interaction and preserving the electron beam quality by using compact focusing elements, in particular the active plasma lensing.
In the frame of the thesis the modelling of the plasma evolution in the discharge capillary for the electron acceleration and for the electron beam focusing in the active plasma lens will be performed for the experimental setup, which is under development at ELI-Beamlines. The applicant will integrate the required plasma diagnostics into the experimental setup. The obtained experimental results will be compared with the modelling. As the second part of the PhD thesis, the PIC simulations will be performed to optimize the LWFA electron beam parameters. Finally, the experimental study of the dedicated electron beam transport will be added to demonstrate an ability to preserve the beam quality, required for build a compact LWFA-based FEL at ELI-Beamlines.