Thesis framework: **Laser-driven Undulator Coherent Radiation Source, Project 2**

Supervisor: Ing. Alexandr Jančárek, CSc., Czech Technical University in Prague, FNSPE

Co-supervisor: Alexander Molodozhentsev, PhD, Jonathan Tyler Green, PhD, ELI ERIC, ELI Beamlines

Abstract:

The aim of the Project is to investigate the plasma source, which can be used as an active plasma lens in order to utilize such a novel focusing element as a key component of a dedicated electron beam line. It will allow to preserve a quality of the electron beam, accelerated by a laser pulse passing through plasma. The high quality electron beam is required to produce a coherent undulator photon radiation (so called, free electron laser FEL regime). Objectives of the Project 2 are the following: (1) develop an advanced all-optical focusing component ('active plasma lens') including the advanced plasma diagnostics, which has to work in the high-repetition rate regime; (2) integrate the active plasma lens into a dedicated electron beam line to transport the electron bunch from the source to an undulator; (3) examine generation the coherent photon radiation in the undulator in different range of the photon radiation wavelength, using the comprehensive 'start-to-end' simulations.

The PhD student will work in collaboration with the LUIS team at ELI-Beamlines, as well as, in tight connection with the laser team and the Project-1 PhD student. The prototype of the plasma discharge setup for the active plasma lens with novel plasma diagnostics setup will be prepared and integrated into the LUIS experimental setup. Experimental activity will be based on the LUIS technology installed in the E5-LUIS experimental hall. In addition, modelling of the laser-plasma interaction to ensure high-quality electron beam will be performed using the ELI-Beamlines super-computer cluster. Successful realization of the Project 2 can open the way to build a compact LPA-based Free Electron Laser based on the high-repetition rate laser. The work is assigned for selected EuPRAXIA-DN candidate.