Virtual Hard X-Ray Collaboration Seminar Series

Date: Thursday 18th March 2021

Title: FEL optimization using phase shifters

Speaker: Myung Hoon Cho, PAL

Abstract:

PAL-XFEL operates phase shifters and variable gap undulators for optimization of FEL intensity. Especially phase shifters are essential instruments for a long undulator line since it is segmented by drift sections. Phase shifters located in the drift sections match the FEL's phase with that of the electron beam. This talk presents the investigation of cases of the phase-matched (in-phase) and the 180° offset (out-of-phase) conditions with results of simulations and experiments. A linear theory and FEL simulations are briefly introduced to understand how the phase shifter affects the FEL amplification. The FEL intensity is dominantly reduced by phase mismatch in the saturation region, where the microbunched electron beam is sufficiently developed, and that the difference of FEL intensity between the in-phase and out-of-phase conditions is an effect of the evolution of the bunching factor. Experiments by scanning the gap of the phase shifter at 9.7 keV show increases of FEL intensity by 4 times compared to the calculated gap of the phase shifter according to the linear set. This intensity increase is obtained dominantly in the saturation region as expected. In addition, we also show an interesting simple experiment of preliminarily two-color lasing simply using phase shifters.