Session 16. FELs / BWOs / Cherenkov devices

April 30 (Tuesday) / 16:30 ~ 17:50 / Room 1

Session Chair: Young Uk Jeong (Korea Atomic Energy Research Institute, Korea)

16:30 ~ 16:50

16.1 / [Keynote] Enhanced radiation using Cerenkov effect in Fano metamaterial

Seontae Kim (Seoul National University, Korea), Dongpyo Hong (Seoul National University, Korea), Matlabjon Sattorov (Seoul-Teracom, Inc. / Advanced Institutes of Convergence Technology, Korea), Muhammad Mohsin Hossain (Seoul National University, Korea), Sun-Hong Min (Korea Institute of Radiological and Medical Sciences, Korea), Gun-Sik Park (Seoul National University, Korea)

The Fano metamaterial provides a way of trapping and releasing electromagnetic waves in microwave and terahertz regime. We show that, by utilizing the electromagnetic properties, the efficiency of radiation power from the Cerenkov effect in our recently proposed metallic metamaterial is much larger than the one from the ordinary Cerenkov and Smith Purcell effects. The optimization of the efficiency was numerically conducted by manipulating the quality(Q) factor of the trapped Cerenkov light. The proposed metamaterial is suitable for developing compact and highly efficient free electron lasers.

16:50 ~ 17:10

16.2 / Realization of ultra-stable hard X-ray Free Electron Laser

H.-S. Kang (Pohang Accelerator Laboratory, S. Korea)

The use of electron-beam-based alignment incorporating undulator radiation spectrum analysis has allowed reliable operation of PAL-XFEL with unprecedented stability in terms of orbit, energy, and timing. A timing jitter of smaller than 20 fs for the FEL photon beam, a transverse position jitter of smaller than 10% of the photon beam size, and a variation of FEL intensity of smaller than 5% are consistently achieved due to the use of state-of-the-art design of the electron linear accelerator and the 3-BC lattice less vulnerable to RF jitters. The low timing jitter of the electron beam makes it possible to observe Bi(111) phonon dynamics without the need for timing-jitter correction, indicating that PAL-XFEL will be an extremely useful tool for hard X-ray time-resolved experiments.

17:10 ~ 17:30

16.3 / RF-Undulators and Powering Sources towards Compact Efficient Compton FEL-scattrons

Nikolai Yu. Peskov (Russian Academy of Sciences, Russia), Edward B. Abubakirov (Russian Academy of Sciences, Russia), Ilya V. Bandurkin (Russian Academy of Sciences, Russia), Andrey

N. Denisenko (Russian Academy of Sciences, Russia), Naum S. Ginzburg (Russian Academy of Sciences, Russia), Sergey V. Kuzikov (Russian Academy of Sciences, Russia), Andrey V. Savilov (Russian Academy of Sciences, Russia), Alexander A. Vikharev (Russian Academy of Sciences, Russia), Vladislav Yu. Zaslavsky (Russian Academy of Sciences, Russia)

Conception of Compton-type FELs operating up to X-ray band is under development currently at IAP RAS (N.Novgorod). This concept is aimed at reducing energy of a driving relativistic electron beam and thereby increasing efficiency of the electron-wave interaction in FEL, as well as achieving relative compactness of the generator. The basis of this concept is RF-undulators of a new type - the so-called "flying" undulators. Present paper is devoted to the results of current research of these RF-undulators, their simulations and "cold" tests in the Ka-band. For powering RF-undulators spatially-extended narrow-band Cerenkov masers are developed in the specified frequency range. In order to achieve the required sub-gigawatt power level of the pumping wave in a strongly oversized oscillator, we exploit the original idea of using two-dimensional distributed feedback implemented in the 2D doubly-periodical slow-wave structures. The design parameters of Ka-band surface-wave oscillator intended for powering RF-undulators, results of its simulation and initial experimental studies are presented.

17:30 ~ 17:50

16.4 / Development of a High-power Terahertz Free Electron Laser Using a Microtron accelerator and an Electro-magnetic Planar Undulator

Sangyoon Bae (Korea Atomic Energy Research Institute / Chungnam National University, Korea), Sergey Miginsky (Korea Atomic Energy Research Institute, Korea), Taesik Yoon (Korea Atomic Energy Research Institute / Chungnam National University, Korea), Boris A. Gudkov (Korea Atomic Energy Research Institute, Korea), Kyu-Ha Jang (Korea Atomic Energy Research Institute, Korea), Kitae Lee (Korea Atomic Energy Research Institute, Korea), Min Yong Jeon (Chungnam National University, Korea), Young Uk Jeong (Korea Atomic Energy Research Institute, Korea)

A high-power terahetz FEL is under development at KAERI. We developed a compact microtron to accelerate electrons up to 5 MeV with the energy spread of about 0.4%. An electro-magnetic planar undulator was designed and fabricated to cover the FEL's lasing wavelength range of 350~650 μm. The magnetic field strength in the gap of the undulator is changeable from 0.76 to 1.18 T by varying the coil current of the undulator from 1.4 to 2.4 kA. The undulator provides horizontal focusing force to keep the low energy electrons passing a specially-designed narrow waveguide.