Contribution ID: **51** Type: **not specified**

A high-power and tunable narrowband THz radiator design

Monday, 22 July 2024 16:00 (20 minutes)

Free-electron laser facilities demand versatile and inexpensive THz sources for pump-probe experiments. Smith-Purcell radiation provides a compact method to generate resonant and narrowband terahertz sources when relativistic electrons go through periodic dielectric grating structures, which are cost-efficient when fabricated by 3D printing. It has certain advantages over other available approaches but is limited by its low radiation power. This work proposes a 3D terahertz emission-collection concept to boost the terahertz efficiency and narrow the bandwidth of the central wavelength. Systematic simulations demonstrate that the 3D Smith-Purcell radiation can improve the coherent radiation power by orders of magnitude compared with the conventional 2D collection concept. Most importantly, mechanical deformations are first proposed to be introduced to deformable dielectric materials to generate continuously tunable THz radiations from ultrarelativistic electrons. A high-energy terahertz radiator, based on a helix pillar structure from inverse design optimization, is verified to emit more powerful terahertz radiation and achieve considerable tunability upon mechanical loads. This work provides valuable insights into the development of high-power and tunable narrowband terahertz radiators.

Working group

WG6 : Radiation generation, medical and industrial applications

Primary authors: Dr ZHANG, Tinglian (Paul Scherrer Institut (PSI)); Dr ISCHEBECK, Rasmus (Paul Scherrer Institut (PSI)); Dr NIEDERMEYER, Uwe (Carl Zeiss AG); Dr JURANIC, Pavle (Paul Scherrer Institut (PSI))

Presenter: Dr ZHANG, Tinglian (Paul Scherrer Institut (PSI))

Session Classification: WG6