Compact Grating-Based NIR Free-Electron-Laser Design

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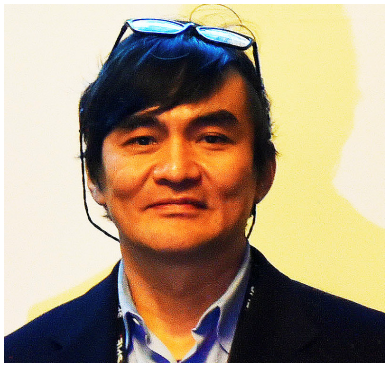
Abstract:
The dielectric-based free electron laser (FEL) is a breakthrough in compact, high-performance laser technology, offering potential applications in diverse fields. With an innovative design and dielectric materials, it ensures exceptional laser performance in a compact form suitable for industrial and medical use. The enhanced design, employing COMSOL techniques and CST software, enhances electron-grating interaction, leading to notable coupling effects.

Observing resonant coupling phenomena in interactions between a 50 keV electron and a 400 nm waveguide thickness, coupled with grating periods of 290 nm, 300 nm, and 310 nm, the FEL device demonstrated radiation emission within a resonant frequency range of 0.192 PHz to 0.194 PHz, accompanied by an electric field intensity of 10-10 V/m.

The fabrication process followed a tripartite iterative procedure, creating distinct mesa, waveguide, and grating layers. Iterative lithography and Deep Reactive Ion Etching (DRIE) operations resulted in precise dimensions, positioning the dielectric-based FEL device as a promising solution for advancing laser technology applications.

Short biography:



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