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Photonic Crystal-Based Compact High-Power Vacuum Electronic Devices

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Combining the photonic crystal-based structures with vacuum electronic devices opens the way for creation of a family of radiation sources: photonic BWOs, volume FELs (VFEL), etc. Some beneficial options of such structures, which enable tunability and increasing the radiation source efficiency, are discussed. The VFEL instability law declares start current for generator with the interaction length L to be determined by L^-5 rather than L^-3, thus enabling miniaturization of radiation source. Conditions enabling achievement of generation threshold and observation of THz single-frequency generation in a photonic BWO for electron beam parameters available at existing accelerators are discussed.

Summary

Combining the photonic crystal-based structures with vacuum electronic devices opens the way for creation of a family of radiation sources: volume FELs, photonic BWOs, etc. [1-7]. Some beneficial options become available, namely: use for radiation generation of multiple either pencil-like or sheet electron beams instead of single annular or sheet one and, thus, establishing the beam-wave interaction within the whole crystal cross-section and increasing the efficiency of radiation source [3-5].

One more option is given by the new instability law derived in [1,2,6,7], which declares start current for generator with the interaction length L to be determined by L-5 rather than L-3 even for one-dimensional interaction (the index of power grows with increasing of number of diffracted waves). This option enables miniaturization of radiation source.

Frequency tuning could be provided by change of photonic crystal geometry.

Conditions enabling to achieve generation threshold and to observe a single-frequency generation in THz range in a photonic BWO for electron beam parameters available at existing accelerators are discussed.

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