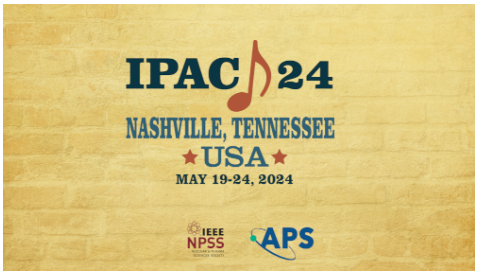

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Optimization of nanostructured plasmas for laser wakefield acceleration using a Bayesian algorithm

Tuesday, 21 May 2024 16:00 (2 hours)

Nanostructures are currently attracting attention as a medium for obtaining ultra-high-density plasmas for beam-driven or laser-driven acceleration. This study investigates Bayesian optimization in Laser Wakefield Acceleration (LWFA) to enhance solid-state plasma parameters towards achieving extremely high gradients on the order of TV/m or beyond, specifically focusing on nanostructured plasmas based on arrays of carbon nanotubes. Through Particle-In-Cell (PIC) simulations via EPOCH and custom Python scripts, we conducted a parameter analysis for various configurations of carbon nanotube arrays. Utilizing the open-source machine learning library BoTorch for optimization, our work resulted in a detailed database of simulation results. This enabled us to pinpoint optimal parameters for generating effective wakefields in these specialized plasmas. Ultimately, the results demonstrate that Bayesian optimization is an excellent tool for significantly refining parameter selection for nanostructures like carbon nanotube arrays, thus enabling the design of promising nanostructures for LWFA.

Footnotes

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