



Contribution ID: 2117 Contribution code: SUPC024

Type: Student Poster Presentation

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

Sunday, May 19, 2024 2:00 PM (4 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

Funding Agency

Work supported by the Generalitat Valenciana's Gen-T Programme under grant agreement CIDEAGENT/2019/58

Paper preparation format

Region represented

Europe

Author: RODRÍGUEZ PÉREZ, Juan (Instituto Universitario de Ciencia de los Materiales)

Co-authors: BONATTO, Alexandre (Universidade Federal de Ciências da Saúde de Porto Alegre); BONTOIU, Cristian (The University of Liverpool); XIA, Guoxing (Cockcroft Institute); RESTA-LOPEZ, Javier (Instituto Universitario de Ciencia de los Materiales); MARTÍN-LUNA, Pablo (Instituto de Física Corpuscular)

Presenter: RODRÍGUEZ PÉREZ, Juan (Instituto Universitario de Ciencia de los Materiales)

Session Classification: Student Poster Session

Track Classification: MC1: Colliders and other Particle and Nuclear and Physics Accelerators:
MC1.A16 Advanced Concepts