

## Tuning curves for a laser-plasma accelerator

*Tuesday, 19 September 2023 18:05 (25 minutes)*

In this talk, we explore recent results on optimal tuning of beam parameters of laser-plasma accelerators (LPA) at the LUX experiment. Precise control over electron beam parameters is essential for realizing the wide range of applications projected for LPAs. However, the complexity of the laser-plasma interaction makes tuning challenging, often leading to suboptimal outcomes. To address this issue, we employ an approach called multiobjective Bayesian optimization to navigate this complexity and derive optimal tuning curves for LPAs. For various electron energies, we demonstrate tuning of the charge over a broad range, while preserving optimal beam loading conditions and low energy spread. This is achieved by moving the system's control parameters along Pareto-optimal tuning curves. These tuning curves can explain the sometimes counterintuitive interplay between laser and plasma control variables that is necessary to find the best trade-off between competing beam properties, allowing operators to precisely tune the machine to the demands of a given application.

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