Automation and modelling of laser-driven plasma accelerators

Matthew Streeter[1]
[1] *Queen's University Belfast, UK*
m.streeter@qub.ac.uk

Automated control of laser-plasma interactions is becoming more desirable, with the advent of commercially available high-repetition rate high-power laser systems and an increased focus on industrial applications. In this talk, I will describe closed-loop experiments at the UK Central Laser Facility, which allowed for the implementation of machine learning techniques to model and optimise the performance of plasma accelerators. With this platform, Bayesian optimisation was used to enhance electron and x-ray beams generated by laser wakefield acceleration [1] as well as proton beam generation from laser-solid interactions [2]. Finally, I will discuss the design and training of a neural network to make predictions of electron spectra using secondary diagnostics of a laser wakefield accelerator [3]. Modelling of this type allows for the estimation of beam properties prior to undergoing some destructive process, gaining information beneficial to both fundamental physics experiments and industrial applications.

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References

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