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Bayesian optimization for generating attosecond X-ray FEL pulses

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Ångström and attosecond represent fundamental spatiotemporal scales for studying electron dynamics in various materials. Recently, high-power attosecond hard X-ray pulses have been successfully demonstrated at the European XFEL using the self-chirping operation mode. However, the current process heavily depends on manual tuning by experienced operators, which is time-intensive and less scalable. In this work, we report recent advancements in automating and optimizing the generation of high-power attosecond X-ray pulses using Bayesian optimization techniques. By leveraging machine-learning-based approach, we aim to enhance pulse energy, spectral quality, and operational efficiency, paving the way for more accessible and reproducible attosecond X-ray experiments.

Footnotes

Paper preparation format

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