

## Application for the student session

Presentation title:

**On-Line Optimization Algorithm for High-Gain Free Electron Lasers**

Abstract:

Recent years have seen an increasing interest in the free electron laser (FEL), which opens up new research domains at previously inaccessible length (nanometers) and time (femtoseconds) scales for quantum materials condensed matter science, photochemistry, structural biology and medicine. Due to the increasing complexity, uncertainty and data dimensions in the online tuning process of FELs, conventional methods often encounter bottlenecks when attempting to increase the average pulse energy and improve the stability of the light. This article describes an online optimization strategy based on deep reinforcement learning (DRL) methods. During a reinforcement learning process, an agent can periodically control quadrupole and corrector magnets, observe the results, and then automatically adjust its strategy to optimize the laser spot profile on a photocathode. An apparent enhancement of the maximum FEL intensity can be experimentally achieved by our proposed method.

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