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Towards Machine Learning-Enhanced Laser Cooling and Trapping SHANGJIE GUO, Joint Quantum Institute, University of Maryland, College Park, National Institute of Standards and Technology, JUSTYNA P. ZWOLAK, National Institute of Standards and Technology, I. B. SPIELMAN, Joint Quantum Institute, University of Maryland, College Park, National Institute of Standards and Technology — Since its invention in the early 1970s, laser manipulation of atoms has broken records and became a routine technology. Today, researchers combine heuristics and out-of-loop optimization to inform the parameters in otherwise scripted experimental control sequences. However, as the configurations of both the apparatus (magneto-optical trap, MOT) and protocol (laser pulse sequences, magnetic fields, etc.) are numerous, the limits of laser cooling remain unknown. We will use machine learning (ML) techniques to optimize the MOT loading process and the following sub-Doppler laser cooling. In particular, we are developing a realistic 3D simulator of the experimental system to generate data for training an ML algorithm and to use as an off-line test bed. In this talk, I will discuss the design and preliminary performance of the simulator in comparison with experimental data for validation.

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