# Dual Laser Frequency Stabilization for a $Yb^+$ single-ion trap

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Frequency stabilized lasers play a crucial role in numerous atomic physics experiments, including single-ion traps. The cooling laser frequency must be stabilized to a fraction of the natural line width of an atomic transition to facilitate efficient ion cooling and manipulation of states. Additional stabilized lasers are necessary to "repump" the ion from metastable states, ensuring high scattering rates on the cooling transition, or to optically pump the ion in a specific state.

We present the laser stabilization of a 370 nm laser on a hollow cathode lamp with a target fractional frequency stability below $5 \cdot 10^{-10}$ at 1 second. The optical setup (shown Fig. 1) is part of a single-ion optical compact clock based on a surface-electrode trap that we will operate with $^{171}Yb^+$ ions on the electric quadrupole transition at 436 nm[1]. In the experiment, the goal is to simultaneously stabilize a 370 nm and a 935 nm laser to target the $^2S_{1/2} \rightarrow {}^2P_{1/2}$ and $^2D_{3/2} \rightarrow {}^3D_{[3/2]1/2}$ transitions of $Yb^+$ ions produced within a hollow cathode discharge lamp[2,3]. Two lasers can be locked on the same atomic sample. We will present the performance of the dual-laser lock and the current status of the experiment.

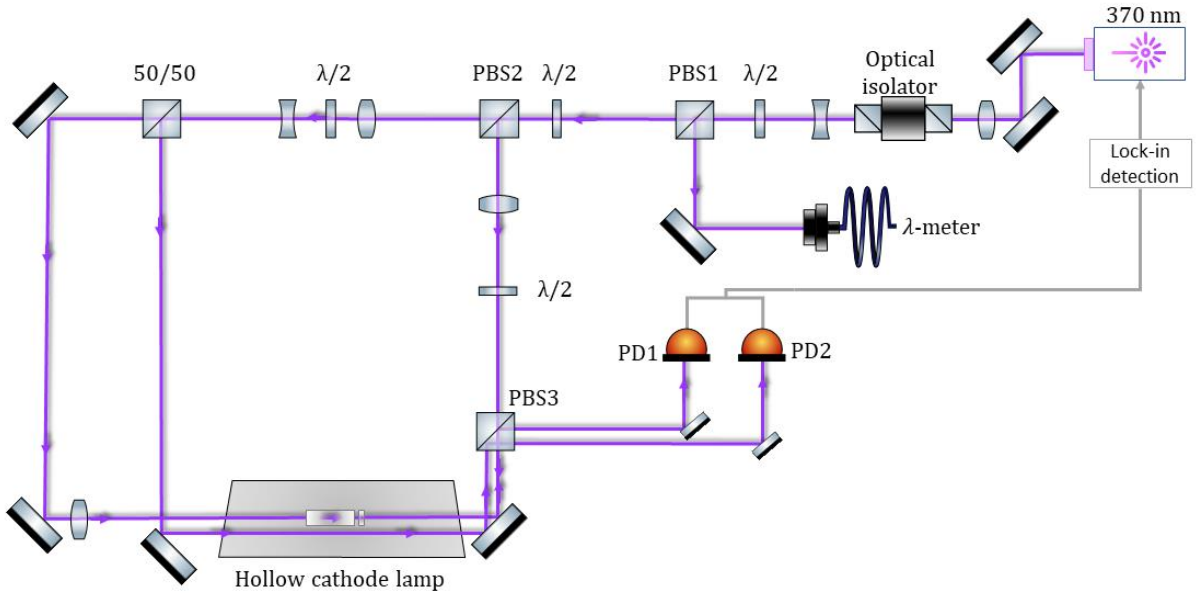


Fig. 1: Optical scheme for saturated absorption spectroscopy on atomic sample generated in hollow cathode lamp. PBS - Polarization Beam Splitter, PD – Photodiode, λ-meter: Wavemeter .

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[3] S. C. Burd, P. J. W. du Toit, and H. Uys, "Coupled optical resonance laser locking," Opt. Express 22, 25043-25052 (2014).