Towards high precision spectroscopy of ultracold silver

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More than twenty years after the initial demonstration of a magneto-optical trap for ultracold silver [1], there is a renewed interest in this element, driven by the aim to create highly polar ground state molecules composed of silver and an alkali metal [2]. Additionally, since the nineties silver has been considered as a possible candidate for a construction of an optical atomic clock due to its metastable state (τ =115 ms) accessible from the ground state by a two-photon transition (661.2 nm) [3] making it insensitive to the first-order Doppler effects [4].

Our research is centered on highly precise spectroscopic investigations of the clock transition, $4d^{10}5s\,^2\mathrm{S}_{1/2} \rightarrow 4d^{9}5s\,^2\mathrm{D}_{5/2}$, along with a transition from the metastable state to the excited state $4d^{10}6p\,^2\mathrm{P}_{3/2}$ (547.7 nm). These measurements will enable complete control over the clock transition, which is important for both frequency metrology and encoding optical qubits in quantum computing. Additionally, the excitation at 547.7 nm will enhance the efficiency of the magneto-optical trapping stage due to elimination of the leakage from the cooling transition into the metastable state.

For the purpose of obtaining the highest possible precision of our measurements we will utilize an optical frequency comb synchronized via PIONEER fiber network to a strontium optical atomic clock [5].

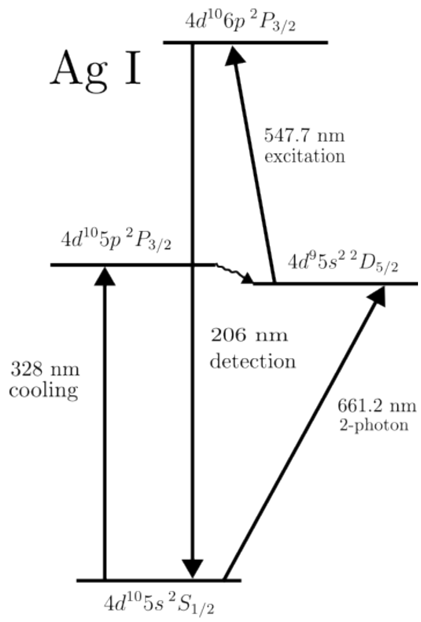

Figure 1: Energy levels of silver

References

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