# State-selective control of Yb atoms for quantum simulation of LGTs

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The ground and meta-stable clock state pair in ytterbium provides an excellent resource for quantum metrology, simulation and computation applications. Being capable of individually addressing the two optical clock qubit states in a state-selective manner enhances the controllability of such systems, allowing for novel methods for state preparation, read-out or simulation schemes. Utilizing high-resolution clock spectroscopy, we present the first measurements of the Yb ground-state tune-out wavelength and of two new magic wavelengths [1]. We further showcase how this will be used in our hybrid tweezer-lattice experiment to probe and engineer lattice gauge theories, using state-dependent potentials to robustly implement local gauge invariance [2].

[1] Phys. Rev. A 108, 053325 (2023)
[2] PRX Quantum 4, 020330 (2023)