Spectroscopy of the $^1S_0 \rightarrow {}^3P_0$ clock transition in magnesium

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We report on the latest status of the magnesium optical lattice clock experiment at IQ in Hannover. 10^4 magnesium atoms are optically trapped in a lattice at the predicted magic wavelength of 469 nm. In order to fulfill the power requirements for sufficient trapping, the lattice is generated within a build-up cavity with a power enhancement factor of 30. The maximum circulating power is 2 W which can be computer-controlled for removing the hottest atoms during a ramping sequence.

As the bosonic isotope ^{24}Mg does not possess a nuclear spin and thus no hyperfine structure, the linewidth of the spin-forbidden clock transition naturally equals zero as there is no coupling to other states. However, laser excitation is possible under presence of a strong magnetic field coupling the $^3P_0$ state to the $^3P_1$ state. Performing spectroscopy on the clock transition, we observe a clear asymmetry between the red and the blue sideband of the carrier signal where we calculate the temperature of the atoms to be 1.3 μK. Varying lattice power and wavelength, we are able to give a first estimate on the magic wavelength between 467.66 and 468.95 nm.