# PTB's transportable Sr lattice clock

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The unprecedented accuracy of optical clocks can only be fully exploited by comparisons in the optical regime. New kinds of these measurements are enabled by transportable setups that allow operation at arbitrary locations after a short startup time. As one example, combined with long range optical fiber links[1], applications such as chronometric leveling[2] will become possible between locations where no stationary optical clock is available. Furthermore a high number of comparisons between non-identical optical clocks from different institutions will provide a stringent test on the individual systems and will eventually lead to a grid of optical frequency ratios known with better accuracy than the realization of the SI second. Such a dataset can also provide new limits on possible variations of fundamental constants.

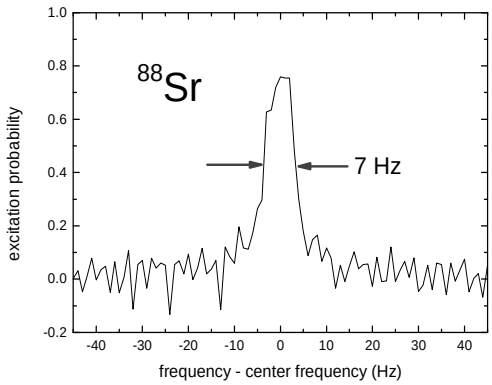


Fig. 1. Spectroscopy on the clock transition of $^{88}$Sr. A nearly Fourier limited linewidth of roughly 7 Hz was observed with a clock pulse time of 180 ms using a transportable clock laser.

We will present the progress on a strontium lattice clock setup, which is designed to be transportable and competitive with today's optical clocks. As uncertainties in the ambient temperature are a crucial factor for strontium clocks, care was taken to provide a homogeneous temperature across the vacuum chamber. The magnetic field coils for trapping of strontium atoms are designed for low power dissipation and efficient water cooling. A Zeeman slower with permanent magnets has been implemented. Spectroscopy on the clock transition of the more abundant bosonic isotope $^{88}$Sr has been carried out showing a linewidth of about 7 Hz. The evaluation of the uncertainty budget will be performed on the $^{87}$Sr isotope using PTB's stationary strontium clock as a highly accurate and stable reference[3].

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[1] K. Predehl *et al.*, "A 920-Kilometer Optical Fiber Link for Frequency Metrology at the 19th Decimal place", Science, Vol. **336**, p. 441-444, 2012

[2] M. Vermeer, "Chronometric levelling", Reports of the Finnish Geodetic Institute, 83:2, 1983.

[3] St. Falke *et al.*, "A strontium lattice clock with $3 \times 10^{-17}$ inaccuracy and its frequency", arXiv:1312.3419