Pulsed optical pumping in a Rb vapour cell using a compact magnetron-type microwave cavity

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A high-performance Rb cell clock based on pulsed optical pumping (POP) with optical detection has been demonstrated previously, showing excellent clock stabilities on both the short-term and up to few days timescales[1]. A compact magnetron-type microwave cavity has previously been developed for a Rb atomic clock[2] based on conventional continuous-wave double-resonance (DR) interrogation. This magnetron-type cavity shows a homogenous microwave field distribution while having a cavity volume 3 times smaller than the cavity used in[1], which makes it interesting for the realization of a POP clock with reduced physics package size.

In this communication we report on the evaluation of pulsed optical pumping with our magnetron-type cavity. Using the pulsed technique and optical detection, high-contrast Ramsey fringes were observed, see Fig.1. The central fringe of the Ramsey signal has a linewidth of ≈ 150 Hz and contrast of ≈ 40%. Under these conditions, the shot-noise limit is estimated at a level of $1\times10^{-13}\,\tau^{-1/2}$ and is expected to be further improved, which shows the great potential of a POP clock based on the compact magnetron-type cavity. Further results will be presented at the conference.

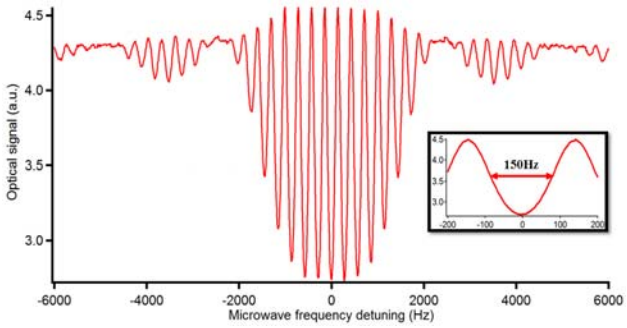

Fig. 1: Ramsey signal observed with optical detection. The central fringe has a linewidth of about 150Hz and contrast of about 40%.

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[2] C. Stefanucci, T. Bandi, F. Merli, M. Pellaton, C. Affolderbach, G. Mileti, A. K. Skrivervik, "Compact microwave cavity for high performance rubidium frequency standards". Rev. Sci. Instrum. **83**, 104706, 2012.