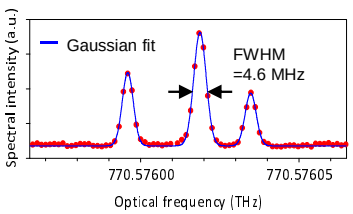
TWO-PHOTON ABSORPTION SPECTROSCOPY OF RUBIDIUM WITH A DUAL-COMB TEQUNIQUE

AKIKO NISHIYAMA, SATORU YOSHIDA, TAKUYA HARIKI, YOSHIAKI NAKAJIMA, KAORU MINOSHIMA, *Department of Engineering Science, Graduate School of Informatics, The University of Electro-Communications, Tokyo, Japan*.

Dual-comb spectroscopies have great potential for high-resolution molecular and atomic spectroscopies, thanks to the broadband comb spectrum consisting of dense narrow modes[a]. In this study, we apply the dual-comb system to Doppler-free two-photon absorption spectroscopy. The outputs of two frequency combs excite several two-photon transitions of rubidium[b], and we obtained broadband Doppler-free spectra from dual-comb fluorescence signals. The fluorescence detection scheme circumvents the sensitivity limit which is effectively determined by the dynamic range of photodetectors in absorption-based dual-comb spectroscopies. Our system realized high-sensitive, Doppler-free high-resolution and broadband atomic spectroscopy.

A part of observed spectra of $5S_{1/2}$ - $5D_{5/2}$ transition is shown in the figure. The hyperfine structures of the F" = 1 - F' = 3,2,1 transitions are fully-resolved and the spectral widths are approximately 5 MHz. The absolute frequency axis is precisely calibrated from comb mode frequencies which were stabilized to a GPS-disciplined clock.



This work was supported by JST through the ERATO MINOSHIMA Intelligent Optical Synthesizer Project and Grant-in-Aid for JSPS Fellows (16J02345).

[a] A. Nishiyama, S. Yoshida, Y. Nakajima, H. Sasada, K. Nakagawa, A. Onae, K. and Minoshima, Opt. Express 24, 25894 (2016).
[b] A. Hipke, S. A. Meek, T. Ideguchi, T.W. Hänsch, and N. Picqué, Phys. Rev. A 90, 011805(R) (2014).