

## Difference-frequency combs in cold atom physics

Tue, 2016-07-26 16:46 - [Ryan Hanley](#) [1] **Date:** 2016-05-04

### Author(s):

Russell Kliese, Nazanin Hoghooghi, Thomas Puppe, Felix Rohde, Alexander Sell, Armin Zach, Patrick Leisching, Wilhelm Kaenders, Niamh C. Keegan, Alistair D. Bounds, Elizabeth M. Bridge, Jack Leonard, Charles S. Adams, Simon L. Cornish, Matthew P. A. Jones

### Reference:

Eur. Phys. J. Special Topics 225, 2775–2784 (2016)

### URL:

10.1140/epjst/e2016-60092-0

Optical frequency combs provide the clockwork to relate optical frequencies to radio frequencies. Hence, combs allow to measure optical frequencies with respect to a radio frequency where the accuracy is limited only by the reference signal. In order to provide a stable link between the radio and optical frequencies, the two parameters of the frequency comb must be fixed: the carrier envelope offset frequency  $f_{ceo}$  and the pulse repetition-rate  $f_{rep}$ . We have developed the first optical frequency comb based on difference frequency generation (DFG) that eliminates  $f_{ceo}$  by design - specifically tailored for applications in cold atom physics. An  $f_{ceo}$ -free spectrum at 1550 nm is generated from a super continuum spanning more than an optical octave. Established amplification and frequency conversion techniques based on reliable telecom fiber technology allow generation of multiple wavelength outputs. In this paper we discuss the frequency comb design, characterization, and optical frequency measurement of Sr Rydberg states. The DFG technique allows for a compact and robust, passively  $f_{ceo}$  stable frequency comb significantly improving reliability in practical applications.

- [H2020](#) [2]
- [RySQ](#) [3]
- [FP7](#) [4]
- [Quantum Metrology, Sensing and Imaging](#) [5]
- [Result](#) [6]
- [15.10.Ne Neutral atoms: electronic states](#) [7]
- [15.10.Ry Rydberg atoms](#) [8]

**Source URL:** <http://qurope.eu/db/publications/difference-frequency-combs-cold-atom-physics>

### Links:

[1] <http://qurope.eu/users/ryanhanley>

[2] <http://qurope.eu/category/european-commission/h2020>

[3] <http://qurope.eu/category/projects/rysq>

[4] <http://qurope.eu/category/european-commission/fp7>

[5] <http://qurope.eu/category/virtual-institute/quantum-metrology-sensing-and-imaging>

[6] <http://qurope.eu/category/attribute/result>

[7] <http://qurope.eu/category/qics/10-quantum-computation/15-implementations-quantum-optics/1510ne-neutral-atoms-electron>

[8] <http://qurope.eu/category/qics/10-quantum-computation/15-implementations-quantum-optics/1510ry-rydberg-atoms>

