A Cavity-Free Self-Referencing Frequency Comb

Tech ID: 27592 / UC Case 2017-604-0

BRIEF DESCRIPTION

A self-referencing frequency comb based on high-order sideband generation (HSG) that does not require cavities.

Applications include "set-and-forget" optical atomic clocks and high-resolution spectrometers for airborne chemicals.

BACKGROUND

All existing methods of generating frequency combs requires that a cavity be tuned to adjust the combs' tooth spacing. The required cavities lead to problems with miniaturization and/or noise. Octave-spinning frequency combs based on mode-locked lasers are the combs with lowest noise, but are difficult to miniaturize. Frequency combs in which the cavity is a dielectric microresonator are easy to miniaturize, but suffer from phase noise associated with the same nonlinear optical processes that are required to generate the combs.

DESCRIPTION

Researchers at the University of California, Santa Barbara have discovered high-order sideband generation (HSG), a new phenomenon in the interaction of light with matter. HSG enables a new approach to creating self-referencing frequency combs that do not require cavities. Advanced terahertz-frequency sources will enable self-referencing frequency combs based on HSG with low cost, size, weight and power, eventually on the scale of a chip. The principles of HSG enable combs operating at wavelengths ranging from the long-wave infrared to the ultraviolet.

Applications include robust, miniaturized, "set-and-forget" optical atomic clocks, and high-resolution spectrometers for airborne chemicals that could be deployed on a mobile platform like a cell phone.

ADVANTAGES

- Increased frequency-stability of comb teeth
- Small cost, weight, size and power
- Simplified tuning

APPLICATIONS

- Military/weapons
- Dead reckoning in GPS-denied environments

PATENT STATUS

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OTHER INFORMATION

KEYWORDS

high-order sideband generation, HSG, atomic clock, spectrometer, frequency comb, military weapons, dead reckoning, indmicroelec

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics
- **Nanotechnology**
  - Tools and Devices
- **Security and Defense**
  - Other

RELATED CASES

2017-604-0

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,490,974	11/26/2019	2017-604

RELATED MATERIALS

- Dynamical Birefringence: Electron-Hole Recollisions as Probes of Berry Curvature - 11/21/2017

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Compact Module for Complementary-Channel Terahertz Pulse Slicing

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