

# Frequency Combs Outside the Metrology Lab: Time Transfer over Long Distance Terrestrial Links

Laura C. Sinclair<sup>1</sup>, Emily D. Caldwell<sup>1,2</sup>, Benjamin K. Stuhl<sup>3</sup>, William C. Swann<sup>1</sup>, Nathan R. Newbury<sup>1</sup>, and Jean-Daniel Deschenes<sup>4</sup>

*1. National Institute of Standards and Technology; Boulder, Colorado, United States.*

*2. Department of Electrical, Energy and Computer Engineering, University of Colorado; Boulder, Colorado, United States.*

*3. Space Dynamics Laboratory; North Logan, Utah, United States.*

*4. Octosig Consulting; Quebec City, Quebec, Canada.*

*Author e-mail address: laura.sinclair@nist.gov*

**Abstract:** Future clock networks will require femtosecond-level time distribution for applications from fundamental physics tests to distributed coherent sensing. We present a quantum-limited comb-based free-space time transfer approach and results on clock synchronization over ultra-long distances. © Work of the US Government, not subject to copyright