Contribution ID: **173** Type: **Invited Poster**

Optical Frequency Transfer and Velocimetry to Rapidly Moving Targets

Precise frequency synchronization between distant points is essential for a huge range of scientific measurements. Frequency synchronization to moving targets, such as a satellite in orbit, will provide tests of fundamental physics [1]. Frequency synchronization has been improved with the use of free space optical technology. However, robust optical control systems must be designed to measure and suppress the large Doppler shifts when transfer occurs to rapidly moving targets [2]. The design of an optical control system capable of Doppler velocimetry is described, along with the capability to perform frequency transfer.

The Doppler tracking system has successfully been demonstrated in the laboratory, with maximum tracking rates of 1 MHz/s or 1.5/m/s2. Fractional frequency stability on the order of 10e-17 is obtained after 10 seconds of integration, along with a noise density of 10e-7 cyc2/Hz at 10Hz.

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Track Classification: Time and Frequency Transfer