

Sebastien Fernandez - Free space optical link to a tethered balloon for frequency transfer and chronometric Geodesy

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Optical clocks have demonstrated uncertainties in the 10^{-18} region in fractional frequency. This makes them prime candidates for applications like chronometric geodesy, navigation and fundamental physics. Such applications require frequency transfer between a reference clock in a static place and a transportable one, e.g. enabling geopotential mapping over a region. It is thus necessary to develop a free-space optical link, in order to extend the current fiber link network in a flexible way. I will present the TOFU (“Transfert Optique de Fréquence Ultrastable”) project. It consists in developing a free space phase-stabilized optical link through an airborne relay, over expected distances up to ~ 100 km. We already set up a 300m-folded link between a ground transceiver and a retroreflector carried by a balloon at CNES premises. I will present the design of this system, which includes a phase measurement and compensation unit and an optical transceiver. Following, I will show the performance and limitations of the system, that we evaluated during a measurement campaign lead in March 2023. Finally, I will describe the further technical developments in order to build an active airborne transceiver, replacing the passive retroreflector.

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