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Optically-Based Microwave: Frequency Comb Bootstrapping and other Comb Activities

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ABSTRACT

Reaching quantum projection noise in atomic fountains requires a low-noise ultra-stable microwave signal. The division of a high-stability optical signal in to the microwave domain by an optical frequency comb has been proven to vastly exceed the performance of any other established technology. I present our new scheme to generate a hybrid microwave, featuring both the excellent short-term frequency stability of an optical cavity and the long-term phase predictability of an H-maser. Preliminary stabilities against microwave fountains confirm its capacity to replace our 11.98 GHz cryogenic oscillator. Moreover, the referencing of an optical clock transported outside the laboratory is a requirement to ensure the accuracy of the measurements. I present two combinations of techniques, the bootstrapping of an OFC and the exploitation of an accurate 1542 nm reference or the exploitation of an laser reference on the atomic transition of the clock, in order to generate locally an accurate RF signal, even in an environment away from a metrology laboratory.

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