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RECENT RESULTS ON A RUBIDIUM PULSED OPTICALLY PUMPED CLOCK FOR SPACE APPLICATIONS

Abstract

Rubidium vapor-cell clocks are at the basis of many time-keeping applications, including global navigation satellite systems (GNSS) and telecommunications. These devices demonstrated to be reliable, robust and compact and are able to deliver a stable signal for one day of integration time or longer. However, more recently, laser-pumped cell clocks have demonstrated improved stability performances compared to traditional lamp-pumped devices, maintaining at the same time the potential of reduced size weight and power consumption (SWaP). The usage of laser radiation has the drawback, related to simultaneous presence of laser and microwave signals during the clock interrogation, of introducing a rather high sensitivity of the clock output signal to the laser parameters (namely frequency and intensity). In the Rb POP (Pulsed Optically Pumped) frequency standard, developed by the Italian National Metrology Institute (INRiM), the usage of pulsed laser and microwave radiations is introduced allowing to strongly relax the requirements on the laser noise and stability, since the clock state spectroscopy is performed in the dark. Rb POP technology has been then transferred from INRiM to Leonardo SpA and is currently under industrialization for Space applications. We report on the recent results obtained with a Rb-POP clock developed in the framework of the Leonardo-INRiM collaboration. The physics package developed

by Leonardo S.p.A. includes space-graded components, weights less than 4 kg and occupies only a 4-liters volume. It has been characterized with custom optics and electronics developed at INRIM laboratories. By taking advantage of advanced stabilization techniques for the laser and microwave pulses, this arrangement exhibits state-of-the-art short and mid-term stability.