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RUBIDIUM PULSED OPTICALLY PUMPED CLOCK FOR NAVIGATION SATELLITES

Abstract

Leonardo in collaboration with INRIM is developing a space grade industrialized version of the Rubidium POP atomic clock, that will address future GNSS satellite constellations needs. In the frame of ESA General Support Technology Program (GSTP), the Physics Package of this novel atomic clock has beed designed, built and tested. We present the advancement status of the development program. Reliable space qualified atomic clocks with reduced mass and power consumption and high frequency stability will be a fundamental asset for the future Global Navigation Satellite Systems as well as in other applications including satellite communications and deep space navigation. In these respects the Rubidium Pulsed Optically Pumped (Rb POP) clock is considered a promising candidate since it is, in all the above aspects, outperforming the Passive Hydrogen Maser (PHM), presently the most stable clock flying on navigation

satellites. In the Rb POP frequency standard a laser beam resonant with the ^{87}Rb D_2 line at 780.2 nm is transmitted through a Rb vapor cell placed inside a microwave cavity resonating at the ground state hyperfine frequency splitting of Rubidium at 6834 MHz. Clock oscillation frequency is frequency locked to the center of the Ramsey fringe pattern observed in the optical absorption after a proper sequence of optical and microwave pulses. This interrogation technique makes it possible to reduce to a negligible level the light shift induced instabilities, because optical and microwave pulses are never simultaneously applied to the atomic vapor. Actual measured performances of the Rb POP atomic clock Physics Package will be presented and discussed in the paper, as well the future plans toward In Orbit Demonstration.