



Canadian Association
of Physicists

Association canadienne
des physiciens et physiciennes

Contribution ID: 2263

Type: **Invited Speaker** / **Conférencier(ère) invité(e)**

Applications of Auto-locked Laser Systems for Precision Metrology (I)

Thursday 14 June 2018 11:30 (30 minutes)

We discuss applications of a versatile, auto-locking laser system consisting of an external cavity diode laser and waveguide amplifier. The diode laser, which is capable of being vacuum-sealed, can be frequency stabilized with reference to atomic, molecular, and solid state spectra using a digital controller that relies either on a pattern-matching algorithm or on first or third derivative feedback. We review the performance characteristics of this continuous wave laser system and describe its suitability for accurate measurements of gravitational acceleration that are relevant for the exploration of natural resources. We show that a pulsed laser system based on this design can be used for industrial magnetometry and for realizing a new class of lidar transmitters. We also discuss the possibility of using this laser system for realizing a precise measurement of atomic lifetimes using coherent transient effects.

- Work supported by CFI, OIT, NSERC, OCE, and York University

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Session Classification: R2-3 Laser Physics and Spectroscopy** (DAMOPC) | Physique des lasers et spectroscopie (DPAMPC)

Track Classification: Division of Atomic, Molecular and Optical Physics, Canada / Division de la physique atomique, moléculaire et photonique, Canada (DAMOPC-DPAMPC)