

Abstract Submitted
for the DAMOP12 Meeting of
The American Physical Society

Sorting Category: 1.0 (E)

Revisiting Pound-Drever-Hall frequency stabilization in the radio-frequency domain CHELSEA LIEKHUS-SCHMALTZ, JAMES MARTIN, University of Waterloo — By revisiting Pound-Drever-Hall locking as a method for stabilizing rf oscillators, we have developed two new laser stabilization methods and an undergraduate lab exploring the technique. In the first stabilization scheme a tunable rf source (stabilized using Pound-Drever-Hall locking) phase modulates an injection locked diode laser. The length of an optical cavity can be locked to one of the adjustable sidebands of this laser, which stabilizes a second laser [1]. The second scheme is a version of rf beat note locking with one frequency modulated laser. The rf heterodyne signal can be mixed with an rf tunable source and a Pound-Drever-Hall error signal generated from reflection off an rf cavity can stabilize one of the original lasers. By changing the tunable frequency, the locked laser frequency can be changed. The stability and tunability of both stabilization methods are established by observing the hyperfine components of the ^{87}Rb $5P_{3/2}-5D_{5/2}$ transition in a vapor cell. Finally, an undergraduate lab [2] was developed that consists of locking a voltage-controlled-oscillator to a copper resonating cavity using Pound-Drever-Hall locking. By working at lower frequencies, the technique can be understood in more detail.

[1] arxiv/1109.0338

[2] arxiv/1108.0960

Prefer Oral Session
 Prefer Poster Session

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Date submitted: 21 Mar 2012

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