Cavity Paper

General

- Making optical atomic clocks more stable with 10−16-level laser stabilization , V. Jiang et al.,Nature Photonics **5**, 158–161 (2011)
- High-precision laser stabilization via optical cavities , M. Martin and J. Ye

Overview Cavities

Relevant effects influencing frequency stability

- **Fundamental limit: Thermal noise limit**
  - Thermal-Noise Limit in the Frequency Stabilization of Lasers with Rigid Cavities , K. Numata et al., PRL **93**, 250602 (2004)
  - Thermal noise in optical cavities revisited , T. Kessler et al., J. Opt. Soc. Am. B Vol. **29**, No. 1 (2012)
- **Reduction of thermal noise limit**
  - **Higher-order mode locking:**
    - Thermal noise limited higher-order mode locking of a reference cavity , X. Y. Zeng et al., arXiv:1801.05026v1 (2018)
- **Laser Lock: Pound-Drever-Hall (PDH):**
  - Laser Phase and Frequency Stabilization Using an Optical Resonator , R. W. P. Drever et al., Appl. Phys. B **31**, 97-105 (1983)
- **Vibration:**
  - Simple vibration-insensitive cavity for laser stabilization at the 10^-16 level , J. Keller et al., Appl. Phys. **B 116**, 203–210 (2014)
  - https://journals.aps.org/pra/abstract/10.1103/PhysRevA.79.053829
- **Residual amplitude modulation:**
  - Reduction of residual amplitude modulation to 1 × 10-6 for frequency modulation and laser stabilization , W. Zhang et al., Optics Letters Vol. **39**, No. 7 (2014)
  - Investigation and cancellation of residual amplitude modulation in fiber electro-optic modulator based frequency modulation gas sensing technique , Z. Li et al., Sensors and Actuators B **196**, 23–30 (2014)
  - Residual amplitude modulation in interferometric gravitational wave detector , K. Kokeyama et al., J. Opt. Soc. Am. A Vol. **31**, No. 1 (2014)
    - Residual Amplitude Modulation in Interferometric Gravitational Wave Detectors , K. Kokeyama et al., aXiv:1309.4522v1 [gr-qc] 18 Sep 2013

- **Temperature/CTE:**
  - **ULE compensations rings:**
    - Tuning the thermal expansion properties of optical reference cavities with fused silica mirrors
      , T. Legero et al., J. Opt. Soc. Am. B Vol. **27**, No. 5 (2010)

- Mercury (Paris) cavity:
  - Ultrastable lasers based on vibration insensitive cavities
    , J. Millo et al., PR A **79**, 053829 (2009)
  - Laser locking to the Hg199 □01−□03 clock transition with 5.4×10−15/√□ fractional frequency instability
    , J. J. McFerran et al., Optics Letters Vol. **37**, No. 17, 3477-3479 (2012)

Coating

- **Crystaline coatings:**
  - Tenfold reduction of Brownian noise in high-reflectivity optical coatings
    , Garrett D. Cole et al., Nature Photonics **7**, 644–650 (2013)
  - Optical performance of large-area crystalline coatings
    , M. Marchito et al., Opt. Exp. 6114, Vol. 26, No. 5 (2018)

Spacer geometries / Cavity types

- **Vertical geometry:**
  - **Length: 2.5 cm:**
    - Compact, thermal-noise-limited reference cavity for ultra-low-noise microwave generation
      , J. Davila-Rodriguez et al., Opt. lett. Vol. 42, No. 7 (2017)
  - **Length: 7 cm:**
    - Compact, thermal-noise-limited optical cavity for diode laser stabilization at 1×10−15
      , A. D. Ludlow et al., Optics Letters Vol. **32**, Issue 6, pp. 641-643 (2007)
  - **Length: 10 cm:**
    - A compact, robust, and transportable ultra-stable laser with a fractional frequency instability of 1 × 10−15
      , Q. F. Chen et al., REVIEW OF SCIENTIFIC INSTRUMENTS 85, 113107 (2014)
  - **Length: 48 cm:**
    - 8 × 10−17 fractional laser frequency instability with a long room-temperature cavity
      , S. Häfner et al., Optical Letters Vol. **40**, No. 9 (2015)
    - A strontium lattice clock with 3×10^−17 inaccuracy and its frequency: a_strontium_lattice_clock_with_310_-17_inaccuracy_and_its_frequency.pdf

- **Cubic geometry:**

    - Force-insensitive optical cavity
, S. Webster et al., Optics Letters Vol. **36**, Issue 18, pp. 3572-3574 (2011)
        - PTB took the NPL-design and updated it for a better longterm stability (see Häfner PHD-thesis, Chapter 4.2)

- **Cryogenic single-crystal optical cavities:**
    - **Length: 6 cm:**
    - **Length: 21 cm:**
        - Ultrastable laser with average fractional frequency drift rate below 5 × 10−19/s
        , C. Hagemann et al., Optics Letters Vol. **39**, No. 17 (2014)
            - A sub-40-mHz-linewidth laser based on a silicon single-crystal optical cavity
            , T. Kessler et al., Nature Photonics Vol. **6**, 687-692 (2012)
        - https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.118.263202

Applications

- **Transfer of stability:**
    - Providing 10−16 Short-Term Stability of a 1.5-µm Laser to Optical Clocks
    , C. Hagemann et. al., IEEE Transactions on instrumentation and measurement, VOL. 62, NO. 6 (2013)
- **Transportable cavities:**
    - Single-ion, transportable optical atomic clocks
    , Marion Delehaye & Clément Lacroûte, Journal of Modern Optics, 65:5-6, 622-639 (2018)
- **Lorentz invariance for the electron:**