

High Power, Low Linewidth Ridge Waveguide Laser

Stabilized by Volume Holographic
Grating External Cavity at 780nm

orator:



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➤ **Focus:**

- Highly stable external-cavity diode lasers (ECDL) with an output power of several hundred milliwatt

➤ **Applications:**

- Optical cooling & trapping, Raman spectroscopy, LIDAR, time standards

➤ **Means:**

- Feedback by volume holographic grating (VHG), compact packaging

➤ **Advantages:**

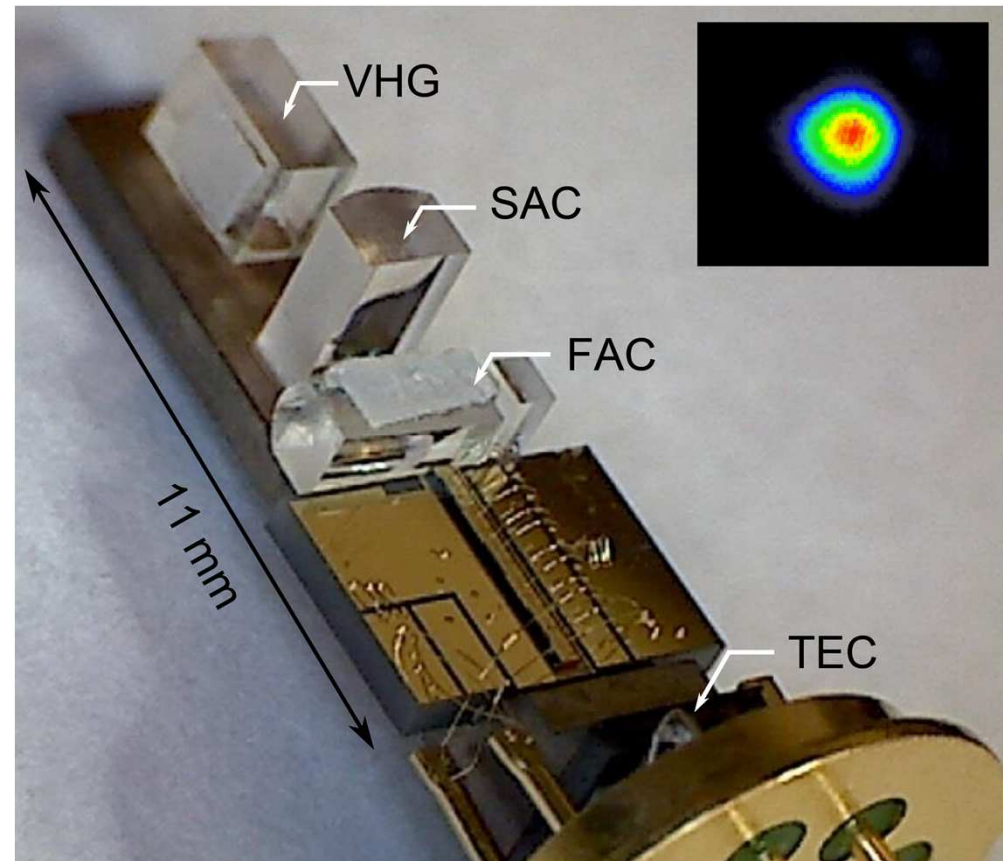
- High mechanical stability, low manufacturing costs

➤ Laser Diode

- Chip Length: 3900 μm
- Front Facet: AR Coated
- Rear Facet: HR Coated
- Collimation: Separate Collimation for Fast and Slow Axis

➤ Bragg Grating

- Center Wavelength: 780nm
- Spectral Width: 0.1nm
- Reflectivity: 12%



➤ Output Power

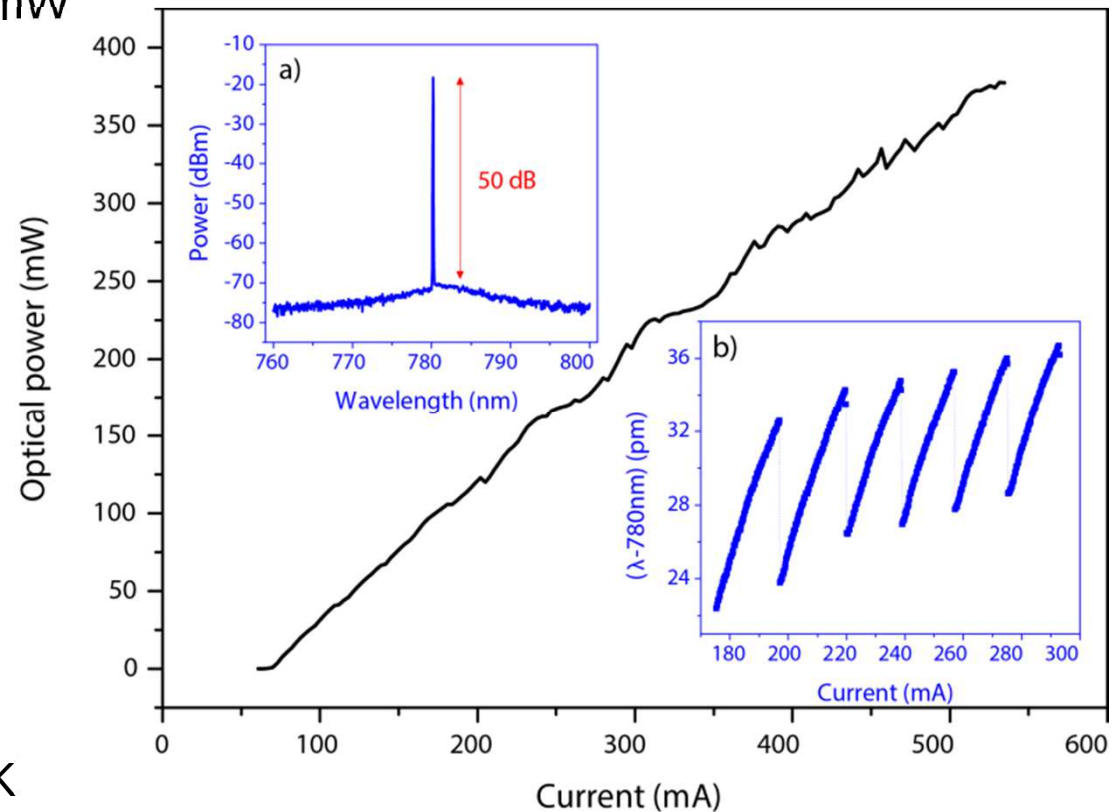
- Max. Output Power: 380 mW
- Slope Efficiency: 0.8 W/A

➤ Side Mode Suppression

- > 50dB

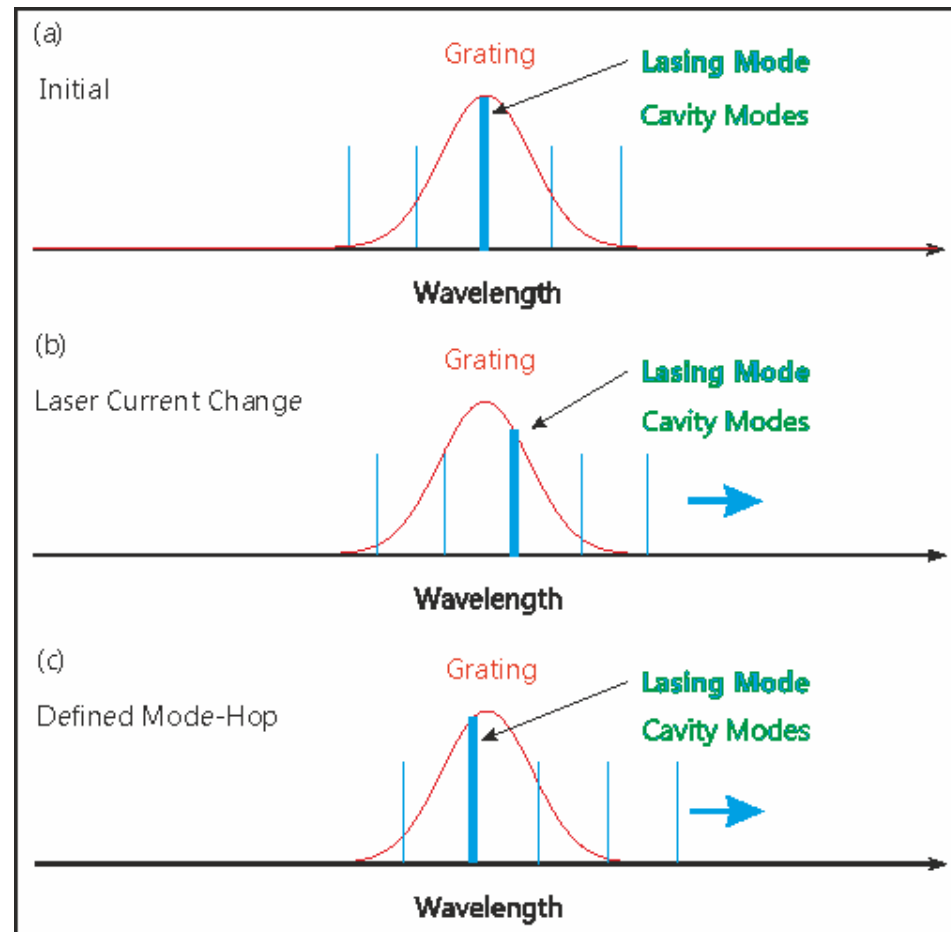
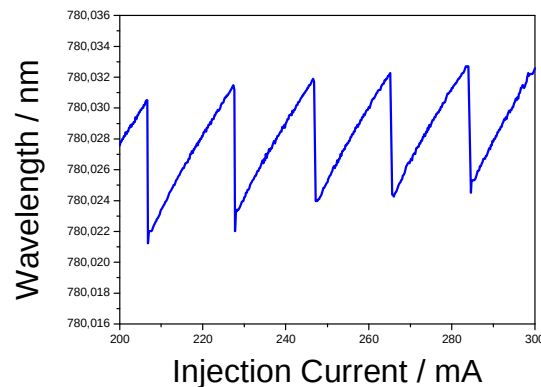
➤ Wavelength Tuning

- 5.2 GHz Mode-Hop Free
- Via Current: 0.5 pm/A
- Via Temperature: 10 pm/K



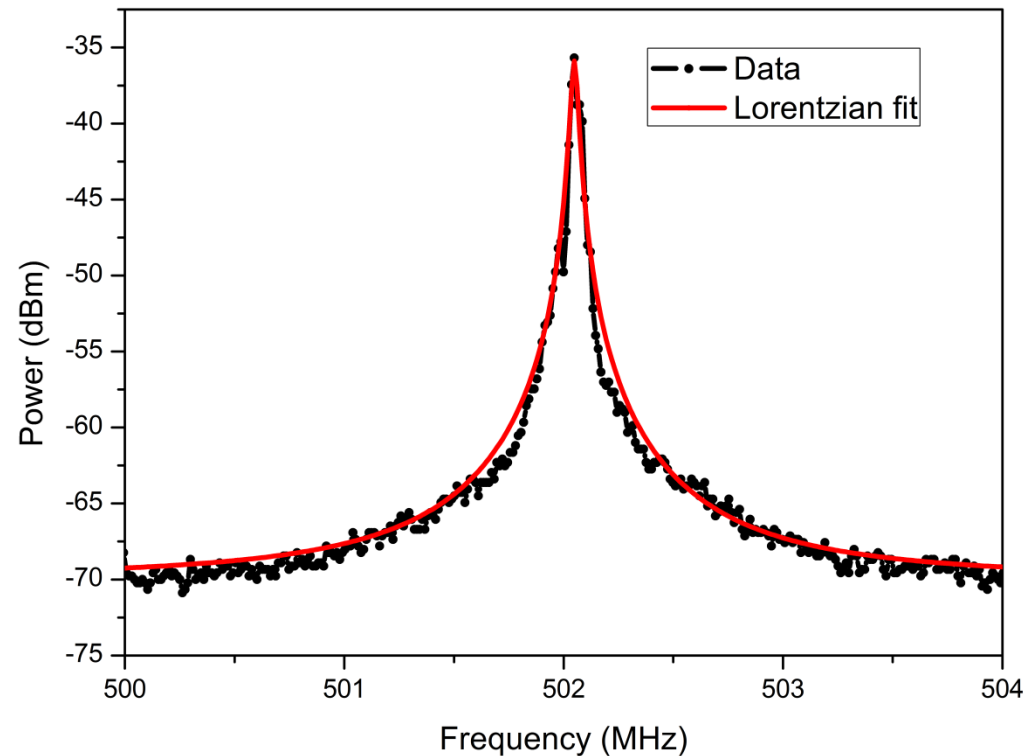
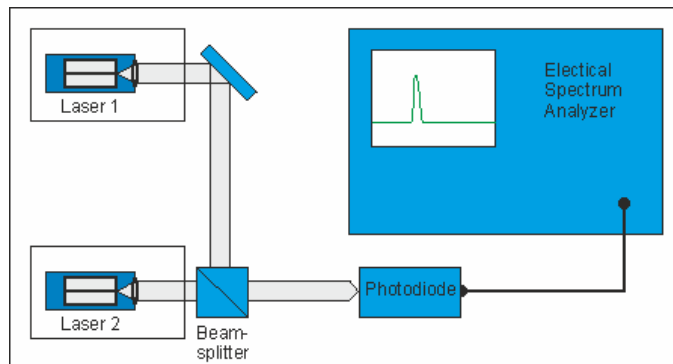
Tuning Mechanism

- (a) Initial Status
- (b) Laser Current Change
 - Mode position change
- (c) Wavelength Tuning
 - Mode position changes relative to Grating
- (d) Defined Mode-Hop
 - As soon as one mode leaves the reflection band of the Grating, another mode shifts in



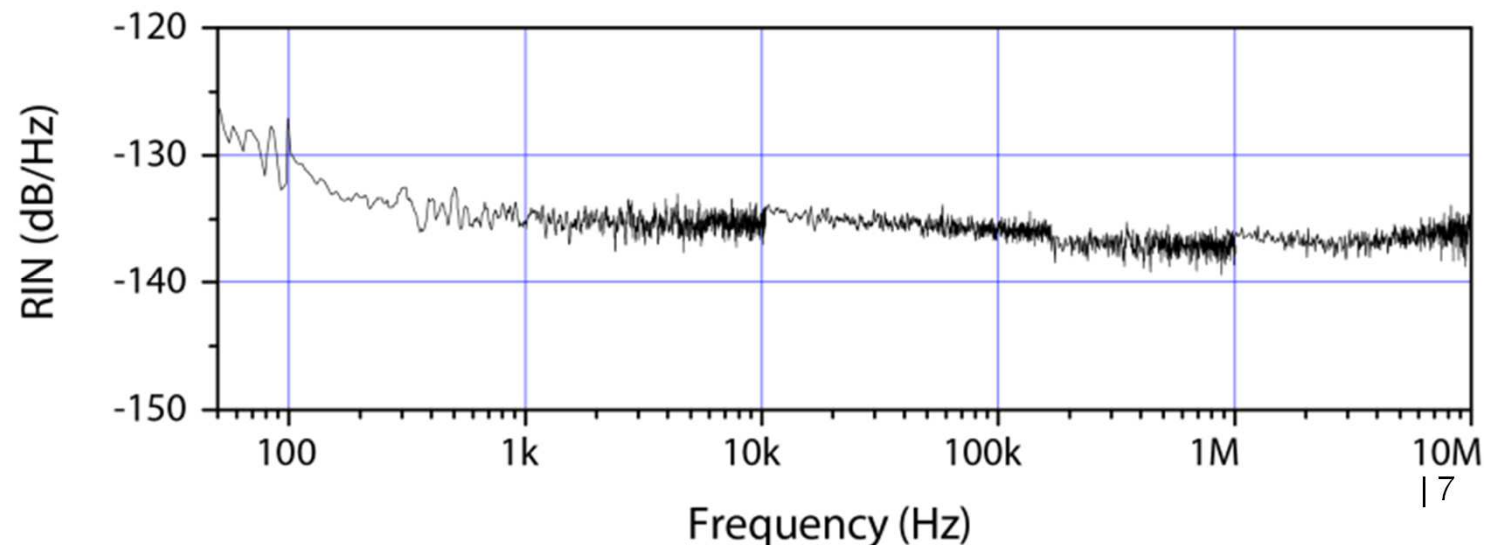
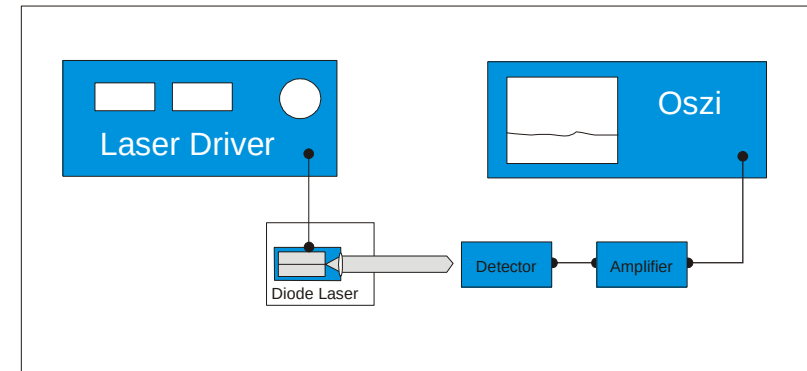
► Heterodyne Measurement

- Beat Node of two identical VBG Lasers
- No External Locking applied
- Lorentzian Fit (FWHM):
 - 36kHz @ 1ms/2MHz
- Linewidth: 18kHz (FWHM)



➤ RIN Measurement

- Low, nearly constant RIN of -136 dB/Hz above 1 kHz
- No Microphonic Cavity Resonances
- RIN is reduced for higher Operation Current Values



➤ Spectroscopy Setup

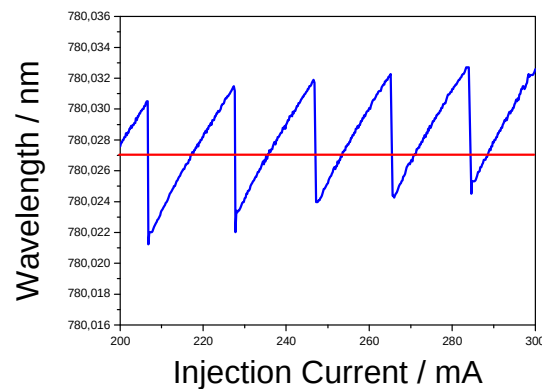
➤ Saturated Rb Spectroscopy

➤ Results

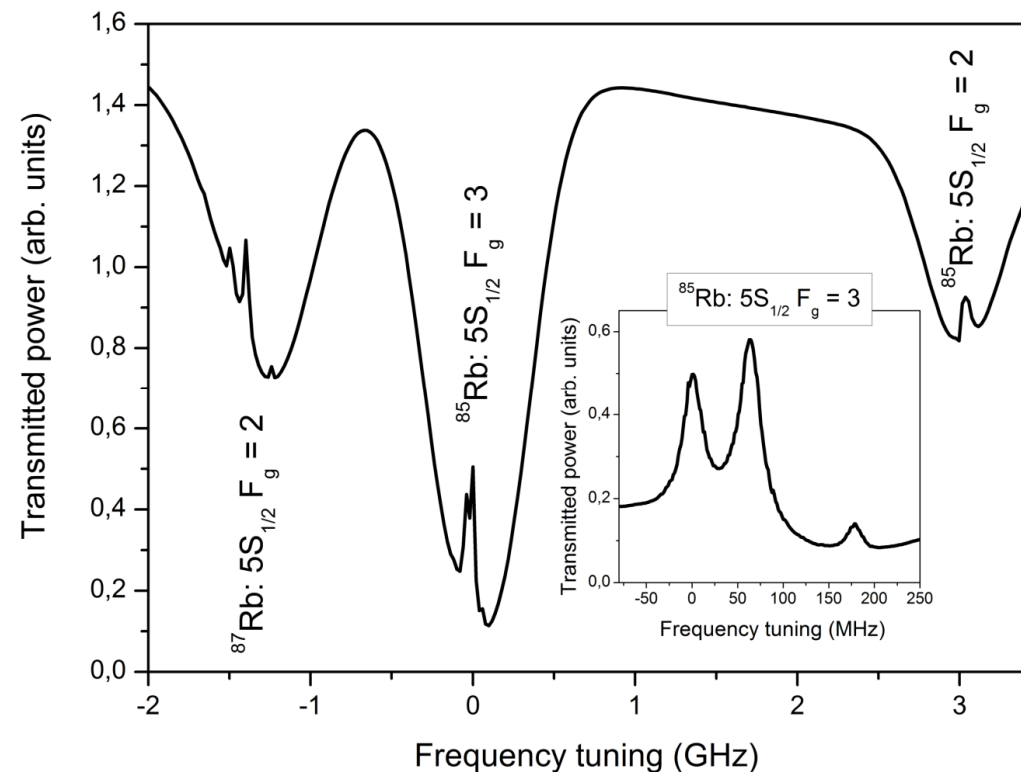
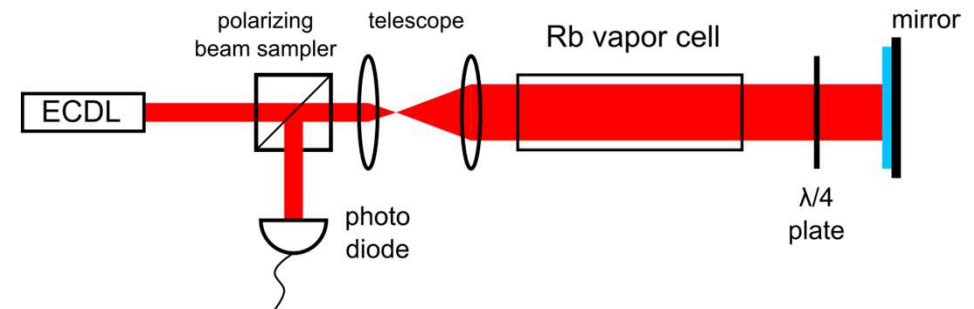
➤ Rubidium D2 Transition

➤ Hyperfine Lamb Dips clearly visible

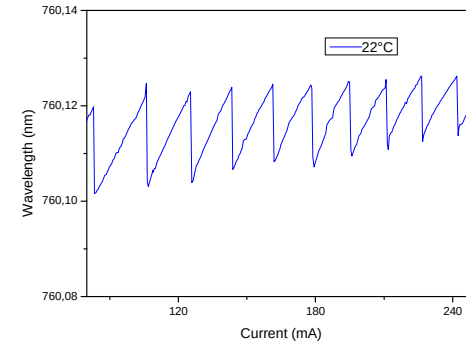
➤ 5.4GHz stable Mode-hop Free tuning



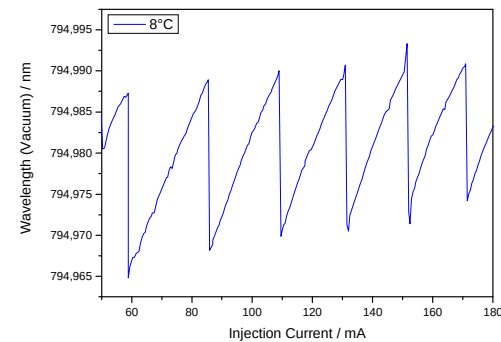
➤ Spectrum Repeats at different Power levels



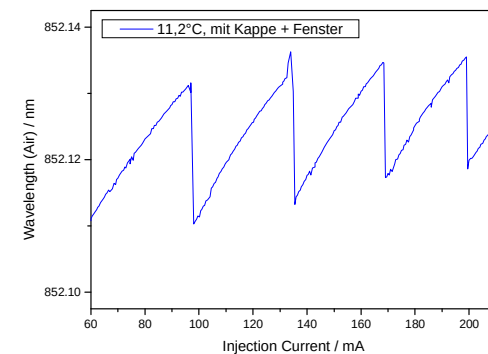
➤ 760nm: Oxygen



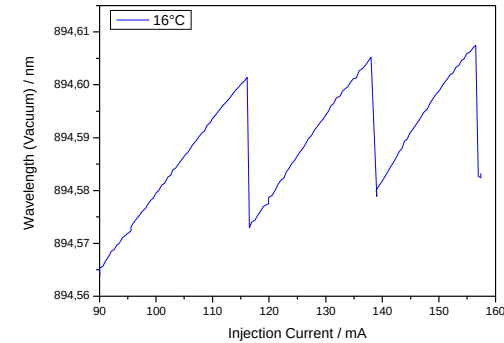
➤ 795nm: Rubidium D1



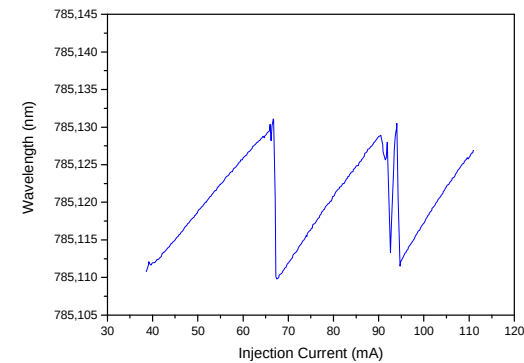
➤ 852nm: Cesium D2



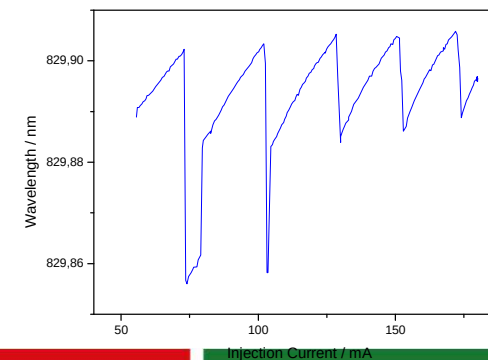
➤ 895nm Cesium D1



➤ 785nm: Raman Spectroscopy



➤ 830nm: Raman Spectroscopy



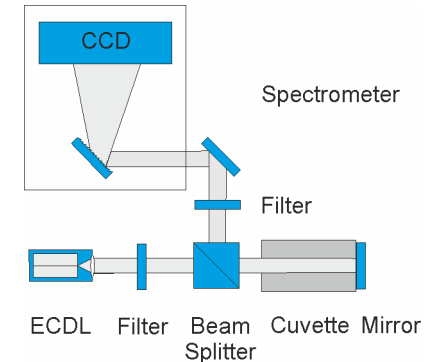
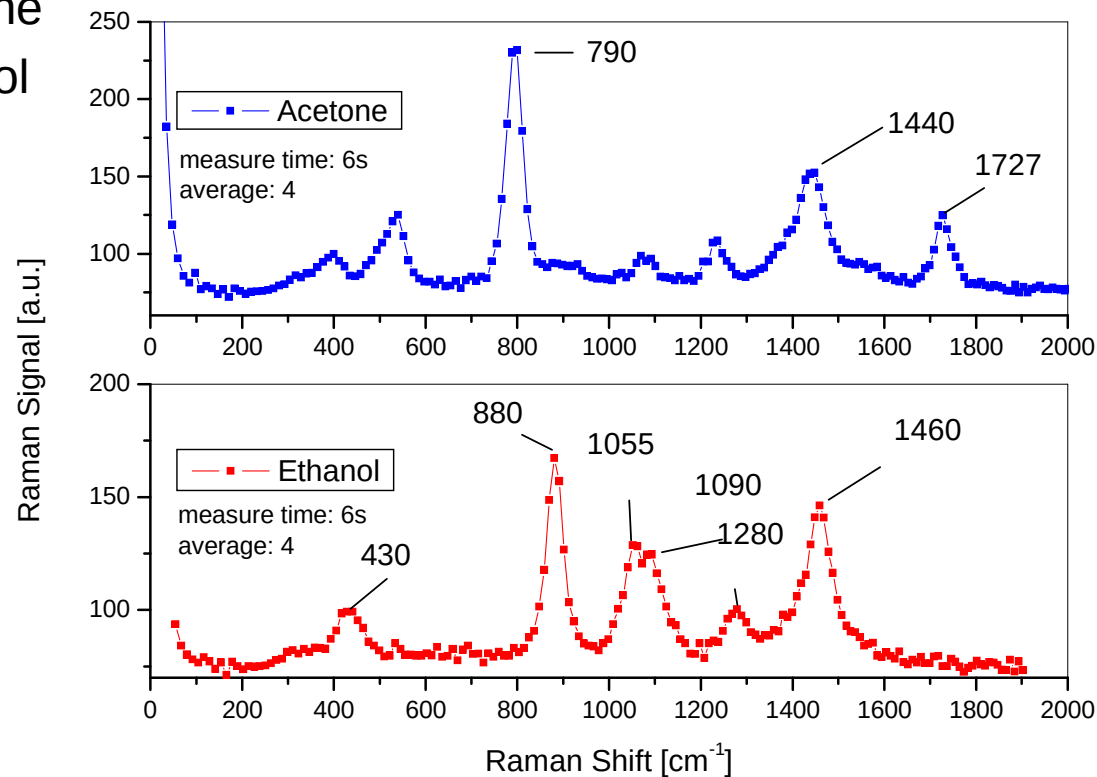
➤ Spectroscopy Setup

➤ Raman Spectroscopy 785nm

➤ Results

➤ Acetone

➤ Ethanol



- A Compact, Narrow Linewidth Volume Holographic Grating External with High Output Power of 380 mW at 780nm was presented
- Excellent Laser Stability and Wavelength Tunability via Laser Current and Laser Temperature was demonstrated
- Volume Holographic Grating Period can be chosen for any Wavelength within the Visible and Near Infrared Spectral Regime
- Project is Supported by Bundesministerium für Bildung und Forschung (BMBF) within Grant 13N13402 since May 1, 2015.

▶ *Thank You For Your Attention!*

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