Fall 10-31-2009

780 nm Diode Lasers for Atomic Physics

Bryson Vivas  
*Pacific University*

Simone Carpenter  
*Pacific University*

Jenny Novak  
*Pacific University*

Andrew M. C. Dawes  
*Pacific University*

---

**Recommended Citation**

Vivas, Bryson; Carpenter, Simone; Novak, Jenny; and Dawes, Andrew M. C., "780 nm Diode Lasers for Atomic Physics" (2009). *All CAS Faculty Scholarship*. 38.  
https://commons.pacificu.edu/casfac/38

---

This Poster is brought to you for free and open access by the Faculty Scholarship (CAS) at CommonKnowledge. It has been accepted for inclusion in All CAS Faculty Scholarship by an authorized administrator of CommonKnowledge. For more information, please contact CommonKnowledge@pacificu.edu.
780 nm Diode Lasers for Atomic Physics

**Description**
This poster presents the results of the summer research project conducted by Bryson Vivas, Simone Carpenter, and Jenny Novak. The research was supervised by Dr. Andrew Dawes and conducted in the Photonics and Quantum Optics Lab of Pacific University.

**Keywords**
Laser, Diode, Atomic Physics, Poster, Murdock

**Disciplines**
Atomic, Molecular and Optical Physics | Optics

**Rights**
This work is licensed under a Creative Commons Attribution-Noncommercial-Share Alike 3.0 License.

This poster is available at CommonKnowledge: https://commons.pacificu.edu/casfac/38
Introduction:
Our goal was to construct three tunable lasers that operate at 780 nm. We will be using these lasers for cooling and trapping Rubidium atoms.

Diode Laser Design [1,2]:
Laser diode – light source
Diffraction Grating
Diffractions different wavelengths emitted from the diode. Reflects out of the laser and back into the diode.
Piezo Stack
Changes length of laser cavity and grating angle by varying the voltage. Fine-tuning of wavelength
Piezo Disc
Changes length of laser cavity by varying the voltage
Thermistor
Measures the temperature for stabilization
$\Delta \theta$
Changes the length of the laser cavity and grating angle
Course (manual) tuning

Laser Construction:
Newport Ultima Mount (U100-P, $75)
Cut L-shape with milling machine
Drill and tap mounting holes for the grating mount
Diode tube holder
Bore hole to hold laser diode tube
Aluminum Grating Mount
Mounting plates
Top plate mounts Newport mount
Bottom plate mounts to steel base (heat sink)
Course tuning
Flex piezo
Brass piezo holder
Thermoelectric cooler (TEC)
Between mounting plates
Controls the temperature of the laser

Finished Product
One of three working lasers tuned to 780 nm.

Two level Atoms:

Linear Spectroscopy:
$\omega_{0}$ is resonance frequency
$\omega$ is the laser frequency
Transmission decreases near $\omega_{0} = \omega$

Non-Linear Spectroscopy:
Goal: avoid effects of atomic motion
Both beams on resonance if $\nu = 0$ and $\omega_{0} = \omega$.
For moving atoms, two beams have different $\omega$ (Doppler effect).
Narrow transmission spikes for $\omega_{0} = \omega$

Future Goals:
Build a frequency stabilization system based on magnetic-field-induced resonance shifts [3]. Lock frequency to F=2 to F'=3 transition.

References:

Acknowledgements:
M. J. Murdock Charitable Trust – Start-up Research Package
Research Corporation for Science Advancement – Cottrell College Science Award #10620
Pacific Research Institute for Science and Mathematics