Coherent Blue Light Emission in Rubidium

Marcus Kienlen  
Pacific University

Noah Holte  
Pacific University

Hunter A. Dassonville  
Pacific University

Andrew M C Dawes  
Pacific University

Follow this and additional works at: http://commons.pacificu.edu/casfac

Part of the Physics Commons

Recommended Citation
Kienlen, Marcus; Holte, Noah; Dassonville, Hunter A.; and Dawes, Andrew M C, "Coherent Blue Light Emission in Rubidium" (2012). All CAS Faculty Scholarship. Paper 55.
http://commons.pacificu.edu/casfac/55
Coherent Blue Light Emission in Rubidium

**Keywords**
nonlinear optics, atomic physics, vapor

**Disciplines**
Physics

**Rights**
This work is licensed under a [Creative Commons Attribution-Noncommercial-No Derivative Works 3.0 License](http://commons.pacificu.edu/casfac/55).
Coherent Blue Light
A four-wave mixing process produces a coherent blue beam when driven by two inexpensive infrared external cavity diode lasers.

4-Wave Mixing Energy Diagram

We scan the 780 nm laser over 6 GHz to measure the Rubidium absorption lines (top curve) and the generated blue light (bottom curves) for a variety of cell temperatures.

Cell temperature determines the vapor density and we find an optimum temperature of 130 °C.

The 776 nm pump laser is tuned to a fixed frequency where the blue light output is optimized.

Peak blue light output occurs when the 780 nm laser is tuned between the \(^{87}\text{Rb}\) hyperfine ground states.

We use two infrared pump lasers: 780 nm and 776 nm
Pump power: 13 – 20 mW each
Heated Rb vapor cell: 60 – 130 °C
Natural abundance (\(^{85}\text{Rb}\) and \(^{87}\text{Rb}\))
Decay from the 5D\(_{5/2}\) level emits up to 100 µW of 420 nm light

Blue light generation is most efficient between resonances where pump beam transmission is maximized.

A visible-light image of the coherent blue light passing through a diffraction grating after the Rubidium cell.

Acknowledgements:
Murdock Charitable Trust
The Research Corporation for Science Advancement
Pacific Research Institute for Science and Mathematics