

**Lecture summary**

- Doppler broadening
- Doppler-free spectroscopy
  - Cross-beam method
  - Two-photon spectroscopy
  - Saturation spectroscopy
    - Energy-momentum conservation in photon absorption
    - Recoil shift

**Homework** (due on Tuesday 5/14)

1. You are given the task of ordering a rubidium vapor cell for a laser spectroscopy experiment. Calculate how long the cell should be. The cell is intended to reference laser light at 780 nm tuned to the resonance of the  $5^2S_{1/2} - 5^2P_{3/2}$  transition.  $5^2S_{1/2}$  is the ground level.  $5^2P_{3/2}$  is the first excited level with a lifetime of 30 ns. The cell should be long enough so that a laser beam on resonance with this transition is absorbed by 10% - 50%. Room temperature operation is assumed.
2. Textbook exercise (8.5) Hyperfine structure in laser spectroscopy.

**Reading Assignments:**

- *About Lock-In Amplifier*, Application Note #3, Stanford Research System  
<http://www.thinksrs.com/downloads/PDFs/ApplicationNotes/AboutLIAs.pdf>