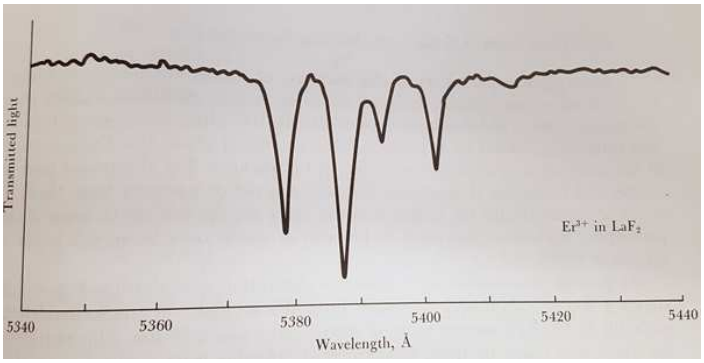
Homework #10 (due Nov. 11)

Each problem is 10 points

Textbook problems 11.4, 11.6

Problem A1: The refractive index of a gas is measured to be n=1.00034 + 0.00005i. Calculate the value of the absorption coefficient for the 632nm wavelength laser beam.

Problem A2: The transmission spectra of Er^{3+} ions in LaF_2 crystal is shown in the figure below. If we use a classical oscillator model for each of the observed resonances, what are the values of ω_0 and γ for each of the resonances?



Problem A3: Some types of spectrometers used to study atomic resonances give an output signal proportional not to the atomic absorption line $\beta(\omega)$, but rather to its first derivative $d\beta/d\omega$. This first-derivative curve has two peaks of opposite sign centered about the resonance frequency ω_o. Find the spacing between these two peaks $\Delta\omega$ in terms of the parameters of an atomic resonance ω_0 and γ.

Extra credit problem: This is a picture of a column of corn syrup illuminated from the top by linearly polarized white light. If the light is polarized, colored bands show up when viewed from the side. If I remover the polarizer, colors disappear. Can you figure out where the colors are coming from? *Hint*: the corn syrup is optically active material, i.e. its rotates the polarization of light.

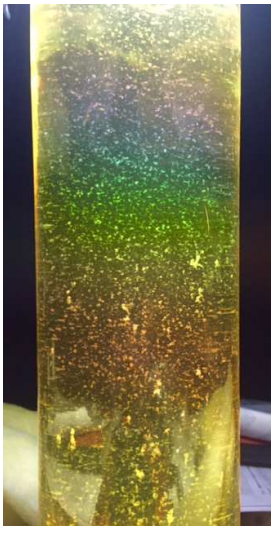


Photo by Richard Allen

Please ignore the white flakes – these are some clumps of sugar-loving bacteria infesting my experiment, and not supposed to be there.