

# Worksheet - Etalons (LS) - FIND $u_T$

Work out all this stuff in your lab notes & open upload page images!



#1 From experience (memory) write out what the etalon trace, and the 'four blobs' trace, looked like on the DSO

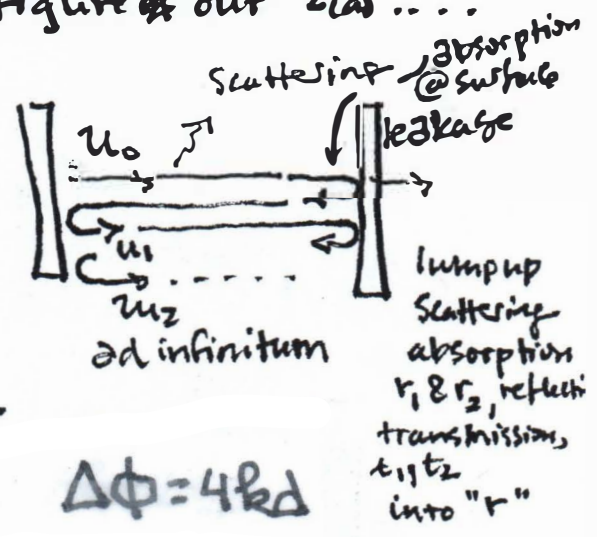
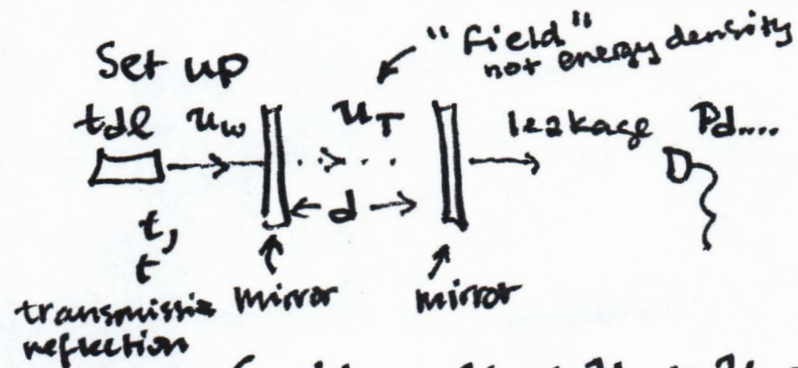
#2 Explain

- (a) how the energy of the hyperfine splittings (of the ground state in this case) can be measured
- (b) how the uncertainty in that quantity may be estimated.

we'll follow Wieman et al, Jones et al. PNAS REV ST. PHYS. EDUC. RES. 020108 (2015)

#3 lets try to understand, or work out how, an etalon works. It is a form of what is called an "optical resonator" we want to

- (a) predict the output signal as a function of
- (b) ask how would the output vary as we tuned laser and used the output to figure out 2(a) ...



model

$$u_T = u_0 + u_1 + u_2 + \dots$$

$$|u_{n+1}| = r |u_n|, \quad r < 1$$

$$u_{n+1} = r e^{i\Delta\phi} u_n$$

$$\Delta\phi = 4\pi d$$

hint:  $1 + a + a^2 + a^3 + \dots = \frac{1}{1-a}$

(c) for this set up, how would you design (what's d?) the resonator so as to have an

FSR of 300 MHz

