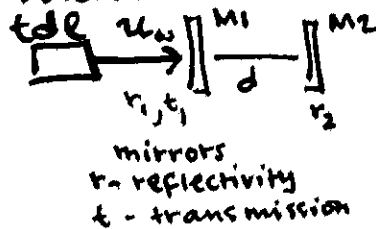


480 worksheet on etalons

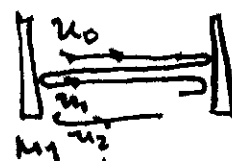
#1 From memory (experience) draw in what the etalon signal (ACBDSO)* looks like in the LS lab. Include the absorption trace of Rb where the tuning parameters were such that all four Doppler broadened blobs were present. How does the etalon enable a measurement of the energy gap of the hyperfine splitting of the $\frac{1}{2}$ state(s)?

#2 How does the etalon "work"? what is an "FSR"? **

#3 Consider the set-up below ***

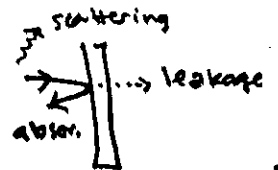


mirrors
r - reflectivity
t - transmission



ad infinitum
back & forth...

the beam isn't really moving down ... just drawing one reflection below the next to reveal & count it...



Some texts write

$$U = U_0 + U_1 + U_2 + \dots$$

$$U_{n+1} = r e^{i2kd} U_n$$

lump all this into "n" { in one round trip
- absorption on mirrors
- leakage, scattering & so forth...

3 a) What's up with U? Hint, $1 + x + x^2 + x^3 + \dots = \frac{1}{1-x}$
Find U, interpret what it is. Is the series to be summed, geometric?

b) plot $U U^*$ using fplot. What is 'x'? What is 'y'? Use the plot to determine the effect of tuning the dl (tdl:)

* ACBDSO - as captured by the digital storage oscilloscope...

** See sec. 4.6 in Mellissinos....

*** See C.H. Wieman, "Transforming..." PHYS. REV. ST PHYS. EDUC. RES 11 020108 (2015)