Pre-lab Questions

1. The Bragg equation (see Eqn [1]) for the set-up shown in Figure 1 looks very similar to the equation that describes X-ray diffraction:

$$m\lambda = 2\lambda_S \sin\left(\frac{\Phi_D}{2}\right) \qquad [1]$$

Derive the Bragg equation for acousto-optics using two methods:

a) Using physical geometry

b) Using conservation of momentum

In each case, draw appropriate diagrams and label important parameters before the derivation.

2. What is the difference between the Raman-Nath regime and the Bragg Regime? Optically how could you tell which regime you are in?

3. A red HeNe (633 nm) is incident on an acoustic wave that has a frequency of 80 MHz and a speed of 5570 m/s in quartz glass. At what angle is the light deflected? Would you see a difference if you used a green HeNe laser (543nm) instead?

4. dBm is a unit of Power. The maximum power you are allowed to drive the AOM with is 33 dBm. With this information answer the following questions.

a) What is the relationship between dBm and Watts.

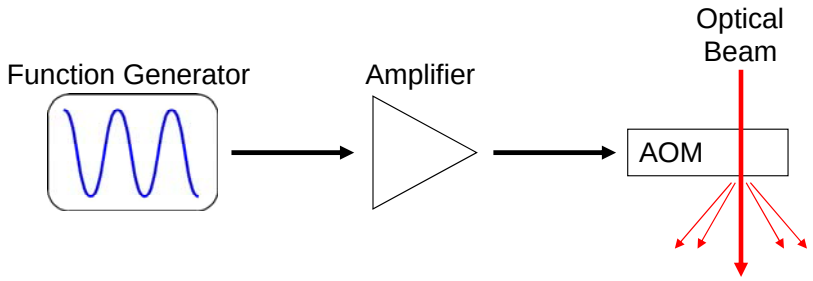
b) What is 1μW, 1mW, 5mW, 10mW, 50mW, 100mW, 500mW, and 1 W in dBm? Notice any patterns?

c) What is the maximum drive power of the AOM in Watts?

d) The gain of an amplifier is usually given in dB. How is a dB defined?

e) Convince yourself that for an amplifier $P_{in}^{\ dBm} + G^{dB} = P_{out}^{\ dBm}$ is true by performing the calculations in Watts using $P_{in}^{\ dBm} = 10dBm$ and $G^{dB} = 30dB$.

f) An AOM can be driven with either a function generator, which outputs a voltage into a 50Ω load, or synthesizer which outputs a power in dBm. Given the set-up below, calculate the maximum power and corresponding voltage (rms) that you can set on your function generator so that you don't damage the AOM.



Additional Relevant Problems

5. Pedrotti 24-13

6. Pedrotti 24-14

7. Pedrotti 24-16