UNIVERSITY OF ALABAMA
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PH 495/ECE 493 LeClair & Kung Spring 2011

Laboratory - Optical Devices

1 Objectives

The objective of this lab is to quantitatively characterize the difference between the way light from a laser, from a light emitting diode and from an incandescent light bulb propagates.

2 Equipment

You will need the following equipment:

- red helium neon laser
- green helium neon laser
- red laser diode
- incandescent light bulb
- photoresistor
- protractor, ruler
- possibly: short focal length lens (to spread the laser beam)

3 Radiation Pattern Measurement

3.1 First, establish your lab setup on a table including: the location of the light source, the location of the photoresistor detector. You should be able to measure the distance between the source and the detector, as well as the angle formed between (i) the axis of the light source (main direction of light emission) and (ii) the axis linking the source and the detector.

3.2 Choose a light source. Choose a reasonable distance L between the source and the detector (e.g. 1 meter), i.e. on that gives you a good signal-to-noise ratio. You may need to cover the detector with a copper tube to prevent unwanted light from straying into the detector.

3.3 Maintaining the same distance L, rotate the detector along a circle that has the light source as its center, from -90° to +90°. Do not move the source. Record the measured detector signal and the corresponding angle.

3.4 Plot the resulting radiation pattern in the following manner.

- Draw a series of concentric (same center O) semi-circles with incremental radii from 0 to 1.
- The semi-circles span an angle range from -90° to +90 °.
- Place points on the semi-circle diagrams corresponding to the [power,angle] pairs measured in step 3.3. Normalize the power to the maximum value obtained.

- Draw the contour formed by these points. This gives a quantitative measure of the radiation pattern.

3.5 Repeat steps 3.2 through 3.4 with two other light sources.

3.6 Compare and comment on the patterns obtained.

4 Attenuation Measurement

4.1 (Same as step 3.1). First, establish your lab setup on a table including: the location of the light source, the location of the photoresistor detector. You should be able to measure the distance between the source and the detector, as well as the angle formed between (i) the axis of the light source (main direction of light emission) and (ii) the axis linking the source and the detector.

4.2 (Same as step 3.2) Choose a light source. Choose a reasonable distance L between the source and the detector (e.g. 1 meter), i.e. on that gives you a good signal-to-noise ratio. You may need to cover the detector with a copper tube to prevent unwanted light from straying into the detector.

4.3 Maintaining the same angle (i.e. 0°), move the detector closer and away from the light source. Record the measured detector signal and the corresponding distance L.

4.4 Plot the normalized power (maximum corresponds to 1) as a function of distance L.

4.5 Repeat steps 4.2 through 4.4 with two other light sources.

4.6 Compare and comment on the measured curves.