

Physics Integration Lesson 24 – Where Do You Find the Most Improvement?

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Although the theory for double-slit interference is well-established, not all students get good results with the Lloyd's mirror variant of the experiment. In the past, when asked how the experiment could be improved, many students responded with "get better lasers." Although the lasers are not that powerful, comparable to a laser scanner at a grocery store; the power of the laser has no impact on the accuracy of the experiment. In fact, the wavelength of the laser light is known to four significant digits. This means that the potential accuracy of this experiment is 0.01 %.

What limits the accuracy of this experiment is measurement. Some measurements can be off by centimeters, while others need precision to less than a millimeter. How can we know which is most critical? This is why we use differential error analysis. Each term in the analysis is associated with errors in each of the measurements. Whichever term is largest is also the one that must be measured with more care. Instead of shifting the blame to the laser, we can focus on correcting what will give us the greatest gain in accuracy.

This is also true in the realm of athletics. When competing in basketball, I had my best start of the season when I took pre-season conditioning seriously. It is hard to focus on proper shooting form and getting good rebound position when I am tired from running drills. However, with better conditioning I had the endurance to practice longer and focus better at what was important for winning games. Fortunately for me, I had coaches who pushed me to do the hard things that brought the greatest gains, rather than let me do what was easy.

With regard to growth in our Christian life, we have a tendency to put effort on what comes easy. We establish good habits that convince us that we are learning more about God and are closer to Him. These habits are beneficial; however, at times we use them to cover up the fact that we are struggling with a sinful habit, putting off a hard decision or resisting to obey in an area that is not easy for us. As we pour more effort in those good habits, we become discouraged because the extra effort doesn't seem to bring about much change. This is like relying on a better laser. A good laser is vital for the success of the experiment, but good results will not be achieved if it is not used correctly. We need a process by which we analyze the critical areas holding us back in our growth and take advantage of coaches (pastors) and the team (the church) to help us make changes for God's glory.

1. I remember many messages while growing up and in my adult life that used Hebrews 12:1 ("...lay aside every weight, and sin which clings so closely...") when addressing this topic. Have you found this passage useful or is there another one that you would recommend on this topic? Explain how this or other passages have helped you.
2. Changing habits (how you do things naturally) is not easy, but requires concerted effort. It is not as easy as realigning a laser. What are some things you find helpful to keep you focused on what is important in making good changes in your life?