Thoughts about learning physics

My teaching philosophy differs from some of my colleagues, and is something you should bear in mind if you plan to stay in this course. Physics 2214 is a perfectly good alternative, and one you should consider if you sense your goals for the semester do not align with my approach to teaching.

To fully realize your creative potential as a research physicist you need to accept that learning is fundamentally an **individual effort**. The learning-by-imitating model only goes so far. Sure, it will prepare you to spot instances of standard problem-cases and train you in applying standard algorithms (formulas, etc.) when solving them. If you were taught the long-division algorithm in grade school you know what I mean. You became very proficient at deploying the algorithm, but what it actually was doing was, well, not your concern.

If your physics training is like a montage of how-to YouTube videos, you won't have any ownership of your understanding and your knowledge will be fragmented. That might be sufficient for an engineer, for applying physics just to get the job done. It is insufficient if you plan on breaking new ground in creative ways. Learning by just assimilating data (formulas, etc.) puts you in the same class as an AI.

A key form of individual effort is **playing**. Humans have a natural capacity of acquiring knowledge by this mechanism. Kids don't need instruction on how to create objects with Legos. They figure it out by playing. Learning to be a creative physicist is no different. You see what works and what doesn't by playing. This comes down to different things in the lab, or when doing "theory". But fundamentally it involves playing, an activity that is best done individually.

Here are some concrete suggestions if this style of learning sounds intriguing (and you're not already a fan).

- Limit you reliance on electronic media. You should not need to look up the area of a sphere on Wikipedia. There is a simple reason the area and volume of a sphere are related by a factor of 3.
- Working on homework with friends is great, because let's face it, it's the only social life you have. Even so, **make a first try completely on your own**. Don't be afraid of making starts that don't go anywhere. It may turn out that to solve the problem a key

step is a "trick" you learned from a friend. But you won't be able to fully appreciate the power of the trick unless you made all those false starts.

- Push your understanding in new directions — just for fun! Don't be afraid of speculating what goes wrong or what new things might happen if an approximation or assumption in lecture or a homework problem is violated.