Quantum Mechanics and Quantum Statistical Physics

Course Short Name: **Quantum**

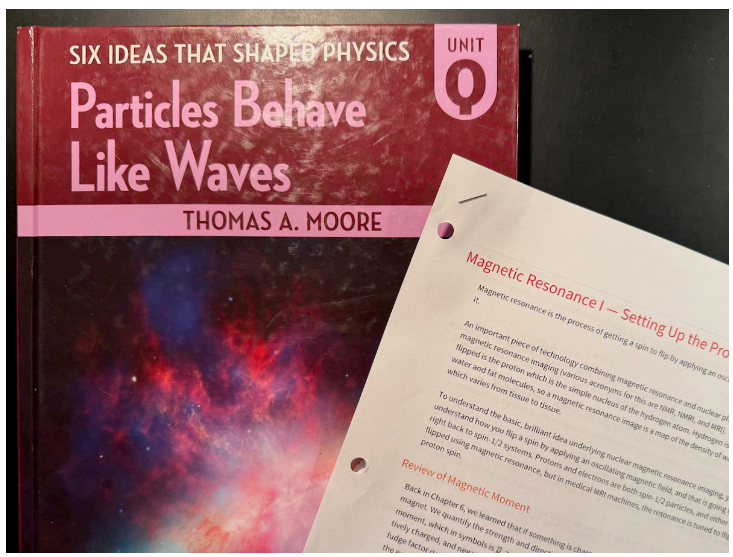
Prereq: One semester of college-level, calculus-based physics *Accessible <===|===|=+=> Hard*

Overview

The main goal of a second semester of introductory modern physics would be to understand the 1920s physics created by de Broglie, Bohr, Schrödinger, and Heisenberg. In very roughly the same time period, special and general relativity, which are also advanced and post-Newtonian, were created by Einstein, but they are ultimately comprehensible, and nowadays they are broadly lumped in with classical physics rather than modern physics. Quantum mechanics and quantum statistical physics remain perpetually modern, non-classical, and partially incomprehensible.

The material we will cover in this course is normally encountered only by physics and chemistry majors, typically in their sophomore year after at least two semesters of challenging prerequisites. The curriculum that builds this way is well-crafted and time-honored, but can also feel stale.

In *Six Ideas that Shaped Physics*,Thomas Moore has upended the curriculum so that quantum mechanics and other topics can be encountered sooner. The first two of Moore's six units cover the standard material of the first semester of calculus-based classical mechanics—but even they have a novel organization—and after classical mechanics has been covered, Moore designed the remaining four units to be usable in any order. One of those is Unit Q, "Particles Behave Like Waves."



The idea of this course is to accept Moore's invitation and jump straight from classical mechanics to quantum mechanics, and then from quantum mechanics, we will also be able to introduce the ideas of quantum statistical physics.

Materials

As described above, we will use Unit Q of *Six Ideas that Shaped Physics* by Thomas Moore, and possibly some supplementary materials to round out developments in early 20th century physics. Toward the end of the semester, instead of covering Moore's chapters on nuclear physics, we will delve into quantum statistical physics, which is necessary to understand a variety of exotic phenomena, including magnetic resonance, semiconductors, and supernovae.