




## CU upper-division QM curriculum



 Indicates a research-demonstrated benefit

### Overview

These materials are supplements to traditionally taught upper-division Quantum I. They include explicit learning goals, interactive lectures, transformed homework problems, common student difficulties, tutorials, in-class group activities, and clicker questions. All materials are modular and can be mixed and matched with any other teaching strategy and materials you would normally use. These materials were developed as part of a comprehensive project to reform the upper-division physics program.



#### Type of Method

Full curriculum, Curriculum supplement, Tutorials




#### Level

**Designed for:** Advanced Undergraduate 

**Can be adapted for:** Intermediate Undergraduate, Graduate



#### Setting

**Designed for:** Lecture - Large (30+ students) , Lecture - Small (<30 students) , Recitation/Discussion Session, Homework

**Can be adapted for:** Out-of-class tutorials



#### Coverage

Many topics with less depth, Traditional upper-division Quantum I coverage (e.g. first half of Griffiths text)



#### Topics

Modern / Quantum



#### Instructor Effort

Medium





#### Resource Needs

Teaching Assistants / Learning Assistants, Clickers, Projector in class



#### Skills

**Designed for:** Conceptual understanding of physics content , Enjoyment of physics , Problem-solving skills, Connecting conceptual and mathematical understanding, Coherent framework for physics, Think like a scientist, Representing knowledge in multiple ways





**Can be adapted for:** Understanding how physics relates to the real world, Reflecting on one's own learning



#### Research Validation

**Based on research into:** how students learn 

**Studied using:** student interviews , classroom observations 

-  **Compatible Methods** [Peer Instruction](#), [PhET](#), [JiTT](#), [CGPS](#), [Physlets](#), [SCALE-UP](#), [OSP](#), [LA Program](#), [CAE TPS](#), [TEFA](#), [CU Modern](#), [QuILTs](#), [PI QM](#), [Tutorials](#), [Clickers](#), [Paradigms](#)
-  **Similar Methods** [CU Modern](#), [CU E&M](#), [QuILTs](#), [PI QM](#), [Paradigms](#)
-  **Developer(s)** Steven Pollock, Stephen Goldhaber, and many others in the CU PER group and the CU Physics department
-  **Website** [http://www.colorado.edu/sei/departments/physics\\_3220.htm](http://www.colorado.edu/sei/departments/physics_3220.htm)