

QED and The Standard Model of Particle Physics

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Syllabus ----- Fall 2019: Mid-September to Early-November

- **Quick History Tour**
 - Big Numbers and Small Numbers
 - Myths and Creation Stories
 - Physics Begins with Astronomy
 - Classical Physics
 - Which Came First? Chicken or Egg, Math or Science
 - The Mechanical Universe
 - Relativity
 - Einstein's Solutions
 - Maxwell's Equations
 - Gravity by Einstein
 - Quantum Mechanics
 - Symmetry
 - What's Real?
- **QED: The Strange Theory of Light and Matter**
 - Introduction
 - Photons: Particles of Light
 - Electrons and Their Interactions; Feynman Diagrams
 - Loose Ends; Early Elementary particle Ideas
- **Elementary Particles**
 - Particle Generations
 - Kinematics
 - Interactions
 - A Brief History of Particle Physics
 - Quantum Numbers
 - The Eightfold Way and the Mass Formula
 - Relativistic Kinematics
 - Identical Particles
 - Physics and Feynman's Diagrams
 - Electromagnetic Interaction
 - Weak Interactions
 - Electroweak unification
 - Hadron Interactions
 - Electroweak Theory
 - Higgs Mechanism
 - Neutrino Astrophysics
 - Quark Parton Model
 - Standard Model Lagrangian

- Quarks
- Color and QCD
- Standard Model Summary
- Unanswered Questions
- Beyond the Standard Model
 - GUTs
 - Proton Decay
 - Theories of Everything
 - Planck Scale
 - Quantum Gravity
 - Supergravity
 - Strings and Extra Dimensions
 - Superstrings
- Fine-tuning and Naturalness in the Foundations of Physics
- When Beauty Gets in the way of Science