

# Course Syllabus

## PHY313: Mystery of Matter

- Week 1: Introduction/Orientation  
Objectives of the course. What is Physics? What is nothing?  
Overview and Fundamentals.
- Week 2: Overview and Fundamentals: Symmetries and Conservation Laws,  
Concept of Time, Einstein's Dream and Unification of Forces, CPT  
symmetries, Matter-Antimatter Asymmetry
- Week 3: Dawn of Modern Physics: Special Relativity
- Week 4: Special Relativity and its Applications, Gravity, Curvature, and  
General Relativity
- Week 5: Quantum Mechanics
- Week 6: Quantum Mechanics, Relativistic Quantum Mechanics  
Angels and Demons (Special Homework Assignment: Watch the  
movie!),
- Week 7: Quantum Gravity, Supergravity, Elementary Particles and  
Conservation Laws in Modern Physics, Particle Detectors,
- Week 8: Particle Accelerators, Feynman Diagrams, Standard Model
- Week 9: Discovery of Higgs particle, Mysteries of Nuclear Matters
- Week 10: Gravity and Seeing a Blackhole, Gravitational Wave and LIGO
- Week 11: The Big-Bang Theory, Dark Matter
- Week 12: Grand Unification and Proton Decay, Large Underground Detectors  
for Proton Decay Searches and Neutrino Physics, Neutrinos and  
Neutrino Oscillations
- Week 13: Neutrino Oscillations, Under-ice/Under-water Detectors
- Week 14: CP Violation and Matter-Antimatter Asymmetry in the Universe
- Week 15: Final Exam/Assignment

Recommended but required textbook:

“From Quarks to the Cosmos”

*Tools of Discovery*

By Leon M. Lederman and David N. Schramm

## **COURSE INFORMATION: PHY 313 / CEI 544 MYSTERY OF MATTER**

### **Spring 2021**

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Note that this course is specifically designed for non-physics/astronomy major students. Students majoring in physics and/or astronomy may not take this course.

**Instructor:** Prof. Chang Kee Jung, office: Physics D-141, phone: 2-8108, e-mail: [chang.jung@stonybrook.edu](mailto:chang.jung@stonybrook.edu), office hours: Mon, Wed 4:00 pm – 4:30 pm, Tue 1:30 pm – 3:30 pm *(Office hours will be conducted right after the lectures on Mondays and Wednesdays in the lecture room, and remotely on Tuesdays by phone or by Zoom.)*

**Class hours:** Mon & Wed 2:40 pm – 4:00 pm

**Class/Lecture:** *Classes will be held in-person in Physics building Room P118 and if needed, online using the Zoom video conferencing application.*

**Prerequisites:** U3 or U4 standing for non-physics/astronomy majors; one D.E.C. E or SNW course.

**Textbook:** Recommended but not required

"From Quarks to the Cosmos", L. Lederman and D. Schramm

**Course Instructions:** Communication of homework assignments, schedules, and other information will be done via email, blackboard as well as in the lecture.

**Homework:** Homework will be assigned approximately each week and it will be collected for grading in the following week. Copied homework will result in a penalty. Late homework can be handed in only within two days (48 hours) after the due date/time, and it will receive a 50% penalty.

**Exams/Assignments:** There will be a final exam during the finals week following the university schedule. There will be no make-up exams.

**Attendance:** Class attendance and participation are strongly encouraged. Regardless of excuses, any students missing more than 10 classes/lectures will not pass the course. (Absences caused by the COVID-19 pandemic related issues will be considered case-by-case.)

**Equipment Requirements:** For online participation, a computer with a camera, a speaker and a microphone is required.

**Grading:** Class attendance/participation 40%, Homework 40% and Final exam 20%.

**Special Notes:** Any excuses (medical or otherwise) are to be documented, and discussed with the instructors in a timely manner. This includes COVID-19 related quarantines. When you are in a situation to be quarantined, you must fill your "Daily Health Screening" online form. If you do so, the university will inform the Physics and Astronomy department and in turn the department will inform the instructor on your status. Simply sending an email to the instructor stating that you are quarantined will not be sufficient for a valid excuse.