General Physics I

Phys1000AA, Phys1000AB, Phys1000AC

Chia-Liang Cheng 鄭嘉良

Due to Covid19 pandemic, this course will go online for three weeks during the period 09/22-10/07

Professor Chia-Liang Cheng (鄭嘉良)
Distinguished Professor, National Dong Hwa University; and Foreign Member, A. M. Prokhorov Academy of Engineering Science, Russia.
Department of physics, National Dong Hwa University, Hualien, Taiwan
+886-3-8903696 (O); +886-3-8903698
clcheng@gms.ndhu.edu.tw
B112, SCI I (Office); B417, SCI I (Lab)

I received my Ph. D. degree from the Physics Department of the University of Oregon, USA in 1993. After obtaining his Ph. D. degree, he was a post-doc with Prof Y.T. Lee (Nobel Laureate in Chemistry, 1986) at the Chemistry Department in the University of California, Berkeley and Institute of Atomic and Molecular Sciences, Academia Sinica, Taipei from 1994-1997. He was an assistant professor at Physics Department of the National Taiwan Normal University for one year, and then he joined NDHU since 1998.

I have served as Director of Department of General Education, and Director of Arts Center (2002-2005); Chairman of the Physics Department (2005-2008), Dean of Committee for General education (2009-2016), and Vice President of the NDHU (2012-2016).

Research:

1. My main research focus is in the spectroscopy/microscopy/nanobiotechnology of nanoparticles for bio and medical applications.
2. My research interests are in Bio/medical applications of nanodiamond; Spectroscopic studies on nanomaterials; visible-light-activated TiO_2 nanoparticles; Infrared, Raman spectroscopy applied in biological systems.
3. My group is one of the pioneering groups in the world to successfully use nanodiamond as a biological marker to observe bio molecules interaction with cells or bacteria.
4. We have recently focused their effort in anticancer drug delivery using nanodiamond as a delivery vehicle into cancer tumors in the cellular and animal model; cancer cell recognition in early stage. In addition, using spectroscopy as non-invasive means to investigate biological object (such as life embryo, etc.) is also developed in my laboratory.

Official web page for this course:

1. My web page
http://faculty.ndhu.edu.tw/~clcheng/class-110/gen-phy110/gen-phy110.htm
This page will be constantly updated, so all our course activities will run based on this page.

2. E-Learning
http://www.elearn.ndhu.edu.tw/moodle/course/view.php?id=89629

3. Online lecture
https://meet.google.com/qmd-krdd-njo?hs=224
We may have to do this for all this semester, no one knows

This is an English taught course

- If you are a foreigner (don't speak Chinese), you really should have taken a Chinese taught course.
- If you are a Taiwanese and you speak Chinese, you really should take the English-taught courses for all your courses.

This course is designed for freshman of Science and Engineering majors; and the whole course will be conducted in English.

There will not be a fixed text book. You are suggested to buy one of the recommended text books and study through out the text.

General Notes for all: (You can find this in the web page, so we will not repeat here)

The lectures are designed as a two-semester course for first-year college students. **General physics** is one of the most basic courses for science and Engineering majors. It is essential and absolutely important for any science courses you will take in the future. You are strongly suggested to do home works and practice as many problems as you can (by yourself, of course), as this is almost the ONLY way to do your general physics right. Do not hesitate to ask questions in or out of class. *There is no stupid question in physics*. Do ask!

Although you have had almost 4 years of physics in your high school days, it is NOT THE SAME. One obvious difference is the textbook will be in English (so will the examine problems). This is a tough obstacle to most freshmen. There is only one way to get this over; that is, you study harder (especially in the first six chapters when the physics is easier, you should also concentrate on the English). However, most importantly, you should treat the general physics from a different prospective. More mathematics will be involved in treatment of the physics problems. Therefore, the solution to a problem sometime is not the most important part, it is the PHYSICS (the physics picture your will build in your mind) that is important in the learning of this course.

Due to the enormous amount of the material in the textbook, we will make choices and skip some parts that are not critical to the subject or future applications. However, we will try to cover all the materials if possible to provide you with a broader view toward the General Physics.

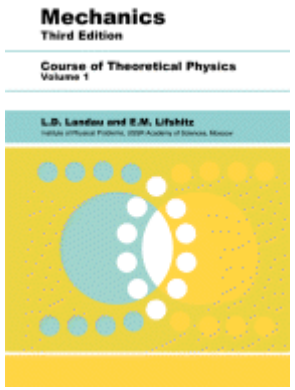
The lectures of this year will start from Chapter 7 of **Serway** and end in Chapter 37. You will have another course, Modern Physics that follows this course as a bridge between General Physics and Quantum Physics. However, it depends on the responds of the class, we may go into the modern physics parts (part 5, Chap. 39-45) if possible.

Some questions you might have

1. I am a computer science major, why should I take Physics? (CIS students)
2. I am a physics major, but General Physics is the same as high school, nothing new! (Phys students)
3. (For CIS foreign students), Great, the university has many English-taught courses; however, this has big problem to you…
4. How should I study?

How should I study?

1. Come to class
2. Read lecture notes, and textbook
3. Do problems
4. Ask questions
5. Discussion
6. …



† This position is symbolized in A. A. Yuzefovich's well-known friendly cartoon, "Dau said", reproduced here.

L. D. LANDAU
Nobel in Physics, 1962
Condensed Matter, Helium

His constant scientific contact with a large number of students and colleagues also represented to Landau a source of knowledge. A unique aspect of his style of work was that, ever since long ago, since the Khar'kov years, he himself almost never read any scientific article or book but nevertheless he was always completely au courant with the latest news in physics. He derived this knowledge from numerous discussions and from the papers presented at the seminar held under his direction. This seminar was held regularly once a week for nearly 30 years, and in the last years its sessions became gatherings of theoretical physicists from all Moscow.

The dialogue between Einstein and Bohr in 1935

MAY 15, 1935 PHYSICAL REVIEW VOLUME 47

Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?

A. EINSTEIN, B. PODOLSKY AND N. ROSEN, *Institute for Advanced Study, Princeton, New Jersey*

(Received March 25, 1935)

Questioning QM

OCTOBER 15, 1935 PHYSICAL REVIEW VOLUME 48

Can Quantum-Mechanical Description of Physical Reality be Considered Complete?

N. BOHR, *Institute for Theoretical Physics, University, Copenhagen*

(Received July 13, 1935)

MAY 15, 1935 PHYSICAL REVIEW VOLUME 47

Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?

A. EINSTEIN, B. PODOLSKY AND N. ROSEN, *Institute for Advanced Study, Princeton, New Jersey*

(Received March 25, 1935)

In a complete theory there is an element corresponding to each element of reality. A sufficient condition for the reality of a physical quantity is the possibility of predicting it with certainty, without disturbing the system. In quantum mechanics in the case of two physical quantities described by non-commuting operators, the knowledge of one precludes the knowledge of the other.

Then either (1) the description of reality given by the wave function in quantum mechanics is not complete or (2) these two quantities cannot have simultaneous reality. Consideration of the problem of making predictions concerning a system on the basis of measurements made on another system that had previously interacted with it leads to the result that if (1) is false then (2) is also false. One is thus led to conclude that the description of reality as given by a wave function is not complete.

"Said to be one of Einstein's mistakes"

OCTOBER 15, 1935 PHYSICAL REVIEW VOLUME 48

Can Quantum-Mechanical Description of Physical Reality be Considered Complete?

N. BOHR, *Institute for Theoretical Physics, University, Copenhagen*

(Received July 13, 1935)

It is shown that a certain "criterion of physical reality" formulated in a recent article with the above title by A. Einstein, B. Podolsky and N. Rosen contains an essential ambiguity when it is applied to quantum phenomena. In this connection a viewpoint termed "complementarity“ is explained from which quantum-mechanical description of physical phenomena would seem to fulfill, within its scope, all rational demands of completeness.