

# ❖ 2024F-PHYS\_0175: Physics 2 (Electromagnetism)

## Instructor : Jeungphill Hanne

### <Education>

- **PhD, Physics**, University of California-Los Angeles, USA  
→ *Majoring in Experimental Biophysics (Dr. Giovanni Zocchi)*
- **PhD Study, Physics**, University of Florida (UF), USA  
→ Majoring in Theoretical Elementary Particle physics
- **MS, Physics**, University of California-Riverside, USA
- **BS, Physics**, Inha University, South Korea

### <Professional Experiences>

- Jul. 2010~ Aug. 2019: **Postdoctoral Research Associate**,  
The Ohio State University Wexner Medical Center, (*Adviser: Dr. Richard Fishel*)  
→ *Studying DNA Mismatch Repair by Experimental Biophysics*
- Sept. 2006~ Apr. 2010 : **Senior Research Scientist**, LG Display Co, Ltd., South Korea  
→ Optical Physics, Optical/Electrical Engineering
- Sept. 2019~ at the present : **Associate Professor**, (Physics, and Electrical & Computer Engineering)  
Sichuan University- Pittsburgh Institute (SCUPI) : Very happy being a “SCUPIan”

### <Research Background & Direction>

- Biophysics, Biomedical Science, Bio/Biomedical Engineering, Optical/Electrical Engineering

→ *So, you can come to me anytime, and can ask any advice, or question for the future Career, and so on....., Very happy to share my experience, but the choice is yours !!*

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### ❖ Agenda for today

#### 1. SCUPI 2024 Fall Academic Calendar

- Academic Calendar : Midterms & Final etc.
- My Schedule : Office hours etc.

#### 2. Course Introduction

- Course information
  - Subject, Text book, Lecture Hour, Office hour, Course website, etc.
- Course Objective & Scope, Course Learning Key Points
- Course Grading & Tentative Course Schedule

#### 3. Call class rolls

#### 4. Brief Introduction of Physics and Physics 2

- What is physics and Why need Physics
- Scope of Physics & What is Electromagnetism

# 1. SCUPI 2024 Spring Academic Calendar

- Academic Calendar : Midterms & Final etc.

SCUPI Academic Calendar for 2024-2025 Fall

	Aug.	Sep.				Oct.				Nov.				Dec.				Jan.				Feb.					
<b>Monday</b>	26	2	9	16	23	30	7	14	21	28	4	11	18	25	2	9	16	23	30	6	13	20	27	3	10	17	24
<b>Tuesday</b>	27	3	10	17	24	1	8	15	22	29	5	12	19	26	3	10	17	24	31	7	14	21	28	4	11	18	25
<b>Wednesday</b>	28	4	11	18	25	2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29	5	12	19	26
<b>Thursday</b>	29	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30	6	13	20	27
<b>Friday</b>	30	6	13	20	27	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	31	7	14	21	28
<b>Saturday</b>	31	7	14	21	28	5	12	19	26	2	9	16	23	30	7	14	21	28	4	11	18	25	1	8	15	22	1
<b>Sunday</b>	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26	2	9	16	23	2
<b>SCU Week</b>	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
<b>SCU Term</b>	2024 Fall Teaching Weeks																			Final Weeks			Winter Recess				

1<sup>st</sup> Midterm

2nd Midterm

Final

*This schedule is preliminary!!*

# 1. SCUPI 2024 Fall Academic Calendar

- My Schedule : Office hours etc.

2024-2025 Fall Semester Course Schedule					
Class time	Monday	Tuesday	Wednesday	Thursday	Friday
08:15-09:00				Physics 1 05 Teach Bulg 1-A603	
09:10-09:55				Physics 1 05 Teach Bulg 1-A603	
10:15-11:00		Physics 1 05 Teach Bulg 1-A603		Office Hour Applied Discrete Math	
11:10-11:55		Physics 1 05 Teach Bulg 1-A603		Office Hour Physics 1 05	
Lunch Break					
13:50-14:35	Applied Discrete Math 3-106		Office Hour Applied Discrete Math		
14:45-15:30	Applied Discrete Math 3-106		Office Hour Physics 1 05		
15:40-16:25	Applied Discrete Math 3-106		Office Hour Physics 2 01		
16:45-17:30	Physics 2 01 3-101		Physics 2 01 3-101		
17:40-18:25	Physics 2 01 3-101		Physics 2 01 3-101		

*But, you can come to my office anytime when I am in my office ^^*

# 2. Course Introduction

## • Course information

### • Physics for Science and Engineering 2

- Learn the basics of General Physics 2

#### → Electromagnetism

: Fundamental to Engineering Research

### • Text Book

- Principle of Physics by David Halliday ,  
Robert Resnick & Jearl Walker,

10th edition.:ISBN-13: 978-1118230749s

### • Lecture

- Instructor : Jeungphill Hanne, PhD

[jeungphill.hanne@scupi.cn](mailto:jeungphill.hanne@scupi.cn)

- Time : please refer to my schedule

- Office Hour: Tues.(15:40-11:55)

- Office : 3-321A @ Zone 3, 412@New Building

### • TA : Ricardo, and Kun

- Office Hrs : To be announced.

### • Course Format

- Lecture, and Active Participation ( i.e. Quiz, **Presentation**, Question, Answers, etc.)

### • Course Grading

- Two Midterms, Final, Homework, Quiz, and Attitude (ex. Attendance, Focus, Engagement, Punctuality for HW, etc.)

JEARL WALKER | DAVID HALLIDAY | ROBERT RESNICK

## Principles of Physics

Tenth Edition



## 2. Course Introduction

### • Course Scope & Objective

- Objective : Understanding the basics of “Electromagnetism”, Learning new Physical, or mathematical properties/theorem and eventually to be summarized to Maxwell’s eq.
- Scope : Electromagnetism(Electricity, Electrical Circuit, Magneticty, Induction, Electromagnetic Wave, Light, Geometrical/Wave Optics, etc.) →Connect to Maxwell’s equations  
→ Required : **Some mathematical Background ! (Vector Calculus, 3D Integral, Diff. equ.)**

*All concepts/Theories will be summarized  
to Maxwell’s Equation !*

*Can be Modified!*

### • Course Grading

- Grading Components : HW + Quiz (15%), Midterm I (25%), Midterm II (25%), Final (25%) and Attitude(10% and more : Attendance, Focus, Engagement, Punctuality for HW, etc.)  
+maybe Plus alpha → < 60% attendance (might be failed for the course!)

*Can be Flexible and be changed!*

# Tentative Course Schedule

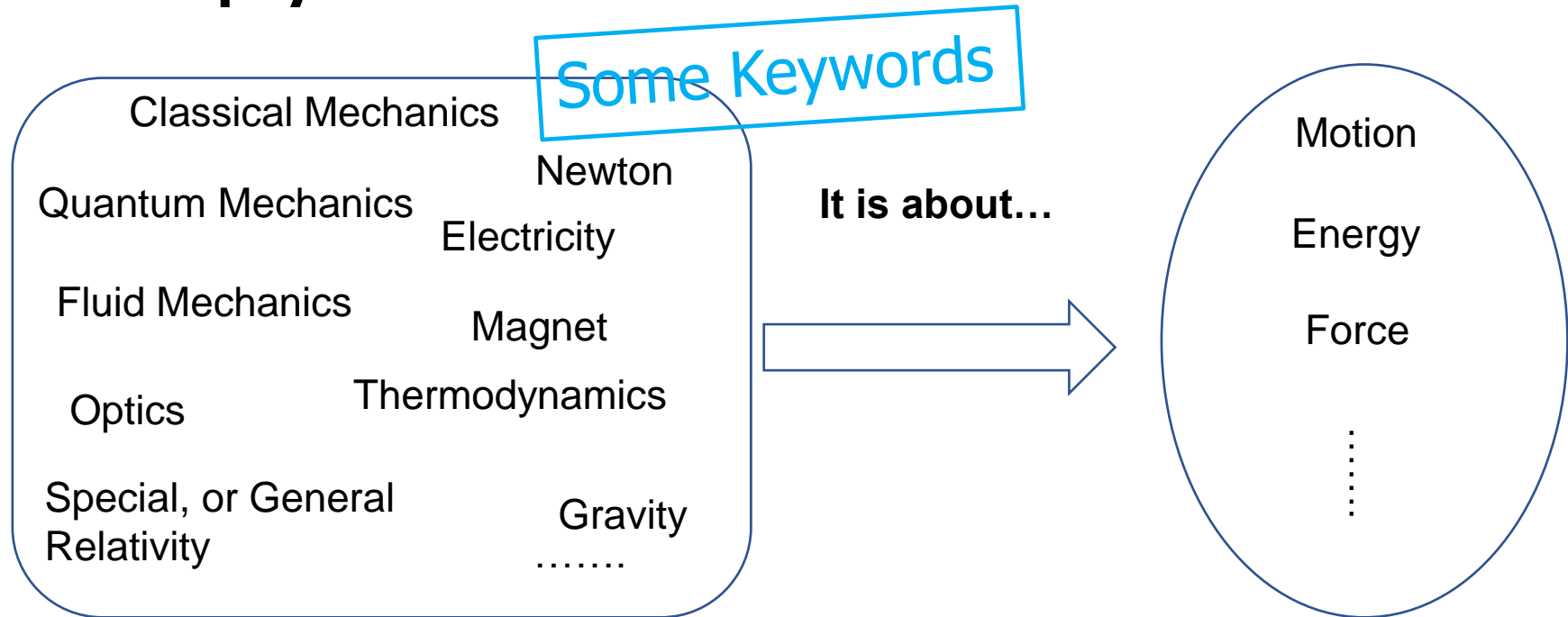
Week	PHYS_0175(Physics 2)	Topics	Assignment
Week 1 (9/2-9/8)	Introduction & Chap 21	Syllabus & Coulomb's Law	HW1
Week 2 (9/9-9/15)	Chap22	Electric Fields	HW2
Week 3 (9/16-9/22)	Chap23	Gauss' Law	
Week 4 (9/23-9/29)	Chap 23 & Chap 24		HW3
Week 5 (9/30-10/6)	Chap 24 & Review	Electric Potential	HW4
Week 6 (10/7-10/13)	Chap 25 & <b>Mid Term 1</b>	Capacitance	
Week 7 (10/14-10/20)	Chap 25		HW5
Week 8 (10/21-10/27)	Chap 26	Current & Resistance	
Week 9 (10/28-11/3)	Chap 26 & Chap27	Circuits	HW6
Week 10 (11/4-11/10)	Chap 27 & Chap 28		HW7
Week 11 (11/11-11/17)	Chap 28	Magnetic Fields	
Week 12 (11/18-11/24)	Review, Chap 29 & <b>Mid Term 2</b>		
Week 13 (11/25-12/1)	Chap 29	Magnetic Fields due to Currents	HW8
Week 14 (12/2-12/8)	Chap 30	Induction & Inductance	HW9
Week 15 (12/9-12/15)	Chap 31	Electromagnetic Oscillation Circuit	HW10
Week 16 (12/16-12/22)	Chap 32	Maxwell's Equation, Magnetism	HW12
Week 17 (12/23-12/29)	Chap33 & Chap34	Electromagnetic Waves	HW13
Week 18 (12/30-1/5)	Chap35 & Chap 36	Geometrical Optics	HW14
Week 19 (1/6-1/12)	Chap36 & Review	Wave Optics	HW15
Week 20 (1/13-1/20)	<b>Final</b>		

Can be changed!

## 4. Introduction of Physics

- What is physics and Why need Physics
- Scope of Physics & What is Classical Mechanics

### • What is physics ?



**“Physics”** → ***“Study how the object moves, stops, stays, behaves, or interact..... ”***

So, “Physics” is fundamental to Engineering ? also Science ?



# 4. Introduction of Physics

- Why “Physics” is fundamental to Engineering ?

→ Because it describe fundamental interactions between objects and motion of objects in Engineering

- Mechanical Engineering : Massive objects
- Electrical Engineering : Charged objects
- Material Science and Engineering : i.e. Complicate, or newly formed objects
- Industrial Engineering : Application of basic engineering subjects
- .....

Interaction  
→ Forces!

**- So, “Physics” is Everything?,  
But Why still study Engineering?**

## 4. Introduction of Physics

### - So, “Physics” is Everything?, But Why still study Engineering?

→ Yes, Physics is fundamental to Engineering,  
However, we can not solve more than two-body problem completely  
and in reality, the Nature is “Many-body problem”,  
& Engineering is also Application of Physics !!

### - What we can do ?

→ One way is to propose “Macroscopic ,or Microscopic Models” and  
confirmed by Experimental Results and Calculations → Suggest New  
Phenomena → Discover them, or correct them by experiments → New Models  
→ Suggest New Phenomena.... → .....

→ This is also the “Physics Way of Thinking” and ask to learn this

***Make sure : What you know, or don't know !!,  
Can explain to others!!***

## 4. Introduction of Physics

By Elon Musk,

after a question of “How can you be such a creative person”

→ Learn **“Physics”**



*“Physics” is basic for Engineering,  
and also for the way of thinking  
for....*



## 4. Brief Introduction of Physics2

### • Scope of Physics & What is Electromagnetism?

- Elementary Particle in Nature and its basic property
- Four Fundamental forces in Nature
- Physics Theory (Classical, Modern)

### - What is Classical Mechanics (Physics 1)?

- “Physics” (‘Motion’) of the **Massive** particles/objects
- Followed by **Newtonian Laws**
- Influenced by **Gravitational Force**

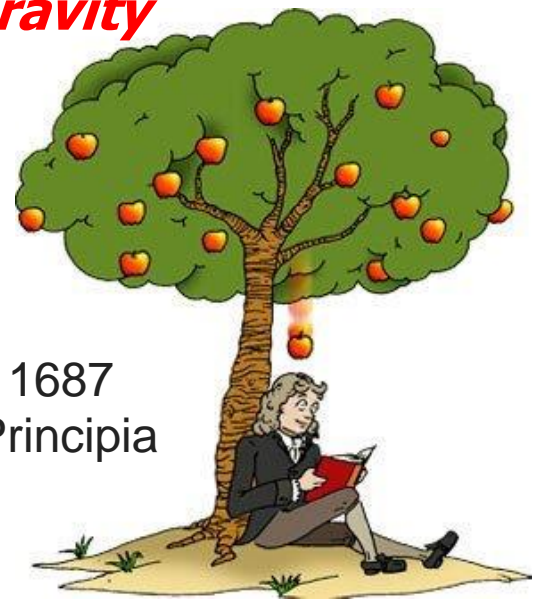
What is “mass”(property), “Newtonian”(Law) and “Gravitational”(Force) ?

### - What is Classical Mechanics for (Physics 2) **Electromagnetism?**

- “Physics” (‘Motion’) of the **???** particles/objects
- Followed by **???**
- Influenced by **???**

# ❖ "Physics Showtime" : ~1850? → ~1995?, ~150 years

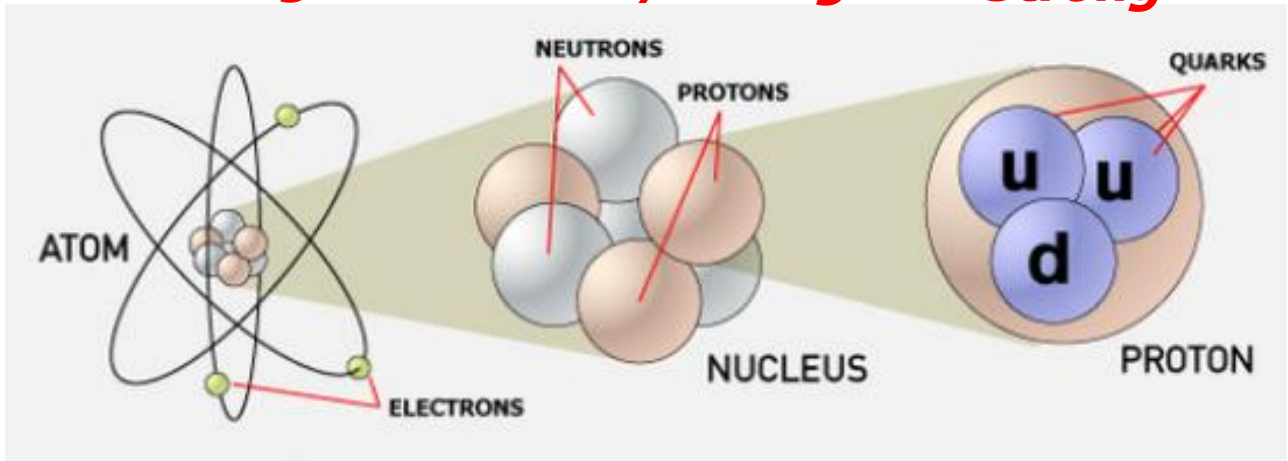
## Gravity



1687  
Principia

Isaac Newton

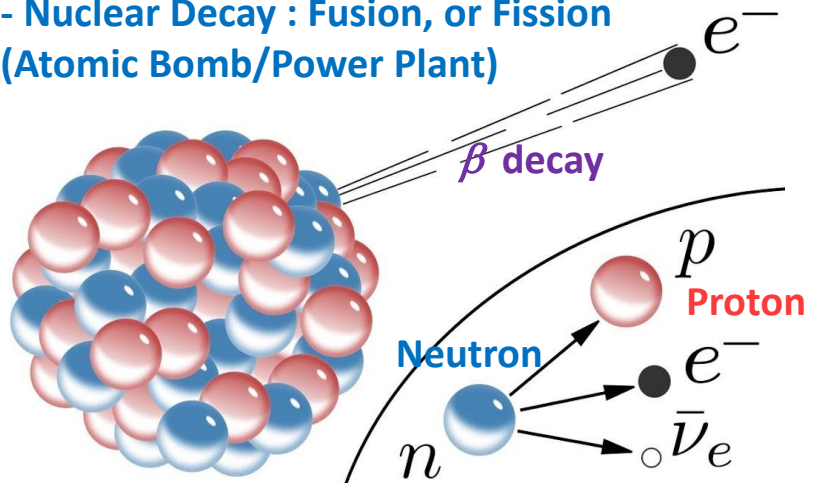
## Electromagnetic Weak/Strong Strong



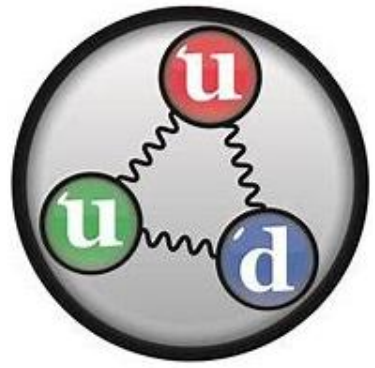
**Strong (~Form the Nucleus glued between protons and neutrons)**

## Weak (Nuclear Decay process)

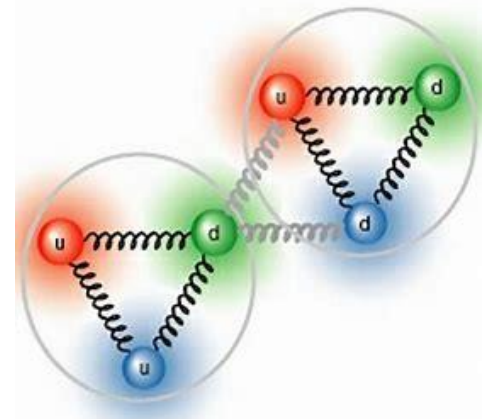
- Nuclear Decay : Fusion, or Fission  
(Atomic Bomb/Power Plant)



## Quark-Quark interaction



In Proton, or Neutron



In Nucleus

# - "Elementary Particle in Nature" : no more break-down

Three categories of particles form the Standard Model. **Matter** is composed of quarks and leptons. The **fundamental bosons** provide three forces: electromagnetism, the strong nuclear force and the weak nuclear force. **Gravity**, the fourth fundamental force, is not explained by the Standard Model.

The **Higgs boson**, discovered in 2012, provides an explanation for how the other particles get **mass**.

Currently, the Standard Model is incomplete and does not explain many important features of the known universe, such as:

- **gravity**
- **dark matter** (27 percent of the universe)
- **dark energy** (68 percent of the universe)



## <Basic Properties>

✓ **Mass**

✓ **Charge**

✓ **Spin**  
~(Angular Momentum)

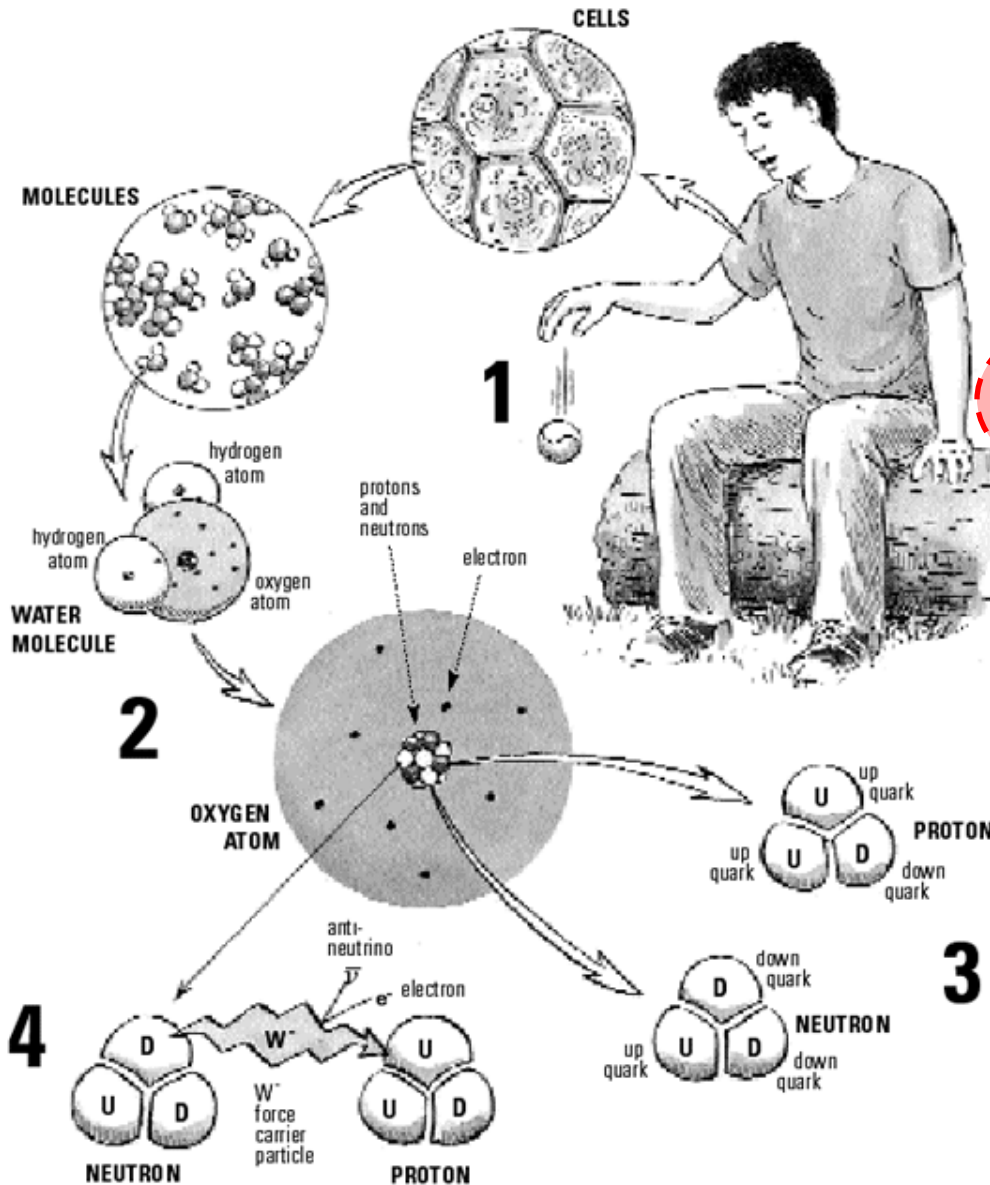
✓ **Parity**

All new elementary particles  
→ Nobel Prize!!

HIGGS: 2015 Nobel Prize!!

## "Standard Model"

# - Four fundamental forces in Nature



## **1. Gravitational Force**

*Mass ↔ Mass*

## **2. Electrical Force**

*Charge (+/-) ↔ Charge (+/-)*

## **3. Weak Force**

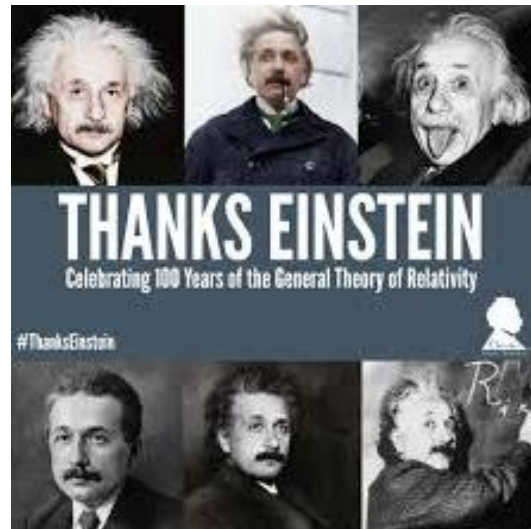
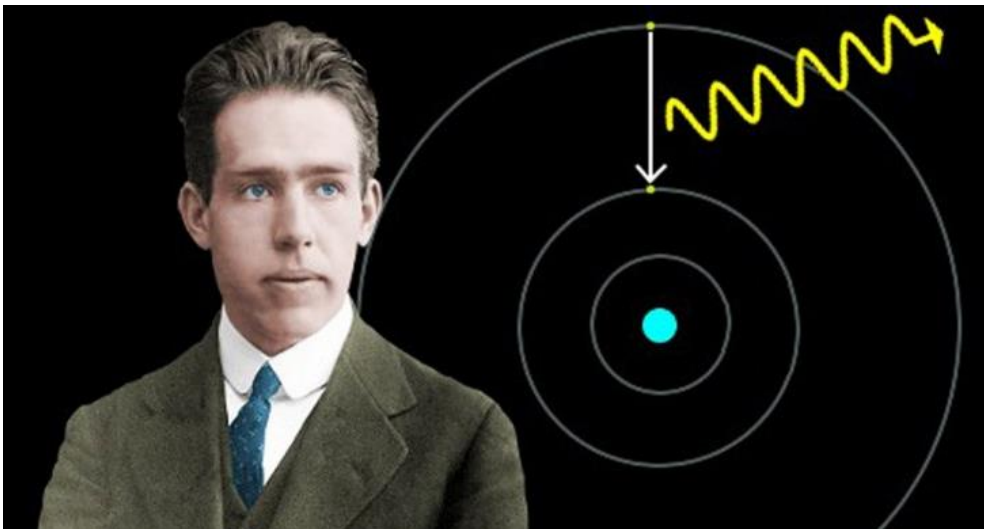
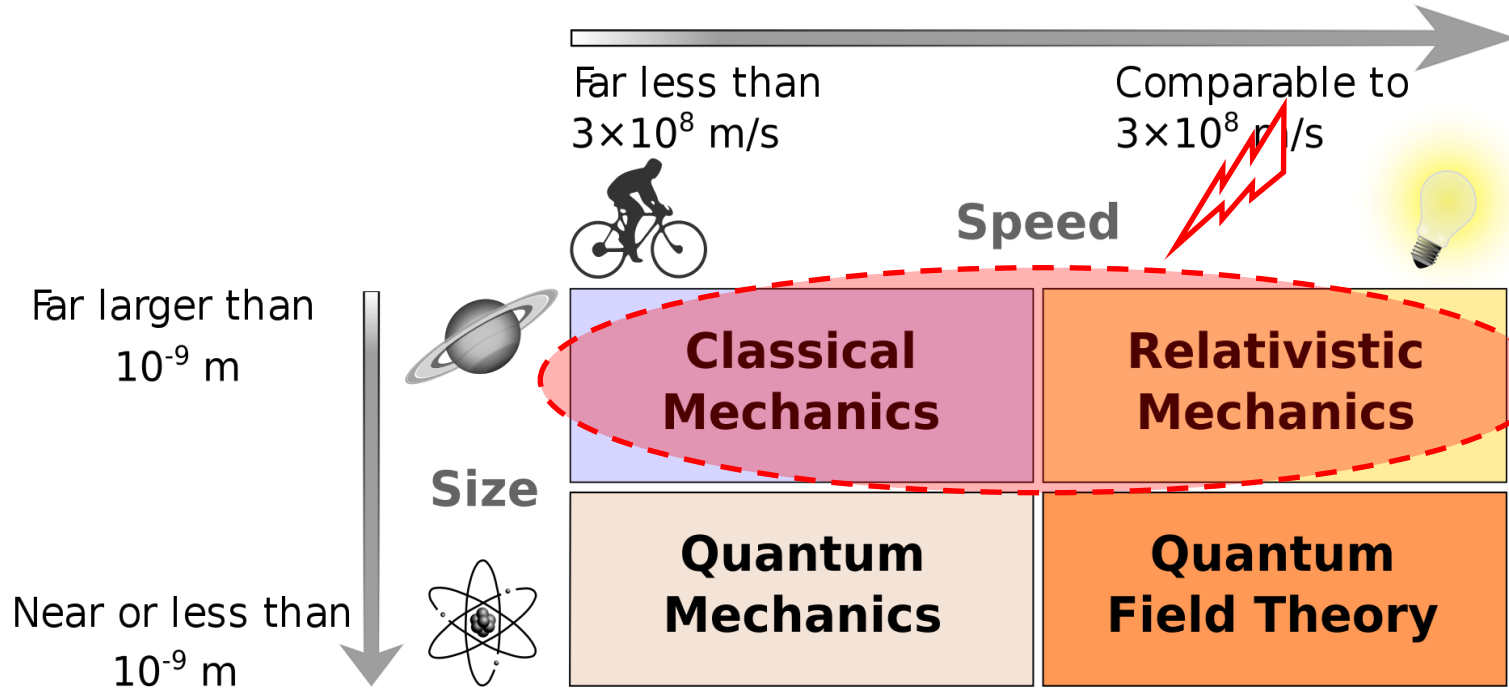
*~ Nuclear decay*

*Nuclear → New Nucleus*

## **4. Strong Force**

*Quark ↔ Quark*

# - "Basic Physics Theory"





# ❖ So, What is Electromagnetism ?

→ “Physics” of the **Electrically Charged** particles/objects influenced by **Electric Forces**

- **Electric Charge** : one of the basic properties of the **elementary particle** in Nature
- **Electric Force** : one of the **Four Fundamental forces** in Nature
  - **Force between Charges**

## For your reference,

- ❖ Basics of Physics so far,
  - Four Fundamental forces in Nature
  - Elementary Particles in Nature containing basic properties (i.e. mass, charge, spin, and parity)
  - Self-complete, but Not a unified theory(?)

Thank you everybody!

, And See you next time