Classical Physics

PH7010:

03/09/2020-05/10/2020: Mon 02:30-03:55 pm, Thu 4:00-5:25 pm.

08/10/2020-11/12/2020: Mon 9:00-9:55 am, Wed at 11:00-11:55 am and Thu 10:00-10:55 am.

EP1017:

03/09/2020-05/10/2020: Mon 12:00-12:55 pm, Tue 9:00-9:55 am and Fri 11:00-11:55 am.

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Course Structure: EP1017 + PH 7010

Brief introduction to Newtonian mechanics, Constraints, Generalized coordinates, Degree of freedom, Virtual work, D'Alembert's Principle of virtual work, Lagrangian formalism, Hamilton's equation, Central force problem (equation of orbits, motion of planets and satellites), Rigid body dynamics

Ref: Classical Mechanics by N. C. Rana & P. C. Joag; Classical Mechanics by Goldstein, Poole & Safko

PH 7010: 3 Credit
Assignment: 30%
Mid Term: 20%
Final Term: 30%
Quiz+Class Participation: 20%

EP1017: 1 Credit
Assignment: 30%
Quiz + Class Participation: 30%
Final Term: 40%

Course Structure: PH 7010

First and Second order autonomous systems; linear transformations of the plane; fixed point, equilibrium and stability analysis; fixed point analysis, limit cycles.

Ref: Introduction to Dynamics by Percival & Richards.

Rigid Body Motion; Hamilton Equation of Motion; Canonical Transformations

Ref: Classical Mechanics by Goldstein, Poole & Safko

Quiz Structure:
After every lesson at **6:00 pm**, two MCQ based on the lecture will be sent you.
You can submit your options online. Your TAs will help you in this regard.

PH 7010:
Satyabrata Mahapatra

EP1017:
K. Mahathi
Saunak Dutta
Soumya Purohit
Gopika K.
Kouchik Makur

EP 1017

A TA will be allotted to a group of students.
Student can directly coordinate with their TA or myself regarding any issue.

What is Classical Physics?

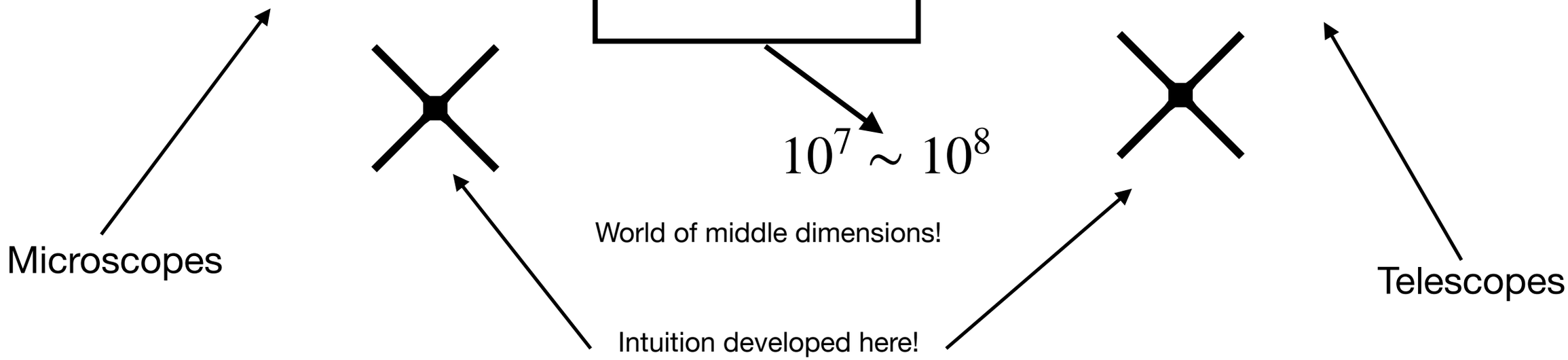
h, c, G

Mass, M (kg)
Length, L (m)
Time, T (s)

$10^{-30}(m_e)$
$10^{-35}(l_p)$
$10^{-42}(t_p)$

10^{-4}	-10^{3}
10^{-4}	-10^{4}
10^{-1}	-10^{7}

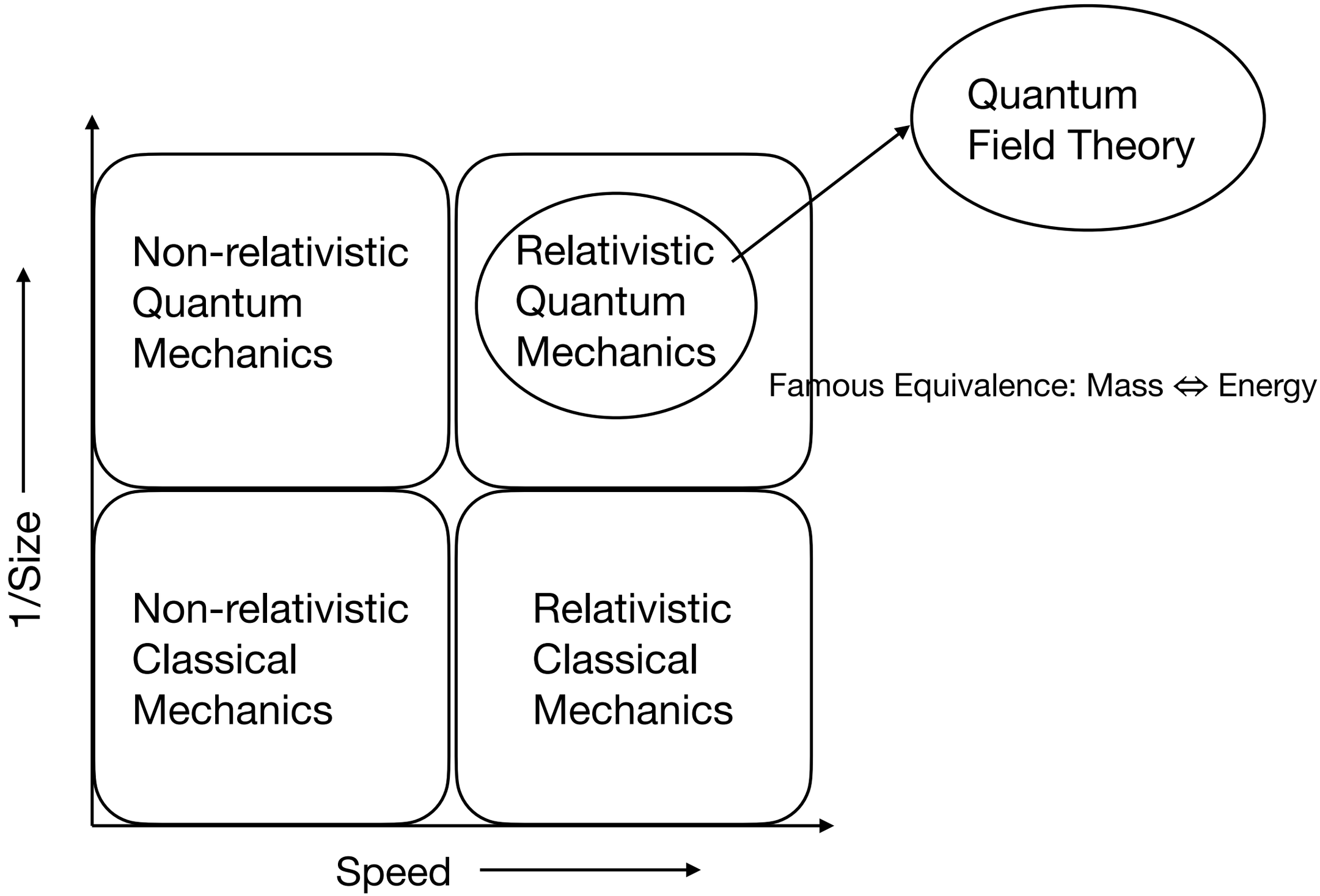
10^{52} "Mass of the universe"
10^{26} "Size of Universe"
10^{17} "Age of Universe"



Other tools: Mathematical Tools $\Longrightarrow$ To understand nature

Newtonian Physics

Non-intuitive: $F \propto \dfrac{\Delta \mathrm{v}}{\Delta t}$


Quantum
Field Theory
Non-relativistic
Quantum
Mechanics
Relativistic
Quantum
Mechanics
Famous Equivalence: Mass ⇔ Energy
1/Size
Non-relativistic
Classical
Mechanics
Relativistic
Classical
Mechanics
Speed

Newton's laws of motion:

These laws are valid in a class of reference frames called *inertial frame*.

Inertial frames $\Leftrightarrow$ Newton's laws of motion.

1> Law of Inertia: In an inertial frame, every free particle has a constant velocity.

Free particle: a particle not acted upon by a net external force.
Equal displacement in equal time.
Motion will be straight line.
$\Longrightarrow$ Along the straight line of the path, space is uniform or homogeneous and so it time.
$\Longrightarrow$ Ideal inertial frames: one with straight lines.

2> Law of Causality: If the total force exerted on a particle by other objects at any specified time is represented by a vector $\mathbf{F}$, then

$$\mathbf{F} = m\mathbf{a} = \frac{d\mathbf{p}}{dt}$$

where $\mathbf{a} = \frac{d\mathbf{v}}{dt}$.

First time defined $\mathbf{F}$ with directly measurable quantities called acceleration and mass.

3> Law of Reciprocity: To the force exerted by an object on a particle, there is an equal and opposite force exerted by particle on the object.

$$\mathbf{F}_{12} = -\mathbf{F}_{21}$$

$\Longrightarrow$ Using second law: $\frac{d}{dt}(\mathbf{p}_1 + \mathbf{p}_2) = 0$ $\Longrightarrow$ Conservation of linear momentum.