Detailed program and schedule of

“Introductory school on phenomenology of QGP”

School of particles and accelerators (IPM),

12-16 Feb 2023 (23-27 Bahman 1401).

Detailed program:

- Lecturer: ***M. Asadi,***

Subject: **Relativistic Hydrodynamics,**

Outlines:

1. Introduction

2. Brief review of non-relativistic hydrodynamics
- Ideal fluid
- Dissipative fluid
- Hydrodynamic modes

3. Relativistic hydrodynamics
- Hydrodynamic variables
- Constitutive relations
- Zeroth-order hydrodynamics
- First-order hydrodynamics

4. Hydrodynamic equations and correlation functions
- Simple diffusion and Kubo formula
- Canonical approach to hydrodynamic response functions
- Retarded functions in relativistic hydrodynamics at $\mu = 0$
- Retarded functions in relativistic hydrodynamics at $\mu \neq 0$
- Variational approach to hydrodynamic response functions

- Lecturer: ***S. M. A. Tabatabaee mehr,***

Subject: **Kinetic Theory,**

Outlines:

1- Basic concepts, relativistic Boltzmann equation.
2- Boltzmann's H-Theorem.
3-Advanced topics: Quantum transport theory, chiral kinetic theory.

- Lecturer: ***S. F. Taghavi,***

Subject: **Phenomenology of QGP,**

Outlines:

An introduction

- A quick overview of the heavy-ion collision physics
- A basic picture of the collectivity in HIC.
- A basic overview of the observables.

-Heavy-ion initial state and pre-equilibrium:

- Nuclear structure.
- Ab initio QCD initial states -> color glass condensate -> IP-Glasma
- More phenomenological models -> TrENTo, MC-Glabuer
- Pre-equilibrium stage

- Collective evolution:

- Modeling the collective evolution -> hydrodynamic, kinetic theory (only from a phenomenological point of view)
- Current collective models in the market -> VISHNU, MUSIC, ...
- Collectivity in small systems.

- Experimental measurements and Bayesian analysis

- Latest updates about the experimental observables related to the collectivity
- Bayesian analysis approach to extract the model's free parameters from the experiment.
- A quick summary

- Lecturer: ***F. Taghinavaz,***

Subject: **Thermal Field Theory,**

Outlines:

1) Review of statistical mechanics,
2) Imaginary time formalism: path integral representation of partition function,
3) Linear response theory,
4) Real time formalism: closed time path and thermofield double,
5) Symmetry breaking at finite temperature.

Schedule:

Sunday, Feb 12, 2023	
9-9:15	Opening ceremony
9:15-10:45	Thermal Field Theory
11-12:30	Thermal Field Theory
13:30-15	Phenomenology of QGP
15:15-16:45	Relativistic Hydrodynamics

Monday, Feb 13, 2023	
9:15-10:45	Kinetic Theory
11-12:30	Relativistic Hydrodynamics
13:30-15	Phenomenology of QGP
15:15-16:45	Thermal Field Theory

Tuesday, Feb 14, 2023	
9:15-10:45	Relativistic Hydrodynamics
11-12:30	Thermal Field Theory
13:30-15	Kinetic Theory

Wednesday, Feb 15, 2023	
9:15-10:45	Kinetic Theory
11-12:30	Relativistic Hydrodynamics
13:30-15	Thermal Field Theory
15:15-16:45	Phenomenology of QGP

Thursday, Feb 16, 2023	
9:15-10:45	Thermal Field Theory
11-12:30	Kinetic Theory
13:30-15	Relativistic Hydrodynamics
15:15-16:45	Phenomenology of QGP