

Overview:

Selected topics in heavy ion collisions - A series of seminars

Rahul Ramachandran Nair

rahul.nair@cern.ch

NCBJ, Warsaw, Poland.

6th December 2021

3: 30 PM (IST)

Online

Thanks to Prof. E. Harikumar for realising this series
and many thanks to the participants for signing in.

About Me

Name: Rahul Ramachandran Nair

BSc: St Berchmans College, Changanacherry, Kerala, India. (2007-2010)

MSc: University Of Hyderabad, Telangana, India.(2011- 2013)

PhD: National Centre For Nuclear Research (NCBJ), Warsaw, Poland (2014-2019)

Present: Scientific Associate at the NCBJ LHC-ALICE group, Warsaw.

Thesis: A study of the imprints of thermalisation on charged particle emission using light front variables in ultrarelativistic heavy-ion collisions

PhD Supervisor: Prof. Dr Hab. Teodor Siemiarczuk, NCBJ, Warsaw, Poland.

Aim and Scope

These are a series of seminars on various topics in heavy-ion collisions.

Aim:

It aims to provide first-hand information to those interested in the physics of heavy-ion collisions. I hope that it will help the listeners to read research the papers in a less cumbersome fashion.

The scope:

- Those who want to start working on heavy-ion collisions.
- Those want to explore analogies of the topics in heavy-ion collisions.
- Those who want to start doing a PhD in heavy-ion collisions.
- Those who like to listen, talk, discuss and think about it 😊.

Plan & Motivation: The first three

TALK-1: Rudimentary introduction to ultrarelativistic heavy-ion collisions

Terminologies, basic geometry of collisions, kinematic variables, brief history of heavy-ion collision experiments.

TALK-2: Observables in heavy-ion collisions and signatures of QGP

Idea of a distribution, fitting, single and multi particle observables and some usual techniques of their estimation at high energy colliders.

TALK-3: A brief survey of the experimental results from heavy-ion collisions

A survey of experimental results from the heavy-ion programs at LHC

Plan & Motivation: The first three

With these three talks: We would like to familiarise with terminologies used in the field of heavy-ion collisions, understand the physical idea behind the usually studied observables, get an idea about their estimation and get to know the recent (if not latest) results in this field.

I expect that after the first three talks, the listener who is new to these topics will be able to immediately start reading a paper published by RHIC or ALICE collaboration.

Plan & Motivation: The next three

TALK-4: QCD phase diagram and heavy-ion collisions

QCD phase diagram, phase transitions, idea of scanning the QCD phase diagram with heavy-ion collisions, experimental searches for the QCD critical point.

TALK-5: Thermalisation in high energy collisions

Thermalisation in high energy collisions, mechanisms, observations problems and puzzles.

TALK-6: Thermal hadron production in high energy collisions via Unruh radiation

Idea of stochastic thermalisation, motivations to connect thermalisation with Unruh radiation, mechanism of thermal hadron production in high energy collisions via Unruh radiation

Plan & Motivation: The next three

Why is it so ?: We would like to understand the mechanisms proposed for explaining the observed thermal behaviour of the particles in high energy collisions. Specifically, the conceptual analogy with Unruh radiation. For this, I think we need to have an idea about the treatment of phase transition in QCD with colliders, specifics of thermal hadron production and an idea about Unruh radiation

I expect that after these six talks one could be able to connect these topics creatively to work further without having severe obstacles at least in the beginning to read the related papers.

Possible complementary talks

Feedbacks - I would like to get some feedback after these six talks. If they are indeed satisfactory and useful for the listeners and there is enough interest, I shall present the following two topics:

Talk 7: Theoretical overview of QCD phase transitions

Order parameters of purely gluonic and quark gluon systems, chiral symmetry restoration, universality classes, treatment of phase transitions etc.

Talk 8: Jet physics - Theory and experiments

Origin of QCD jets, jet algorithms, observations and applications.

Why?: I am planning to work, hopefully soon on these topics both in terms of phenomenology and experiments. So I was studying these topics recently for some time. In case anyone is interested to know more about these topics and further discussions on them, then only it would make sense to present it here.

Resources

Website : <https://sites.google.com/view/hicseminar2021>

Archive: <https://indico.cern.ch/event/1103564/>