- PHY691 - Spring 2023 -

ACCELERATOR

YOUR NEXT 6-D FLIGHT SIMULATOR

Across a Speed-of-Light Universe

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THE AGENDA TODAY

- **Getting introduced to each other**
- **This introduction**
- **A brief review of particle accelerators in history, and where we are today**
- **Introduction to our flight-simulator engine, the ray-tracing code Zgoubi. And to alternate cross-check means.**

• **This course is an introduction to the physics and technology of particle accelerators,**

◇ **based on computer laboratory work**

◇ **during which we will**

- **construct and run virtual accelerators, of all sorts**
- **accelerate charged particle beams**
- **generate synchrotron light**
- **watch the relativistic death of short-lived particles**
- **polarize and shake particle spins**
- **play with Siberian snakes**
- **and much more**

• This course introduces to most types of existing particle accelerators, and to the basic

- technological components of charged particle beam optics,
- principles of charged particle beam dynamics:
  . beam steering, focusing, acceleration, ...
  . collateral aspects: spin dynamics, synchrotron radiation, in-flight decay, ...

◇ All this, *via* numerical simulations on computer.

• These computer simulations are taken from real-life laboratory activities, they constitute the backbone of the course.

• Computer code developments - and debugging ! - will be part of the game.

• This course is also

◇ a forum for discussions to foster deeper

- insight,

- understanding,

- on whatever topic, whenever desired,

- including further (better?) ideas *you* may have of accelerator simulations and code developments

◇ an opportunity to get contacts with world reknown accelerator laboratories and people, if you wish to explore further a possible future in the field

• **"Numerical simulations", or numerical experiments, means what?**

◇ **we will run beam dynamics computer programs**

◇ **manage/process the data they produce,**

◇ **we will keep confronting beam dynamics findings from numerical simulations with theoretical expectations,**

◇ **in an interactive play between both : "numerical experiments" regarding particle beams in accelerators, and the underlying theory.**

Organization of a 1h20m session

(i) On my side (15∼40 minutes) :

◇ **When we start a new topic : a short historical overview**

Cyclotron, synchrotron, synchrotron light, decay-in-flight, spin, etc.

◇ **As needed: accelerator theory.**

◇ **Simulation exercise assignments, including guidance**

(ii) On your side:

◇ **proceed with computer simulations as per latest assignments.**

This is the bulk of the sessions.

◇ **when done with a set of simulations, *you* present it: a few slides,**

to be presented to the group.

I want to see theory, theoretical explanations, in your slides!

These slide presentations may take time: includes discussions,

questions, ...

At times, I may request a written report as part of your home work.