## General information

The exercise sessions will be held as blackboard sessions, where the participants will present their solutions to the group. As such, the problems should be set up and solved before the session. The focus of the exercises lies on analyzing and discussing the task at hand together with the group: thus, a perfect solution is not required to be awarded points. The (attempted) solutions should be submitted via email to the assistant at the start of the exercise session on March 31st. A point will be awarded for each question, and a person will be chosen to present their solution from the pool.

## Exercise 1.
## Plasma diagnostics

a) What is the primary purpose of plasma diagnostics in magnetic confinement fusion?

b) List the basic groups of diagnostics used in magnetic confinement fusion.

c) List the basic diagnostic methods in these groups.

d) What are the main plasma parameters measured with these diagnostics?

e) Explain qualitatively the underlying physics principles in these diagnostics.

f) The diagnostics span the entire range of electromagnetic radiation. Can you identify the physics processes responsible for the different ranges of electromagnetic radiation?

## Exercise 2.
## Power balance of the fusion plasma

How can the following quantities be measured:

a) the confined energy in the plasma?

b) the total radiated power?

c) the spatial distribution of the radiated power?

d) the wall power deposition distribution?

## Exercise 3.
## Characterizing plasma conditions

Imagine that your task is to characterize a plasma discharge by measuring the electron, ion and impurity densities and temperatures, and particle and power fluxes, in as many spatial locations as possible. How would you do this? Which methods would you use and why?

**Exercise 4.**

**Diagnostics in fusion plasmas**

Assume the plasma has reached fusion temperatures.

a) How can the fusion power density be measured?

b) Explain the physics principles of a magnetic proton recoil spectrometer.

c) What other neutron diagnostics exist?

d) What are the impacts of neutrons and fast particles on the diagnostic performance and properties of materials?