

CHAMPP CENTER IN HAMBURG FOR ASTRO-, MATHEMATICAL AND PARTICLE PHYSICS

### LECTURE COURSE IN THE QUANTUM UNIVERSE RESEARCH SCHOOL

Winter Term 2024/2025

# **Theory of Distributions**

## Melanie Graf

#### **Course Description:**

The Theory of Distributions, developed by Laurent Schwartz, allows for the rigorous treatment of objects such as Dirac's delta function, which are fundamental in physics and engineering, and offers a powerful tool in the analysis of partial differential equations. We will cover basic concepts of the theory, such as definitions and fundamental properties of distributions and test function spaces as well as operations with distributions (differentiation, convolution, Fourier transform etc.). If time permits I hope to finish the course with the Malgrange-Ehrenpreis theorem stating that any linear PDE with constant coefficients posses a fundamental solution. Depending on the interest of participants and the progress we may also cover some Sobolev space theory or wave front sets.

#### **Prerequisites:**

Background in Mathematics equivalent to at least Analysis 1-3, Linear Algebra 1-2 and Functional Analysis, some complex analysis would also be good; Students coming from Physics are welcome but should appreciate mathematical precision/rigour and be comfortable with reading and writing proofs

#### Literature:

- Friedlander, Joshi: Introduction to the Theory of Distributions
- Lecture notes by M. Kunzinger: https://www.mat.univie.ac. at/~mike/teaching/ss19/distributions.pdf

Mon, 16:15–17:45, H5, Geomatikum
Thu, 16:15–17:45, H3 / H5, Geomatikum
Tue, 12:15–13:45, 142, Geomatikum
14 October 2024