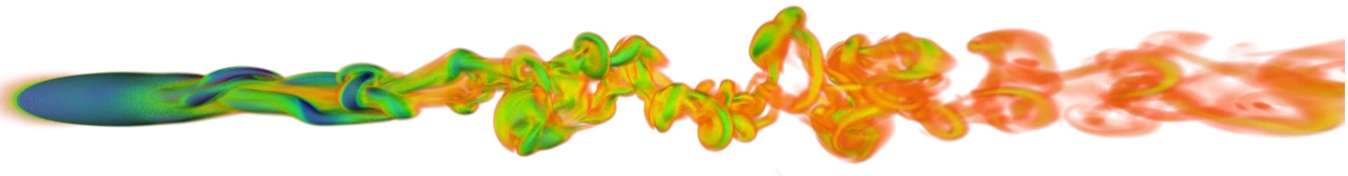
Fluid mechanics



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Objectives

This course will teach the theoretical background for a wide range of astrophysical phenomena that build on fluid and plasma physics. Starting from kinetic theory, we will go via the Klimontovich, Boltzmann and Vlasov equation, to the fluid and magnetohydrodynamic equations. A special emphasize will be on the problem of turbulence. The students will encounter advanced theoretical concepts such as perturbation theory, using Fourier transforms to transform partial differential equations to ordinary differential equations, and develop an understanding of some of the most important equations of classical physics. In exercises, they will learn to apply these methods themselves. A part of this course will be devoted to the development of numerical method for compressible gas flow. The students will implement themselves the scheme in the scientific programming language C++.

Evaluation

Type of examinations: oral exam at the end of the course (50%), numerical project (35%), homework exercises (15%).

Main progression steps

Theoretical courses will be interleaved with programming and exercise classes. From the second week on, students will individually work on their numerical implementation that has to finished by the end of the last week.

Bibliography & Resources

H. Homann: Fluid Mechanics, Lecture notes Link 1
A.R. Choudhuri: The Physics of Fluids and Plasmas, Cambridge University Press
S.B. Pope, Turbulent flows, Cambridge University Press
D.R. Nicholson, Introduction to Plasma Theory, Wiley

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