PHD PROGRAMME IN PHYSICS, ASTROPHYSICS, AND APPLIED PHYSICS
UNIVERSITÀ DEGLI STUDI DI MILANO
PhD Cycle 41 (2025-2026)

All lectures will be given in English.

Course title	Advanced topics in astrophysics and plasma physics - Fundamentals of computational fluid dynamics in astrophysics
Teacher in charge of the course	Lodato Giuseppe
List of the teachers of the course	Lodato Giuseppe, University of Milan, giuseppe.lodato@unimi.it
Training objectives	Obtaining a basic knowledge of the fundamental techniques to solve partial differential equations in fluid dynamics. Particular emphasis will be given to Smoothed Particles Hydrodynamics techniques, with hands on session on an actual high-performance code.
Prerequisites	General knowledge in Astrophysics and Plasma Physics.
Detailed course program	1. Recap of fundamental fluid equations. 2. Finite difference techniques. Von Neumann stability criterion. 3. Advection and diffusion equations. Courant condition. 4. Smoothed Particles Hydodynamics: main equations and the role of artificial viscosity. 5. Hands on session on the Phantom SPH code.
Examination modalities	Oral examination on a simple hydrodynamical simulation performed at home by the student
Preliminary schedule	June 2026 Course enrolment deadline: December 27, 2025.