# SISMA

Séminaire Informatique Scientifique & Mathématiques Appliquées

## AI Agents for Deep Learning Workflows of Complex Hydrodynamics

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The interaction of shockwaves at material interfaces of differing impedance results in an inherently unstable dynamical trajectory, with non-linear growth of perturbations and subsequent jetting occurring in chaotic fashion owing to the well-known Richtmyer-Meshkov instability (RMI). RMI is sustained via baroclinic torque arising from the misalignment of density and pressure gradients, as angular momentum is deposited at material interfaces by passage of the shockwave. There are very few known solutions to preventing the formation of RMI and even partial progress toward its stabilization would enable many important applications in physics and engineering. Through application of new artificial intelligence agents and machine learning workflows, coupled to simulated hydrodynamics, we show that there exist solutions whereby RMI can be controlled, and made to be either suppressed or enhanced at will via engineering special initial conditions. It has been found that the solution space for stabilization of RMI is surprisingly large – ML techniques have enabled the focusing of massive supercomputing resources to attain this understanding through hydrodynamic design optimization. Finally, new work on AI agents for automating the generation of training sets relevant to hydrodynamic problems will also be presented.