Università degli Studi di Cagliari
Dipartimento di Fisica

Istituto Nazionale di Fisica Nucleare
Sezione di Cagliari
High Energy Theory Group

Avviso di Seminario

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h. 11:00 – Aula C

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NONLINEAR DYNAMICS AROUND A HYDRODYNAMICAL CRITICAL POINT

The weakly nonlinear regime of a visco-elastic Navier-Stoles fluid is investigated using multiple scale methods. For the purely hydrodynamic case, it is known that large-scale perturbations tend to the minimum of a Ginzburg-Landau free-energy functional with a double-well (fourth-order) potential. The dynamics of the relaxation process is ruled by a 1D Cahn-Hilliard equation which can be rephrased in terms of the interactions among kinks and anti-kinks, having a hyperbolic tangent shape.
For the visco-elastic case, we found that the dynamics again admits a formulation in terms of a Ginzburg-Landau free-energy functional. For sufficiently small elasticity, the phenomenology is very similar to the purely hydrodynamic case: the free-energy functional is still a fourth-order potential and slightly perturbed hydrodynamic kink-antikink structures hold. A critical point sets in for sufficiently large elasticity: the fourht-order term changes sign and the next nonlinearity must then be taken into account. In spite of the fact that the potential preserves a double-well structure, the 1D character of the problem makes the dynamics sensitive to the details of the potential. I shall discuss some aspects relative to the dynamics of these generalized kink-antikink structures, with particular attention to their role in a new, purely elastic, instability scenario. Finally, some conclusion on the long-standing problem of polymer drag-reduction will be drawn on the basis of our analytical results.