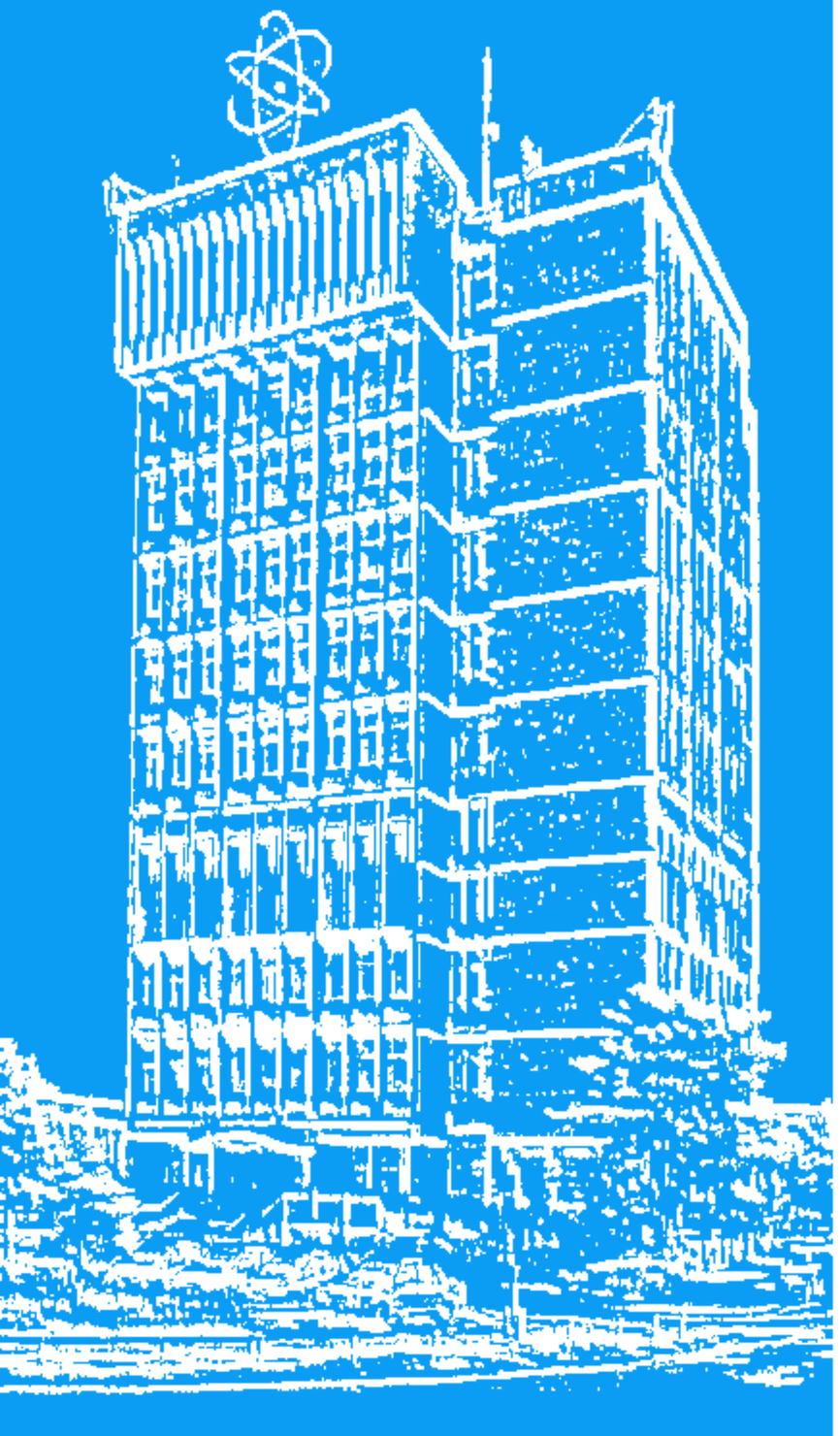
Seminar



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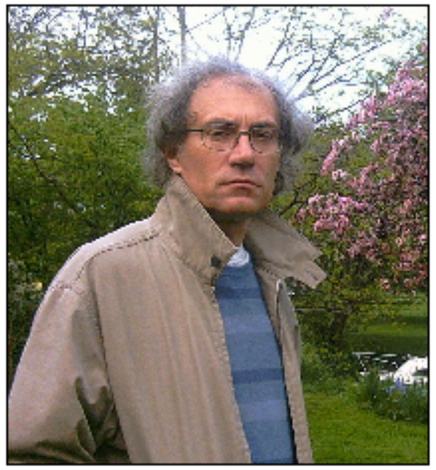

Field theoretical methods in fluid and plasma theory

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In two-dimensions the fluids, plasmas and the planetary atmosphere exhibit an intrinsic evolution to organization. This is most obvious at relaxation from turbulent states when the system evolves toward a reduced subset of flow patterns, characterized by a regular form of the streamfunction (coherent structures). In 2D these physical systems are equivalently described by discrete sets of point-like vortices interacting by self-generated potentials (Coulombian or short range). The continuum limit of the discrete models can naturally be formalized as classical field theories. We construct the Lagrangian for ideal Euler fluid, with matter field (the density of the point-like vortices) as a complex field with fourth-order scalar self-interaction, minimally coupled to a gauge field with Chern-Simons action, in the su(2) algebra. We show that the coherent flows correspond to self-duality and derive the equation sinh-Poisson, which was known that governs the asymptotic flows, by inferrence from numerical simulation. We write the Lagrangian for 2D plasma and planetary atmosphere, where the short range interaction can be obtained by the Higgs mechanism. Applications will be presented for the tropical cyclone, for the cristals of vortices in plasmas and for filamentary structures in laser-generated plasma.

Joi 3.06.2010, ora 11^{00}, Sala de Consiliu, Bloc Turn, etaj 9