# NewTURB meeting

Febraury 1st, 2018

Sala di Struttura della Materia

Dept. of Physics – Univ. of Rome "Tor Vergata"

11:00-11:45 Quantum vortex dynamics by structural complexity analysis

**Renzo L. Ricca** (U. Milano-Bicocca & Beijing U. Technology)

Here we show how structural complexity methods based on recent results of geometric and topological fluid mechanics can be usefully applied to predict fundamental aspects of quantum vortex dynamics. By using a method based on the interpretation of classical linear and angular momentum in terms of signed areas of projected graphs [1] we show how to compute physical information in absence of analytical results. The linear momentum associated with quantum vortex evolution governed by the Gross-Pitaevskii equation is determined by analysing the case of interacting vortex rings, links [2] and torus knots. Then, by introducing adapted polynomials for fluid knots such as HOMFLYPT [3], we show that this polynomial is the best quantifier [4] to detect the process of vortex knots cascade due to a sequence of single reconnection events. These results could be usefully implemented in DNS diagnostics to analyze the evolution of complex vortex tangles.

[1] Ricca, R.L. (2008) Momenta of a vortex tangle by structural complexity analysis. *Physica* D **237**, 2223-2227.
[2] Zuccher, S. & Ricca, R.L. (2017) Relaxation of twist helicity in the cascade process of linked quantum vortices. *Phys. Rev. E* **95**, 053109.
[3] Liu, X. & Ricca, R.L. (2015) On the derivation of HOMFLYPT polynomial invariant for fluid knots. *J. Fluid Mech.* **773**, 34-48.
[4] Ricca, R.L. & Liu, X. (2018) HOMFLYPT polynomial is the best quantifier for topological cascades of vortex knots. *Fluid Dyn. Res.* **50** 011404.

11:45-12:30 Statistical theory of reversals in two-dimensional confined turbulent flows

**Marc Brachet** (Ecole Normale Supérieur)

The truncated Euler equation is a finite set of ordinary differential equations for the amplitude of the large-scale modes. It is shown to correctly describe the transitional dynamics in the turbulent regime of a confined 2D Navier-Stokes flow with bottom friction and periodic forcing. A minimal 13-mode model is presented.

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