Oscillating patterns and Navier-Stokes equations

Yves Meyer

Ecole Normale Superieure de Cachan
61, Avenue du President Wilson
94235 Cachan cedex, France
E-mail: Yves.Meyer@cmla.ens-cachan.fr

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This series of lectures is aimed to illustrate the following paradigm: proving size estimates on solutions of nonlinear evolution equations often relies on understanding some unexpected cancellation properties. These cancellations will be either imposed on the initial condition, or be satisfied by the solution itself whenever it is localized in space or time variable.

Navier-Stokes equations are describing the motion of some incompressible fluid filling the space. This motion will be analyzed when there are no external forces and no boundaries. The four problems which will be studied are (1) the existence of global solutions (no blowup in finite time), (2) the rate of energy decay as time tends to infinity, (3) the localization of solutions with respect to the space variable, (4) the localization of the vorticity and the celebrated coherent structures.

These lectures are based on new and still unpublished material