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# Rigorous and turbulent Taylor-Green flow

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In 1936 G. I. Taylor and A. E. Green commenced a study of the mechanisms by which large "eddies", i.e. flow structures with some coherence and pertinence, produce smaller ones. They envisioned these mechanisms to explain the "energy cascade" in developed turbulence. Generally, turbulence is forced at large spatial scales, e.g. through interaction with material boundaries, and dissipated through viscous damping at small scales. In between these extremes a regime exists in which nonlinear interactions dominate the fluid motion and, on the average, energy cascades towards small scales. Taylor and Green remark that, for the study of this regime, "(...) the extreme limitations of mathematical methods are very evident, for it is only in special cases where the initial motion is such that one of the essential features of turbulent motion (...) is absent that the subsequent motion has so far been calculated."

We will present an overview of dynamics of Taylor-Green flow, starting from rigorous results on equilibrium and time-periodic motion that, indeed, miss essential features of turbulence. We will present numerical evidence for the existence of periodic orbits that reproduce turbulent dynamics and pose their rigorous computation as an open challenge.

*Joint work with Jan-Bouwe van de Berg, Jean-Philippe Lessard and Maxime Breden.*

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