The incompressible Navier–Stokes–Maxwell system

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Abstract

The incompressible Navier-Stokes-Maxwell system is a classical model describing the evolution of a plasma. Although small smooth solutions (*à la* Fujita-Kato) are known to exist, the existence of large weak solutions (*à la* Leray) in the energy space remains unknown. This defect can attributed to the difficulty of coupling the Navier-Stokes equations with a hyperbolic system. In a recent collaboration with Isabelle Gallagher (ENS Paris), we aim at building solutions in large functional spaces. More precisely, for any initial data with finite energy, we show that a smallness condition on the electromagnetic field alone is sufficient to grant the existence of global solutions. The proof relies on new estimates on the heat flow which allow us to completely bypass the use of Chemin-Lerner spaces. These spaces are notoriously badly behaved in Gr'onwall-type arguments. Thus, these new parabolic estimates play a crucial role in our proof and could be of independent interest.

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