Abstract Submitted
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Non-stationary boundary layers and energy dissipation in incompressible flows MARIE FARGE, Ecole Normale Superieure, Paris, France, ROMAIN NGUYEN VAN YEN, Freie Universitaet, Berlin, Germany, KAI SCHNEIDER, Aix-Marseille University, Marseille, France — We argue that d'Alembert paradox (1749) is still unresolved for very large Reynolds number flows. Prandtl (1904) assumed that there exists a viscous boundary layer attached to the wall and predicted that the drag force dissipates energy there at a rate proportional to $Re^{-1/2}$. Kato (1984) proved that, in the limit of infinite Reynolds number, the energy dissipation rate tends to zero if and only if the solution of the Navier-Stokes equation converges towards the solution of the Euler equations (with the same initial data) and then occurs in a very thin boundary layer of thickness proportional to Re^{-1}. By performing direct numerical simulations of a dipole crashing into a wall we show that Kato's scaling is more appropriate than Prandtl's scaling as soon as the boundary layer detaches from the wall. Details can be found in Nguyen van yen, Farge and Schneider, PRL 106, 184502 (2011).

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