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A New Type of Regularity Criterion for the 3D Navier-Stokes Equations

We present a new kind of regularity criterion for the global well-posedness problem of the three dimensional Navier-Stokes equations in the whole space. The main novelty of this new criterion is that it involves the shape of the magnitude of the velocity. More specifically, we prove that if for every fixed time in $(0, T)$, the region of high velocity, appropriately defined with a parameter q, shrinks fast enough as $q \nearrow \infty$, then the solution stays regular beyond T. We further argue that reasonable flows satisfy our criterion, and singularity in Navier-Stokes is highly unlikely.

This is joint work with Prof. Chuong V. Tran of the University of St. Andrews, United Kingdom.