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Xinwei Yu* (xinweiyu@math.ucla.edu), Math. Dept., UCLA Box 951555, Los Angeles, CA 90095, and **Thomas Y Hou, Ruo Li** and **Jian Deng**. *Level Set Dynamics and the Non-blowup of the 2D Quasi-geostrophic Equation*.

The 2D Surface Quasi-geostrophic (SQG) equation describes the transportation of an "active scalar" by a divergence free velocity field. It draws much interest in the PDE community recently after being suggested by Constantin, Majda and Tabak as a non-trivial model for the study of possible finite time singularity formation for the 3D incompressible Euler equations. It turned out that whether there are finite time singularities in the 2D SQG flow is also a very challenging problem and remains open today. In this talk, I will present a novel approach for the study of the singularity problem for the SQG equation. It estimates the growth of the gradient of the active scalar from a pure Lagrangian point of view. Under certain assumptions, this new approach excludes the formation of singularities and furthermore yields sharp growth estimates. I will further present numerical simulations which suggest that the aforementioned assumptions are practical and therefore reasonable. I will also mention recent progresses of the theoretical and numerical study of the singularity problem for the 3D incompressible Euler equations. (Received February 24, 2006)