Ciprian Foias, Michael S Jolly* (msjolly@indiana.edu), Ruomeng Lan, Rishika Rupam, Yong Yang and Bingsheng Zhang. Time analyticity with higher norm estimates for the 2D Navier-Stokes equations.

We present bounds on norms of all orders for solutions on the global attractor $\mathcal{A}$ of the 2D Navier-Stokes equations, complexified in time. Specifically, for periodic boundary conditions on $\Omega = [0, L]^2$, and a force $g \in \mathcal{D}(A^{\alpha - \frac{3}{2}})$, we show there is a fixed strip about the real time axis on which a uniform bound $|A^{\alpha} u| < m_\alpha \nu \kappa_0^\alpha$ holds for each $\alpha \in \mathbb{N}$. Here $A$ is the Stokes operator, $\nu$ is viscosity, $\kappa_0 = 2\pi/L$, and $m_\alpha$ is explicitly given in terms of $g$ and $\alpha$. We show that if any element in $\mathcal{A}$ is in $\mathcal{D}(A^\alpha)$, then all of $\mathcal{A}$ is in $\mathcal{D}(A^\alpha)$, and likewise with $\mathcal{D}(A^\alpha)$ replaced by $C^\infty(\Omega)$. We demonstrate the universality of this “all for one, one for all” law on the union of a hierarchal set of function classes. Finally, we treat the question of whether the zero solution can be in the global attractor for a nonzero force by showing that if this is so, the force must be in a particular function class. (Received September 17, 2013)