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**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  $g \in \mathcal{D}(A^{\frac{\alpha-1}{2}})$ , 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)