Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

On the origin of the drag force on golf balls ELIAS BALARAS, George Washington University, NIKOLAOS BERATLIS, KYLE SQUIRES, Arizona State University — It is well establised that dimples accelerate the drag-crisis on a sphere. The result of the early drag-crisis is a reduction of the drag coefficient by more than a factor of two when compared to a smooth sphere at the same Reynolds number. However, when the drag coefficients for smooth and dimpled spheres in the supercritical regime are compared, the latter is higher by a factor of two to three. To understand the origin of this behavior we conducted direct numerical simulations of the flow around a dimpled sphere, which is similar to commercially available golf balls, in the supercritical regime. By comparing the results to those for a smooth sphere it is found that dimples, although effective in accelerating the drag crisis, impose a local drag-penalty, which contributes significantly to the overall drag force. This finding challenges the broadly accepted view, that the dimples only indirectly affect the drag force on a golf ball by manipulating the structure of the turbulent boundary layer near the wall and consequently affect global separation. Within this view, typically the penalty on the drag force imposed by the dimples is assumed to be small and coming primarily from skin friction. The direct numerical simulations we will report reveal a very different picture.

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Date submitted: 01 Aug 2017 Electronic form version 1.4