Abstract Submitted for the DFD05 Meeting of The American Physical Society

Three-dimensional instabilities in detached boundary layers FRANCOIS GALLAIRE, Laboratoire J. A. Dieudonné, Université de Nice-Sophia Antipolis-CNRS, Nice, France, MATTHIEU MARQUILLIE, Laboratoire de Mécanique de Lille, Université des Sciences et Technologies de Lille, Lille, France, UWE EHRENSTEIN, Laboratoire J. A. Dieudonné, Université de Nice-Sophia Antipolis-CNRS, Nice, France — The three-dimensional direct numerical simulation of the incompressible Navier-Stokes equations of the flow above a bump at a Reynolds number of Re=400 shows stationary streamwise elongated structures in the wake of the bump. A three-dimensional global mode linear analysis is used to interpret these results and shows that the most unstable eigenmode is steady and localized in the recirculation bubble, with spanwise wavelength approximatively ten bump heights. What is the physical mechanism at the origin of this instability? Is this a Görtler instability, a centrifugal instability? These questions motivate an inviscid geometrical optics analysis along closed streamlines, which identifies the most unstable streamline in the flow. We then show that this method, though designed for short wave inviscid instabilities, provides a quantitatively correct estimate of the growth-rate, once suitably modified to take into account viscous effects.

> Jean-Marc Chomaz LadHyX-Ecole Polytechnique-CNRS

Date submitted: 04 Aug 2005

Electronic form version 1.4