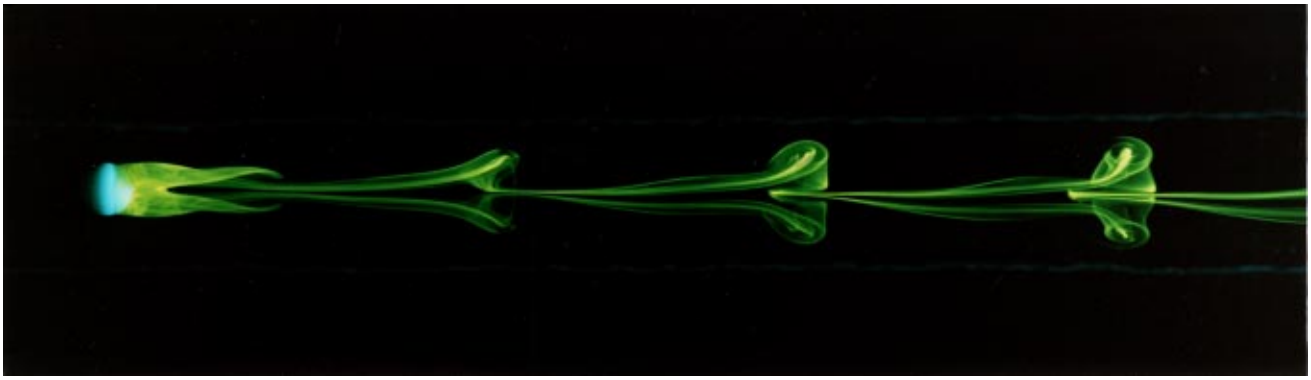

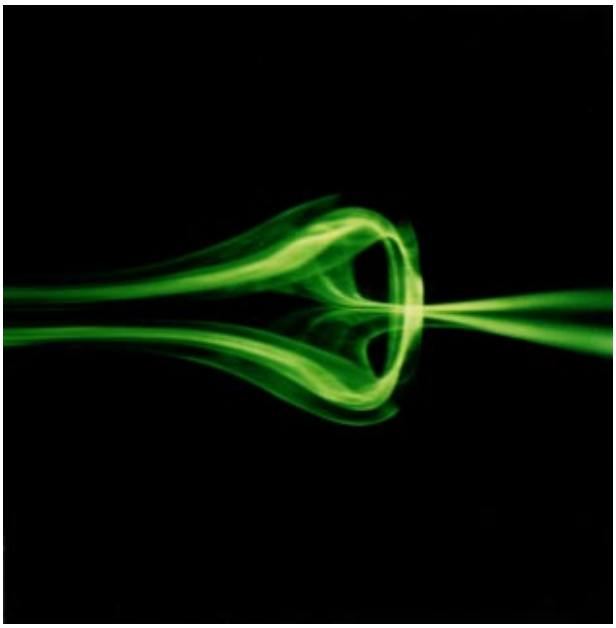

VORTEX DYNAMICS IN THE WAKE OF A SPHERE

Submitted by T. Leweke, M. Provansal, D. Ormières, and R. Lebescond
(**IRPHE, CNRS/Universités Aix-Marseille, France**)

We present experimental visualizations of the flow structure in the wake of a sphere, at a Reynolds number just above the threshold for the onset of periodic wake oscillations. The flow was studied in a water channel, where the sphere of diameter 1 cm was held by a small rod from upstream. Visualization was achieved using fluorescent dye illuminated by laser light.

The first transition occurring in the sphere wake is associated with a loss of the wake's rotational symmetry, while the flow still remains stationary. In this state the recirculation region immediately behind the sphere divides itself into two parallel threads.

The upper photograph shows the flow at a Reynolds number of 320, based on the sphere diameter. Here the wake has undergone a second transition to a time-dependent state, which is characterized by a periodic shedding of vortex loops, connected by counterrotating pairs of vortex filaments. When the wake is viewed from a different angle, it may be (and has often been) misinterpreted as having a helical structure. However, the upper image clearly shows the existence of a reflectional symmetry with respect to a plane going through the sphere center.

The lower photographs show a close-up of the oscillating wake at about seven diameters behind the sphere, seen simultaneously from two perpendicular directions. They give a detailed view of the connection between the horseshoe-type vortex loop and the trailing legs of the loop shed in the previous cycle of the wake oscillations.

These visualizations demonstrate that, even at very low Reynolds numbers, the wake of a sphere placed in a uniform flow has a surprisingly complex spatial structure.

1070-6631/99/11(9)/12/1/$15.00