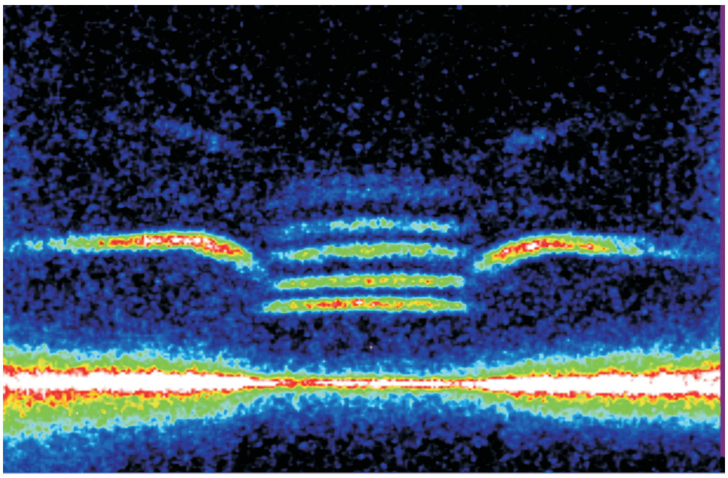
A look at the invisible
Laser diagnostics of gas flows

Nico Dam
Applied Physics group, University of Nijmegen

Fluid dynamics is a classical, but by no means obsolete branch of science, dealing with transport phenomena in fluids (that is, liquid or gas). It is also a ubiquitous component of our daily lives, so everyone, in a sense, is an emperical expert on the subject: the wind is always against you when you are biking, vortices in a draining sink always rotate counter-clockwise (on the Northern hemisphere), and the dimples in the surface of a golf ball are not just cosmetic but make them fly farther.

Experimental fluid dynamics often deals with an invisible medium: air. Drag, lift and wind chill are typically air-motion-induced phenomena that you can feel, but not see. Traditional methods in experimental fluid dynamics typically employ particulate tracers to visualize air flows. Such methods inevitably perturb the flow they are presumed to faithfully represent. All-optical methods are obvious candidates for non- (or at least much less-)intrusive flow diagnostics. Research into these methods has focussed on laser-induced fluorescence imaging of density fields, especially in combustion where chemical species selectivity and trace amounts are an issue. Of course, there are alternative methods, and other parameters than density can be measured as well.

In my talk I will present some recent developments in laser-based flow diagnostics, with an emphasis on Raman imaging of density fields and flow velocity imaging using Molecular Tagging Velocimetry.



Displacement field in an underexpanded air jet,
visualized by Molecular Tagging Velocimetry.