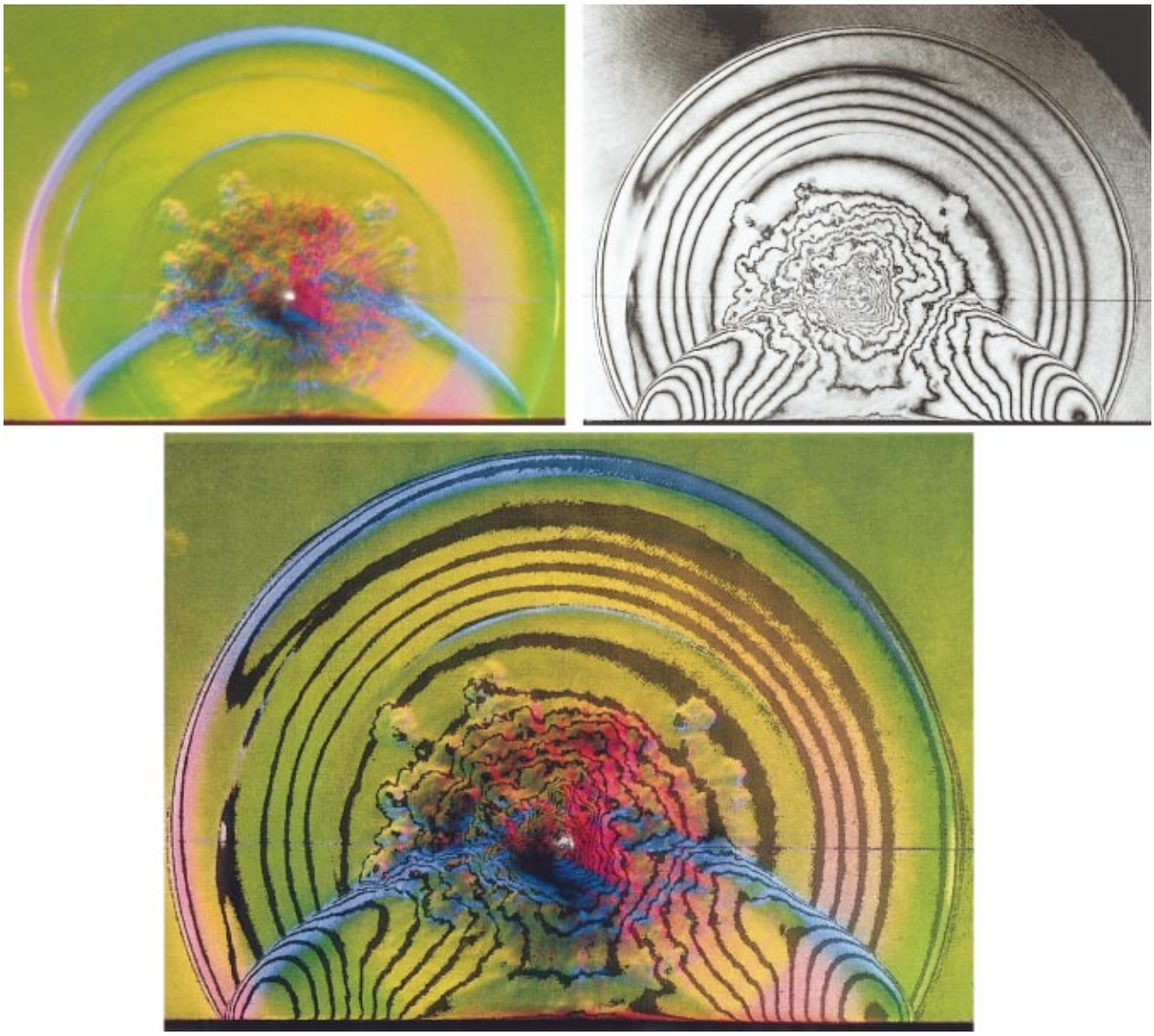

Combined Schlieren and Interferometry Visualization of Blast Waves

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The methods to visualize compressible fluid flows can be classified into three different groups, depending on the derivative of the density that they record (shadow, schlieren, and interferometry). Each method has its inherent strengths and shortcomings, where the latter can sometimes cause a misinterpretation of the observed flow phenomena. For a complete and unambiguous investigation of a compressible flow it is therefore desirable to apply more than just one visualization technique. In flows with a low degree of reproducibility, this multiple visualization has to be conducted si multaneously, i.e., in the same experiment and at the same instant.

One possible combination of visualization methods consists of a holographic interferometer and a color schlieren apparatus. This system yields two records of the flow, one interferogram, in which the density distribution is represented by modulations of intensity (fringes) and a schlieren record, which displays the density gradient (here, the direction of the gradient) by different hues. The two images can be analyzed individually or superimposed.

An example of this combined visualization is shown above: A small explosive charge (10 mg of silver azide, AgN_3), suspended by a thin nylon thread 30 mm above a rigid wall and ignited by the pulse of a Nd:YAG laser, generates a blast wave that reflects from the wall. The visualization shows the primary incident and reflected waves as well as the cloud of combustion products and the secondary wave, which at the instant shown has also reflected from the wall. The image is taken 120 μs after ignition close to the point where the reflection pattern of the primary wave changes from regular reflection to Mach reflection.