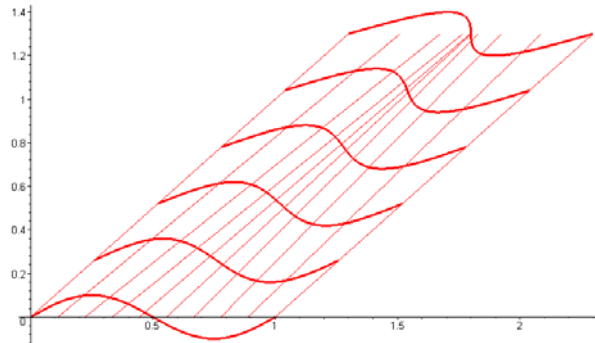


## A micro flow problem for ultrasound



Nonlinear evolution in time of a sound wave.  
The profile is gradually deformed and a shock wave is formed.

The mean free path in air under standard conditions is  $\ell = 50$  nm. The Navier-Stokes equations are valid for sound waves with wavelength  $\lambda$  larger than  $20\ell = 1\mu\text{m}$ . In order to reach smaller wavelengths, new equations are proposed. They are accurate to second order in  $\ell/\lambda$ , whereas the Navier-Stokes equations are accurate to first order only. The project is to study numerically the evolution of a large amplitude nonlinear sound wave by these equations. High accuracy in the numerical solution is important, and since the problem is periodic in space, it is suggested that a Fourier method is used for the spatial discretization.

The project is supervised by Gunilla Kreiss, Nada, on the numerical aspects and Lars Söderholm, Mekanik, on the physical aspects.