

## The Formation of Shocks in 3-Dimensional Fluids

In this lecture I shall summarize the contents of my recent monograph. The monograph considers the relativistic Euler equations in three space dimensions for a perfect fluid with an arbitrary equation of state. We consider regular initial data on a spacelike hyperplane  $\Sigma_0$  in Minkowski spacetime which outside a sphere coincide with the data corresponding to a constant state. We consider the restriction of the initial data to the exterior of a concentric sphere in  $\Sigma_0$  and we consider the maximal classical development of this data. Then, under a suitable restriction on the size of the departure of the initial data from those of the constant state, we prove certain theorems which give a complete description of the maximal classical development. In particular, the theorems give a detailed description of the geometry of the boundary of the domain of the maximal classical development and a detailed analysis of the behavior of the solution at this boundary. A complete picture of shock formation in three-dimensional fluids is thereby obtained. Also, sharp sufficient conditions on the initial data for the formation of a shock in the evolution are established and sharp lower and upper bounds for the temporal extent of the domain of the maximal solution are derived.

The reason why we consider only the maximal development of the restriction of the initial data to the exterior of a sphere is in order to avoid having to treat the long