JEFFREY GROAH
JOEL SMOLLER
BLAKE TEMPLE

Shock Wave Interactions in General Relativity

A Locally Inertial Glimm Scheme for Spherically Symmetric Spacetimes

Springer Monographs in Mathematics

Springer

GROAH · SMOLLER · TEMPLE
Shock Wave Interactions in General Relativity: A Locally Inertial Glimm Scheme for Spherically Symmetric Spacetimes

This monograph is a self contained mathematical treatment of the initial value problem for shock wave solutions of the Einstein equations in General Relativity. The first two chapters provide background for the introduction of a locally inertial Glimm Scheme, a non-dissipative numerical scheme for approximating shock wave solutions of the Einstein equations in spherically symmetric spacetimes. What follows is a careful analysis of this scheme providing a proof of the existence of (shock wave) solutions of the spherically symmetric Einstein equations for a perfect fluid, starting from initial density and velocity profiles that are only locally of bounded total variation. In particular, the result establishes the consistency of the Einstein equations at the level of shock waves in a class of curved spacetimes rich enough to incorporate the interaction of arbitrary numbers of shock waves of arbitrary strength. The book covers the initial value problem for Einstein's gravitational field equations with fluid sources and shock wave initial data. It has a clearly outlined goal: proving a certain local existence theorem. Concluding remarks are added and commentary is provided throughout. The book will be useful to graduate students and researchers in mathematics and physics.

Blake Temple, who organized these notes from research articles with the other two authors, is currently a Professor of Mathematics, and Chair of the Graduate Group in Applied Mathematics, at the University of California, Davis. Joel Smoller teaches Mathematics at the University of Michigan, and Jeffrey Groah is at the Department of Mathematics, Montgomery College, Conroe, Texas.

ISBN 0-387-35073-x