

Foreword

Ron DiPerna was a uniquely talented mathematician. After receiving his Ph. D. in 1972 at the Courant Institute under James Glimm, he spent the next 8 years as the leading young researcher in systems of conservation laws in a single space variable. Following Glimm and Lax, he made many important new contributions to this difficult subject including the systematic use of geometric measure theory for regularity theory, sharp decay estimates, and uniqueness of solutions. Beginning in 1980, his work on hyperbolic conservation laws was strongly influenced by the ideas of Tartar and Murat involving compensated compactness, Young measures, and the weak topology. DiPerna developed novel applications of these ideas culminating in 1983 with the first global existence theorems for isentropic flow with large data. For the remainder of his scientific career DiPerna focused on problems involving the special role of the weak topology for nonlinear partial differential equations from fluid mechanics and kinetic theory. From 1985 to 1987, DiPerna and I collaborated on theories of oscillations and concentrations for incompressible fluid flow including the special mathematical structure that occurs for important physical problems such as vortex sheets. Our joint work was strongly influenced by ideas of P. L. Lions and Brezis among others involving concentration in variational problems with critical Sobolev exponents. From 1987 until 1989 DiPerna collaborated with P. L. Lions and together they developed the first global existence theorems for suitable weak solutions of the Boltzmann equation among many other important applications to transport theory. One important component of this work was the novel velocity averaging method first introduced by Golse, Perthame and Sentis.

This volume consists of several current research papers which both emphasize the vital role which many of DiPerna's ideas have on contemporary research in nonlinear partial differential equations and also stress his special relationship with the French community in nonlinear P.D.E. Ron DiPerna died tragically in January 1989 after a courageous struggle with cancer. He was a warm and loyal friend for many of us with a sharp wit and keen sense of humor. He left us too soon and at the height of his creative scientific power. This volume indicates that many of his ideas and contributions will influence our scientific community into the distant future.

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