

Existence and Uniqueness of Solutions to the Generalized Hydrodynamics Equation

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Abstract

The generalized hydrodynamics (GHD) equation is the equivalent of the Euler equations of hydrodynamics for integrable models. Systems of hyperbolic equations such as the Euler equations usually develop shocks and are plagued by problems of uniqueness. We establish for the first time the existence and uniqueness of solutions to the full GHD equation and the absence of shocks, from a large class of initial conditions with bounded occupation function. We assume only absolute integrability of the two-body scattering shift. In applications to quantum models of fermionic type, this includes all commonly used physical initial states, such as locally thermal states and zero-entropy states. We show in particular that differentiable initial conditions give differentiable solutions at all times and that weak initial conditions such as the Riemann problem have unique weak solutions which preserve entropy. For this purpose, we write the GHD equation as a new fixed-point problem (announced in a companion paper). We show that the fixed point exists, is unique, and is approached, under an iterative solution procedure, in the Banach topology on functions of momenta.

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Generalized Hydrodynamics For The Diffus

R. Pecora



Generalized Hydrodynamics For The Diffus:

Generalized Hydrodynamics for the Diffusion Process Ignatz de Schepper, 1974 Hydrodynamic Scales Of Integrable Many-body Systems Herbert Spohn, 2024-02-27 This book provides a broad introduction to integrable systems with many degrees of freedom Within a much larger orbit discussed are models such as the classical Toda lattice Calogero fluid and Ablowitz Ladik discretized nonlinear Schrödinger equation On the quantum mechanical side featured are the Lieb Liniger delta Bose gas and the quantum Toda lattice As a genuinely novel twist the study deals with random initial data described by generalized Gibbs ensembles with parameters of slow spatial variation This is the hydrodynamic scale in spirit similar to the ballistic Euler scale of nonintegrable simple fluids While integrable microscopic particle models are very diverse the central theme of this book is to elucidate their structural similarity on hydrodynamic scales **Diffusion in Condensed Matter** Paul Heitjans, Jörg Kärger, 2006-01-16 Diffusion as the process of particle transport due to stochastic movement is a phenomenon of crucial relevance for a large variety of processes and materials This comprehensive handbook style survey of diffusion in condensed matter gives detailed insight into diffusion as the process of particle transport due to stochastic movement Leading experts in the field describe in 23 chapters the different aspects of diffusion covering microscopic and macroscopic experimental techniques and exemplary results for various classes of solids liquids and interfaces as well as several theoretical concepts and models Students and scientists in physics chemistry materials science and biology will benefit from this detailed compilation Nonequilibrium Statistical Mechanics Biman Bagchi, 2023-11-21 Nonequilibrium statistical mechanics NESM practically synonymous with time dependent statistical mechanics TDSM is a beautiful and profound subject vast in scope diverse in applications and indispensable in understanding the changing natural phenomena we encounter in the physical chemical and biological world Although time dependent phenomena have been studied from antiquity the modern subject the nonequilibrium statistical mechanics has its genesis in Boltzmann's 1872 classic paper that aimed at extending Maxwell's kinetic theory of gases by including intermolecular interactions Subsequent development of the subject drew upon the seminal work of Einstein and Langevin on Brownian motion Rayleigh and Stokes on hydrodynamics and on the works of Onsager Prigogine Kramers Kubo Mori and Zwanzig One major goal of this book is to develop and present NESM in an organized fashion so that students can appreciate and understand the flow of the subject from postulates to practical uses This book takes the students on a journey from fundamentals to applications mostly using simple mathematics and fundamental concepts With the advent of computers and computational packages and techniques a deep intuitive understanding can allow the students to tackle fairly complex problems like proteins in lipid membranes or solvation of ions in electrolytes used in batteries The subject is still evolving rapidly with forays into complex biological events and materials science Nonequilibrium Statistical Mechanics An Introduction with Applications is thus an introductory text that aims to provide students with a background and skill essential to study and understand time dependent relaxation

phenomena It will allow students to calculate transport properties like diffusion and conductivity The book also teaches the methods to calculate reaction rate on a multi dimensional energy surface in another such application For a beginner in the field especially for one with an aim to study chemistry and biology and also physics one major difficulty faced is a lack of organization of the available study material Since NESM is a vast subject with many different theoretical tools the above poses a problem This book lays the foundations towards understanding time dependent phenomena in a simple and systematic fashion It is accessible to students and researchers who have basic training in physics and mathematics The book can be used to teach advanced undergraduates Some involved topics like the projection operator technique and mode coupling theory are more suitable for Ph D level

Structure and Functional Properties of Colloidal Systems Roque Hidalgo-Alvarez, 2009-11-18 Integrating fundamental research with the technical applications of this rapidly evolving field Structure and Functional Properties of Colloidal Systems clearly presents the connections between structure and functional aspects in colloid and interface science It explores the physical fundamentals of colloid science new developments of synthesis *Structure and Dynamics of Strongly Interacting Colloids and Supramolecular Aggregates in Solution* Sow-Hsin Chen, John S. Huang, Piero Tartaglia, 2012-12-06 During the last decade various powerful experimental tools have been developed such as small angle X ray and neutron scattering X ray and neutron reflection from interfaces neutron spin echo spectroscopy and quasi elastic multiple light scattering and large scale computer simulations Due to the rapid progress brought about by these techniques one witnesses a resurgence of interest in the physicochemical properties of colloids surfactants and macromolecules in solution Although these disciplines have a long history they are at present rapidly transforming into a new interdisciplinary research area generally known as complex liquids or soft condensed matter physics names that reflect the considerable involvement of the chemical and condensed matter physicists This book is based on lectures given at a NATO ASI held in the summer of 1991 and discusses these new developments both in theory and experiment It constitutes the most up to date and comprehensive summary of the entire field

Dynamic Light Scattering R. Pecora, 2013-11-11 In the twenty years since their inception modern dynamic light scattering techniques have become increasingly sophisticated and their applications have grown exceedingly diverse Applications of the techniques to problems in physics chemistry biology medicine and fluid mechanics have proliferated It is probably no longer possible for one or two authors to write a monograph to cover in depth the advances in scattering techniques and the main areas in which they have made a major impact This volume which we expect to be the first of a series presents reviews of selected specialized areas by renowned experts It makes no attempt to be comprehensive it emphasizes a body of related applications to polymeric biological and colloidal systems and to critical phenomena The well known monographs on dynamic light scattering by Berne and Pecora and by Chu were published almost ten years ago They provided comprehensive treatments of the general principles of dynamic light scattering and gave introductions to a wide variety of applications but naturally they could not

treat the new applications and advances in older ones that have arisen in the last decade The new applications include studies of interacting particles in solution Chapter 4 scaling approaches to the dynamics of polymers including polymers in semidilute solution Chapter 5 the use of both Fabry Perot interferometry and photon correlation spectroscopy to study bulk polymers Chapter 6 studies of micelles and microemulsions Chapter 8 studies of polymer gels Chapter 9 Pattern Formation and Lattice gas Automata Anna T. Lawniczak,1996 Articles review the diverse recent progress in the theory and development of lattice gas and lattice Boltzmann methods and their applications It features up to date articles takes an interdisciplinary approach including mathematics physical chemistry and geophysics *Philosophical Transactions* ,2004 *Dissertation Abstracts International* ,1976 *Acta Physica Polonica* ,1977 Section A includes general physics solid state physics applied physics **Encyclopedia of Physical Science and Technology** ,1992 *Physics Briefs* ,1994 **International Aerospace Abstracts** ,1996 **La diffusion de la lumière par les fluides. Paris, 15-17 juillet 1971** ,1972 **Diffusion and Defect Data** ,1985 Dynamics of Fluids in Hierarchical Porous Media John H. Cushman,1990 Recent years have produced an explosion of research on the transport of fluid mixtures in natural heterogeneous porous media During this period it has become apparent that many if not most porous media such as soil and geologic formations possess a hierarchical structure This text ties together the most recent and powerful theoretical computational and experimental methods for studying such media It provides the stimulus necessary to bring about a successful resolution of many of the complex problems associated with transport in natural porous media be they in a groundwater contamination or a petroleum engineering context **Spectroscopy of Condensed Media** C.H. Wang,1985-04-28 Spectroscopy of Condensed Media Dynamics of Molecular Interactions discusses the use of molecular spectroscopy including nuclear magnetic resonance NMR and nonlinear optical spectroscopy in dynamic processes in condensed molecular systems The book reviews relationship between transition probability and the time correlation function of an isotropic electric dipole system linear response theory and light scattering resulting from the translational motion of molecules in fluids The text describes molecular rotation theories of angular momentum nuclear magnetic resonance and spontaneous and coherent Raman effects Closely related with the Raman and Brillouin scattering are vibrational dephasing relaxation processes and dynamics of phase transition solids The book highlights the advantages of using NMR and also explains the basic concepts such as local field spin temperature and effective Hamiltonians that are employed in interpreting NMR experiments The investigator can use nonlinear optical spectroscopy to study condensed matter The text also cites two methods in which the investigator can control the time dependent average Hamiltonian by 1 manipulating the intensity timing phase of the pulses or 2 by sample spinning The book is intended for advanced graduate students in physical chemistry that will equally benefit both investigators and scientists involved in physics research *Chemical Abstracts* ,1929 **Zeitschrift für Naturforschung** ,1977

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