

Preface

This book was written during my stay at the Center for Space Plasma and Aeronomic Research (CSPAR) at the University of Alabama in Huntsville, between the years 2010 and 2014. During that time, Prof. Dr. Gary Zank was giving the lecture on *Transport Processes in Astrophysics*, which included many problems from the fields of statistics, transport theory (particle transport and turbulence transport), diffusion theory, and many more. I had the great pleasure to teach some of the classes and to help him grade the classwork. Since many of the problems were quite complex and intricate at times, I found it conducive to collect and solve those problems in a comprehensive way and to organize them in this book.

Therefore, this book is what it is: a solution manual providing detailed and extensive descriptions of the solutions to nearly all problems given in the lecture notes *Transport Processes in Space Physics and Astrophysics (Lecture Notes in Physics)* by Gary P. Zank, see [5], and on multiple occasions in this book we refer to the lecture notes for further reading.

At the beginning of each section, we give a brief introduction and repetition of all information necessary to understand the problems and solutions. However, it has to be clear that this book cannot substitute the lecture notes and, therefore, should be understood as a supplement to it. The reader is also referred to any textbooks in physics and math related to this topic.

Note that some problems and equations have been altered from the lecture notes to be more consistent with the terminology in this book or to clarify the concept of the problem itself. For example, Problem 3.3 has been extended by some subquestions to provide a better idea of the steps necessary to solve the problem. Some equations have been corrected, for example Eq. (2.112), compare with Eq. (3.33) in the lecture notes, and for the sake of brevity (and to avoid too many repetitions) some problems have been omitted altogether. For example, the problems in Sect. 5.2 from the lecture notes (Transport Equation for Relativistic Charged Particles) have not been included in this book, since they are similar to the preceding Sect. 5.1. (5.1.1 The Focussed Transport equation).

I want to thank Prof. Dr. Gary Zank for this wonderful opportunity to write this book and the freedom I had in writing it. The many conversations and discussions

I had with him about this solution book and his lecture notes gave me a deep insight into the field of *Transport Processes in Astrophysics* and certainly a better understanding for many of the problems in this book. I want to thank him especially for reading the manuscript and his numerous explanations, which made the solutions much more readable and understandable. However, despite careful readings of the manuscript, I cannot rule out any errors, typos, or mislabeling. Needless to say that all remaining errors are my own.

I also want to thank my colleagues at CSPAR, for their valuable discussions and comments regarding some specific problems.

Lastly, I want to thank all the students who so tenaciously and thoroughly worked through all the problems. Their comments and discussions helped tremendously to improve the readability of this solution book. With their valuable comments and discussions, I was able to go into more detail where it was necessary and leave things out that were only of minor importance.

I hope that this book might be helpful not only to students but also to researchers and anyone who is interested in the exciting field of astrophysics.

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Problems and Solutions

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