

Preface

This book is the written version of my Conference Board of Mathematical Sciences (CBMS) lectures presented during the week of June 10, 2002, at Eastern Illinois University in Charleston, Illinois. The ten lectures centered on my first and persistent academic love—the Newtonian N -body problem.

While some experts actively participated in the sessions, this conference fully lived up to the intent of the CBMS series in that most of the attendees were graduate students, new-comers to the field, or curious mathematicians wishing to learn something about this fascinating topic. Accordingly, the goals of the lectures quickly changed from a technical presentation appropriate primarily for “experts,” to presentations now intended to introduce everyone to the basic structure of N -body systems, to identify certain persistent research themes, and, hopefully, to recruit active participants to this fascinating research area. As such, during each lecture several unsolved research problems were described: some of them are included here.

The new goals for the lectures changed the nature, content, expository tone, and even the subject matter to make the presentations more responsive to the specific interests of the participants while addressing their many questions. For instance, I included more introductory material than originally planned: in retrospect, this was an excellent addition.

The content and approach of this book mimic the changed goals of the lectures; e.g., in addition to new material, you will find discussions intended to develop intuition, introductory material, occasional anecdotes, and descriptions of open problems. To provide cohesion for each chapter, some of the material revolves about unsolved research problems—where the motivating role of the problem may be of more value than the actual problem. In Chap. 1, for instance, much of the discussion is intended to lead to an unresolved issue about the weird dynamics exhibited in the F-ring of Saturn. In Chap. 2, the discussion is tied together via a conjecture involving the diameter of the N -body system. In Chap. 3, the unifying problems involve the important issue of finding certain N -body configurations, which leads to

a discussion of the rings of Saturn. In Chap. 4, the issue involves collisions. The concluding Chap. 5 discusses the likelihood of “bad things happening.” Everyone, from novices to experts, will find something new.

Some results are new, while others have been presented earlier (e.g., at colloquia, Oberwolfach meetings—particularly several during the 1970s—Midwest Dynamical Systems meetings, a 1983 month long mini-course given in Recife, Brazil while visiting Hildeberto Cabral, in a series of lectures in Paris over 1985-87 hosted by Michael Herman, several informal lectures during 1989 in Barcelona hosted by Jaume Llibre, etc.) and even advertised as “will appear” in fully intended but never completed papers. In other words, many of these results have not been previously published. As most authors of a book quickly discover, the hard part is not to decide what to include, but what to exclude—particularly if a book is to be eventually completed. (Some of the excluded material probably will appear in [90].)

Other results described in this book come from my earlier papers. The particular journals that published these papers are implicitly acknowledged and thanked via the references. But my expository paper [88] “*A visit to the Newtonian n -body via elementary complex variables*” is extensively used to provide structure and motivation for a couple of the chapters, particularly the introductory one, so I want to explicitly thank the MAA for their permission to use it in this manner.

My deep thanks and appreciation go to Patrick Coulton, the chair for this particular CBMS conference, and my long-time friend Gregory Galprin for inviting me to be the CBMS lecturer and for their efforts to assemble a successful CBMS application. I also thank them for their full and active participation in all lectures and extra sessions that they helped to organize, and for everything they did to make the stay so enjoyable for all of us. I want to thank all of the participants for keeping the workshop sessions so lively! My thanks to the Mathematics Department at Eastern Illinois University for their gracious hospitality. My thanks to Ron Rosier and the CBMS for their program that makes these kinds of lectures possible. Thanks to Neal Hulkower: twice at Northwestern he took my year long course on the Newtonian N -body problem (the first in 1969-70), and he still had both sets of lecture notes! His notes proved to be useful in recovering some of my earlier results and arguments. Also thanks to another student (but I do not recall who it was) who gave me a copy of his notes many years ago.

Irvine, California
January, 2005