

Preface

This book aims to present an unified view of three different areas of ultra cold matter, stressing its differences and similarities. We have also tried to reconcile our two complementary and sometimes conflicting attitudes, related with the research motivation and the pedagogical purpose. Most of the book is written with a pedagogical intent, where priority is given to analytical derivations of the main physical concepts and results, over detailed information about the published research literature. Every chapter contains, nevertheless a short discussion on selected experiments and theoretical work. A large number of books have been published on Bose Einstein condensates, but we have approached this subject from a different and somewhat unconventional perspective. Our aim is to suggest a new approach to the problems involved with the production of ultra-cold atoms, Rydberg plasmas and Bose condensates.

We were surprised, during the preparation of this work, with the strong similarities that can be found in the collective processes that can take place in both classical and quantum gases, in neutral gas atoms as well as in plasmas. We have therefore explored the problems of collective modes in condensed and non-condensed cold matter. By covering such different fields and such large areas of knowledge, we could not be exhaustive and complete. We have nevertheless given, for each subject, and whenever possible, references to recent review articles where the reader can find a more detailed account of the literature.

We would like to thank our co-authors in this area, and the stimulating discussions we had with many researchers, with both theoretical and experimental backgrounds. We specially want to thank Robin Kaiser who gave us guidance in the field of atom cooling and confinement, Robert Bingham and Charles Wang for their fresh and innovative approach to quantum coherence, and Padma Shukla for his inspiration in the approach of novel aspects of ultra-cold and strongly coupled plasmas. We also would like to thank Thomas Pohl for very helpful discussions on Rydberg atoms, and Jorge Loureiro for his precious contributions in the exploration of new aspects of collective processes. We also thank Gert Brodin and Mattias Marklund for their support on quantum vacuum problems, and Antonio Serbeto and Gordon Robb for their occasional collaboration on condensates. Research being

a collective process itself, our work results from the contributions of several and sometimes anonymous people. We thank them all.

Lisbon, Portugal
Aubiere Cedex, France

J.T. Mendonça
Hugo Terças

Numa incerta hora fria
perguntei ao fantasma
que força nos prendia

Perguntas, **Carlos Drummond de Andrade**

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Rydberg Plasmas

Mendonça, J.T.; Terças, H.

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