

Preface

If I have seen further it is by standing on the shoulders of giants.

ISAAC NEWTON

This book is based on my master thesis, on which I worked from January 2014 until February 2015 at the Institute for Theoretical Solid State Physics at Karlsruhe Institute of Technology (KIT). The topic regarding the toroidal multipole moments was originally suggested by my supervisor, Professor Carsten Rockstuhl, who had just started to establish a new working group at KIT at the end of 2013. Pointing out some inconsistencies in various derivations and descriptions of the electromagnetic multipole expansion, he motivated me to dig into the depth of the theory of electrodynamics and to find out what's really going on in the multipole expansion.

Soon after I started working, I had the fortune that the working group was joined by an analytically well-experienced postdoctoral researcher, Dr. Ivan Fernandez-Corbaton, who took the role as my advisor and helped me to tackle the sometimes dry theoretical analysis. In the course of time, it became apparent to us that the derivations which argue in favor of the physical significance of toroidal moments are suffering from some assumptions, which turn out to be not justified in general. Condensing these insights then lead to a master thesis which was approved by the supervisors, Prof. Carsten Rockstuhl and Prof. Martin Wegener, and later on also by Springer Spektrum, resulting in their decision to publish it as a book.

At this point, I want to take the chance to express my cordial thanks to several people without them my master thesis and therefore this book would not have been possible. First of all, I would like to thank Prof. Dr. Carsten Rockstuhl for giving me the possibility to work on such an interesting and rewarding topic and for being a great mentor regarding all aspects of research. I would also like to thank Dr. Ivan Fernandez-Corbaton, who did a great job as advisor with his analytical skills and extensive knowledge of literature.

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