Preface

In this book, we present a broader view of relativity in order to understand the fundamental concepts of space, time, and truly universal constants based on the smallest number of postulates. Certain new viewpoints, such as the use of a common time for all observers within a four-dimensional symmetry framework, are non-trivial and need time to digest. The impetus for many of the ideas in this book arose from a term paper (see Appendix B) written by LH for a college physics seminar course in the Fall of 1990. The purpose of that paper was to explore the long-standing question of whether the Lorentz transformation could be unambiguously determined from the results of various experiments. The answer turned out to be negative and this result stimulated our collaboration to step back and look at the big picture of relativity and to explore the physical implications of the principle of relativity — a basic theme of this book.

The distinct features of this book are to stress

(A) a broader view of the relationship between the principle of relativity and our concept of time,

(B) a unification of the spacetime transformations for inertial and non-inertial frames based on limiting Lorentz and Poincaré invariance, and

(C) the truly universal and fundamental constants in both inertial and non-inertial frames.

The title of this edition has been changed to "A Broader View of Relativity — General Implications of Lorentz and Poincaré Invariance" to reflect the focus and the main ideas expounded in the book. The revision for this second edition summarizes our collaborative work performed over the past 15 years. In addition to the new chapters 1, 7, 9, 10, 20, 21, 24, 25 and 27, and new appendices A, B and D, many updates and corrections were made. Moreover, the book has been largely rewritten to reflect updates in our understanding of the conceptual basis of taiji and common relativity including the role that human defined systems of units play in those theories.

Much of the new material is related to the physics of accelerated frames. The physics and spacetime properties of accelerated frames are smoothly connected to those of inertial frames through the limiting Lorentz and Poincaré

invariance because all accelerated frames become inertial frames in the limit of zero accelerations. Quantum electrodynamics and gravity as a (generalized) Yang-Mills theory are discussed in both inertial and non-inertial frames.

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