About this Book

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In my experience, textbook treatments of General Relativity are either highly mathematical with little discussion of concepts or highly conceptual with little discussion of the mathematics. The former is usually designed for graduate students or advanced undergraduates while the latter is designed for a general audience. Very few resources exist that are appropriate for students in their second or third year, and that is the audience that I wanted to reach when I decided to offer my own course in General Relativity.

One excellent resource that I found was *Exploring Black Holes*, the first edition of which was written by Edwin F. Taylor and John Archibald Wheeler but is unfortunately out of print. The second edition is much more comprehensive, and is freely available on Edwin Taylor's website. This particular treatment requires only calculus and avoids differential equations by simply stating the metric and focusing on what we can learn from the metric. I used that book the first two times I taught the course, and it very much inspired the structure and style of this book. I decided to write my own book primarily for two reasons. First, I wanted to introduce four-vectors and index notation. Second, I found the freely available edition of *Exploring Black Holes* to have a little bit too much information to fit into a one-semester course.

For anyone who is already familiar with General Relativity, here are some things you will find:

- metrics
- constants of motion
- effective potential
- four-vectors
- index notation
- the geodesic equation

Here are some things you will *not* find in this book:

- Ricci tensor and its contractions
- Christoffel symbols
- killing vectors
- how to solve the Einstein Field Equations
- stress-energy tensor

One of my goals in writing this book was to keep things concise. This required cutting some content and leaving many derivations as an exercise to the reader.

I have divided the problems in this book into two main types: Exercises and Boxes. Exercises are either conceptual in nature or are meant to test fluency in basic skills. They are intended to be completed in class by the students if possible. All Exercises include answers so that students can review them after class. Boxes are primarily scaffolded derivations and real-world applications that are intended to be done outside of class.