



“Physics in Canada”

Book Review

“La Physique au Canada”

Critique de livre

“**Gravitation**”, by Misner, Thorne, and Wheeler, Princeton University Press, 2017 (reprint from 1973 edition), pp. 1336, ISBN 9780691177793, price 74.95

The Misner-Thorne-Wheeler (known colloquially as MTW) textbook *Gravitation* is a well-loved classic on the topic of general relativity. Originally published in 1973, this 2017 reissue remains largely unchanged; the preface highlights outdated chapters and subjects (e.g., gravitational wave detection) as well as providing a brief summary of concepts which the modern reader should peruse in lieu of updating the actual content of the textbook. MTW is nearly 1300 pages long with 44 chapters divided into 10 parts. The book notably features two “tracks,” interwoven throughout, the first examining introductory material and the second delving into more mathematically intensive topics. Intended for graduate study and above, this book was challenging but not impenetrable for me as a first year graduate student. Too often reading physics feels like reading a laundry list of equations with little conceptual framework; I found *Gravitation*’s detailed written explanations refreshing.

Initially, the “tracks” separating introductory and advanced material struck me as superfluous. Why not just place more advanced material in later chapters, as most textbooks do? As I continued reading, however, I began to see the benefit of keeping related material grouped together. Tracks allow the reader to pick and choose which topics to consider deeply and which to skim without skipping entire chapters of content. Some reviewers of the original MTW claim this makes the book difficult to read sequentially, but I did not find this to be the case.

I am on the fence about this textbook’s use of “boxes.” Allegedly, the boxes cover material which might otherwise be taught in a lecture setting. In some cases I felt this worked well; setting aside certain topics from the main text makes sense. In other cases I felt confused as to why a box was used, e.g., in chapter 31, the Eddington-Finkelstein coordinate system is given a box, but other coordinate systems are described in the body of the chapter. MTW also uses summarizing comments in the margin of its chapters, which I found to be immensely helpful--with the most important concepts set aside, this textbook practically takes notes for you.

MTW is famous for its lengthy written explanations and copious use of figures. For the mathematically gifted who detest reading, this textbook may not be for you; for the rest of us, it is a godsend. Though I have taken a GR course before, the figures in this textbook deepened my conceptual understanding of the topic considerably. Some figures seem needlessly complicated, e.g., figure 1.7 describes a device with walls of lucite and mesh

pockets to catch steel balls--why are the pockets necessary? Why do we need to know the kind of material the walls are made of? I am the first to appreciate detailed writing, but there are some cases where brevity is preferable. Figure captions is one of those cases--a good figure should speak for itself! Though I found myself raising my eyebrows on more than one occasion at captions over a half a page long, the majority of figures are well constructed with captions of appropriate length.

Most exercises in MTW are grouped at the end of each chapter (as is to be expected), but there are a notable minority interspersed throughout the chapters. I cannot recall having seen this in a textbook before. Placing an exercise or two at the end of each section encourages the student to work through the problem immediately after reading the relevant material, which I think is a very smart move. By the time I get to the end of a long chapter, I've forgotten what's at the beginning; exercises at the end of each section act as checkpoints of understanding. More textbooks should do this!

Flaws notwithstanding, the MTW textbook is the only physics textbook I can recall being a pleasure to read. Where dry, jargon-laden writing seems to be the norm, MTW use a conversational tone easily accessible to graduate (and some bright undergraduate) students. If you have a complete conceptual understanding of general relativity and only want a textbook which regurgitates the relevant mathematics, MTW is a bad choice. Otherwise, I cannot recommend this book enough.

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