Misner, Thorne, Wheeler, *Gravitation: A 50-Year Anniversary Celebration*

David Kaiser
The Ups and Downs of Gravity

Worldwide publications on general relativity
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“I believe that more time and effort might well be devoted to the systematic teaching of the theory of relativity than is usual at present at most universities.”

Einstein’s foreword in Bergmann’s 1942 textbook

Throughout the 1950s, most physics PhD programs in the US neither required nor recommended coursework on general relativity, nor included GR on graduate students’ qualifying exams.
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Photographic plate from 1919 eclipse expedition

“The Renaissance of Relativity”
After 1945, publications on GR grew at a faster rate than the overall (exponential) increase across physics.

The rapid rise began before the new experiments (Pound-Rebka gravitational redshift, Shapiro time-delay) or astrophysical discoveries (quasars, CMB).

The timing underscores the importance of institutions, networks, and influential teachers.
What Kind of Book is MTW?

Thought on preface
Mon. 13 July 1970

Previous preface - considered relativity
largely sold & or at least understood.
This preface has to do more - make clear
the idea itself. But soberly, factually, no
hyperbole, no enthusiasm. The committee
planning graduate courses in U. of X.

John A. Wheeler papers,
American Philosophical Society
What Kind of Book is MTW?

PREFAE

This is a textbook on gravitation physics (Einstein’s “general relativity” or “geometrodynamics”). It supplies two tracks through the subject. The first track is focused on the key physical ideas. It assumes, as mathematical prerequisite, only vector analysis and simple partial-differential equations. It is suitable for a one-semester course at the junior or senior level or in graduate school; and it constitutes—in the opinion of the authors—the indispensable core of gravitation theory that every advanced student of physics should learn. The Track-1 material is contained in those pages of the book that have a 1 outlined in gray in the upper outside corner, by which the eye of the reader can quickly pick out the Track-1 sections. In the contents, the same purpose is served by a gray bar beside the section, box, or figure number.
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PREFACE

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Nothing seems more attractive at first glance than the idea that gravitation is a manifestation of the curvature of space (A), and nothing more ridiculous as a second glance (B). How can the tracks of a ball and of a bullet be curved so differently that curvatures arise from the geometry of space? No wonder that great Riemann did not give the world a geometric theory of gravity. Yet, at the age of 26, June 1854, he gave the world the mathematical machinery to define and calculate curvature (metric and Riemannian geometry). Yes, he spent his dying days at 40 working to find a unified account of electricity and gravitation. But if there was one reason more than any other why he failed to make the decisive connection between gravitation and curvature, it was this, that he thought of space and the curvature of space, not of spacetime and the curvature of spacetime. To make this forward step took the forty years to special relativity (1905), time on the same footing as space, and another ten years (1915) general relativity. Depicted in spacetime (C), the tracks of ball and bullet appear to have incompatible curvatures. In fact, however, neither track has any curvature at all. They both look curved in (C) only because one has forgotten that the spacetime they travel in is itself curved—curved precisely enough to make their tracks the straight lines (geodesics).

If it is at first satisfying to see curvature and curvature of spacetime at that, coming to the fact it is a direct way, than a little more reflection produces a much more serious sense of concern. Curvature with respect to what? Not with respect to the laboratory. The earth-bound laboratory has no simple notion whatever in a proper discussion. First, it is no Lorentz frame. Second, even to mention the earth makes one think of an astrophysical version of gravity (distance from center of earth to ball or bullet). In contrast, it was the whole point of Einstein that physics looks simple only when analyzed locally. To look at local physics, however, means to consider one good pair of one set particle with good pairs of other set particles traveling (1) nearly with (2) nearly the same speeds. Then one can "look at the separations between these nearby sets particles and from the second time-rate of change of these separations and the "equation of geodesic deviation" (equation 1.3) read out the curvature of spacetime."
What Kind of Book is MTW?

“I was rather shocked to learn from Bruce [Armbruster, the editor] that the people at [W. H.] Freeman are so out-of-touch with our book that they have not been regarding it as a textbook, but rather as a technical monograph. I suppose that the enormous size of the book has something to do with it. [...] Freeman had not been expecting to pick up the textbook market with this book” at all, but rather to prepare an expensive hardcover edition for sale to libraries.

*Kip Thorne to John Wheeler and Charles Misner, February 17, 1972*
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After some frenzied negotiations over pricing and royalty rates, the publisher agreed to publish a sturdy paperback edition priced at $19.95 [around $130 today], so that the paperback edition of MTW would remain comparable in price to the hardcover edition of Steven Weinberg’s Gravitation and Cosmology (1972).
What Kind of Book is MTW?

“A pedagogic masterpiece.”
Dennis Sciama, Science (March 22, 1974)

“One of the great books of science, a lamp to illuminate this Aladdin’s cave of theoretical physics whose genie was Albert Einstein.”
Michael Berry, Science Progress (1975)

“This is a difficult book to read in a linear, progressive fashion. [...] There is a commendable attempt at informality, but this reviewer found the breeziness irritating at times.”
L. Resnick, Physics in Canada (June 1975)

“The variety of gimmicks is bewildering—framed headings with quotations, marginal titles, ‘boxes’ sometimes extending over several pages, heavy type, light type, large type, small type. Clearly the book is an experiment in presentation on a grand scale.”
W. H. McCrea, Contemporary Physics (July 1974)

A reader would be most comfortable with MTW “if he is a regular subscriber to Time magazine—the writing of these authors has much in common with its breathless style.”
Ian Roxburgh, New Scientist (September 26, 1974)
“Perhaps it is strange to review here a textbook full of mathematics, a book, moreover, whose 6.7-pound bulk the young, the old, and the infirm can scarcely lift. But those who read like to know what is being published and discussed.”

“Imagine that three highly inventive people get together to invent a scientific book. Not just to write it, but invent the tone, the style, the methods of exposition, the format.”

The book’s engaging prose “awakens hope that the fuzzy and lugubrious ‘style’ that still spreads its gloom over so much of American science may not be in fashion forever. [...] Moreover, much like ‘new wave’ fashion in French cinema there are few stories that should be told sequentially.”
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A few years later, the publisher W. H. Freeman advertised a discount rate for MTW to subscribers of Scientific American—a far cry from their original assessment that MTW would only sell to libraries.
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“When friends ask me about what I am doing, I have made the mistake of telling them the truth [about his attempts to read MTW]. Sometimes I think they are right, I feel as though I am on the brink of madness. I go out to have a beer and listen to someone talk about his love affairs, the clutch on his pick-up truck, the problems with his children, the plumbing, the bus service. I look at him and see him dealing with all these important issues and I ask myself why do I care if I ever understand the difference between leptons and leprosy?”

Yet he had become “obsessed” with Einstein’s own question: “whether or not God had any choice in the creation of the Universe. Could God be a traveling technician whose responsibility is to supervise gravitational collapses and big bangs?”

Dan Foley to Kip Thorne, February 7, 1980
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“Many people buy the book who are attracted by the mystique, the boxes, the interesting illustrations, the ideas, but who don’t expect to and never will get deep into the mathematics. [...] I think we can add a few things and take away a lot of things to keep this group ‘on board.’”

John A. Wheeler to Peter Renz (editor at W. H. Freeman), June 28, 1979
Since its original publication in 1973, Misner, Thorne, and Wheeler’s *Gravitation* has been a fascinating and inspiring *hybrid*: part research monograph, part textbook, and part popular book, all wrapped up in “merely” 1279 pages.

Congratulations on the book’s first 50 years! And—with the 2017 reprint edition from Princeton University Press—good luck with the next 50 years!