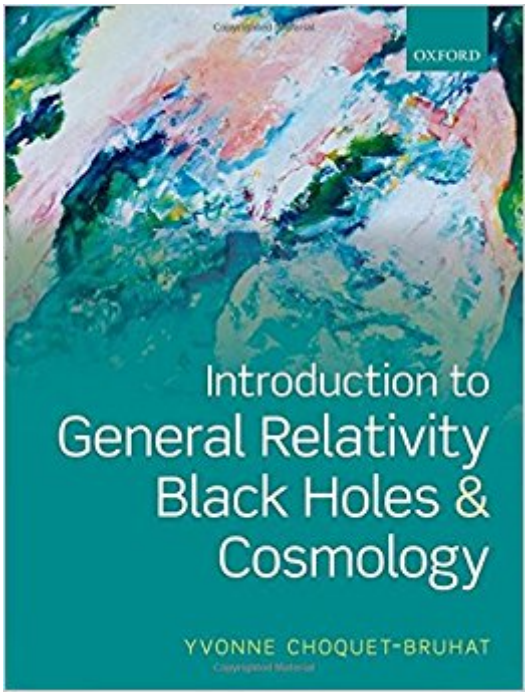
Introduction To General Relativity, Black Holes And Cosmology



Synopsis

General Relativity is a beautiful geometric theory, simple in its mathematical formulation but leading to numerous consequences with striking physical interpretations: gravitational waves, black holes, cosmological models, and so on. This introductory textbook is written for mathematics students interested in physics and physics students interested in exact mathematical formulations (or for anyone with a scientific mind who is curious to know more of the world we live in), recent remarkable experimental and observational results which confirm the theory are clearly described and no specialised physics knowledge is required. The mathematical level of Part A is aimed at undergraduate students and could be the basis for a course on General Relativity. Part B is more advanced, but still does not require sophisticated mathematics. Based on Yvonne Choquet-Bruhat's more advanced text, General Relativity and the Einstein Equations, the aim of this book is to give with precision, but as simply as possible, the foundations and main consequences of General Relativity. The first five chapters from General Relativity and the Einstein Equations have been updated with new sections and chapters on black holes, gravitational waves, singularities, and the Reissner-Nordstrom and interior Schwarzchild solutions. The rigour behind this book will provide readers with the perfect preparation to follow the great mathematical progress in the actual development, as well as the ability to model, the latest astrophysical and cosmological observations. The book presents basic General Relativity and provides a basis for understanding and using the fundamental theory.

Book Information

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Customer Reviews

"It is a very specific book on General Relativity and its relationship to the universe. It's a fascinating

topic for experts and lay-readers alike." --Skeptic Ink"Recommended." --Choice "...for a reader who already knows some general relativity, Choquet-Bruhat's book is an ideal introduction to the mathematical approach." --Physics Today

Yvonne Choquet-Bruhat, French Academy of the Sciences, Paris and the American Academy of Arts and ScienceYvonne Choquet-Bruhat has worked on General Relativity (and other subjects in mathematics and physics) for some sixty years, publishing over 300 scientific papers (the most recent in July 2011). She was elected President of the International Society of General Relativity between 1980 and 1983, was the first woman to be elected to the French Academy of Sciences, is a member of the Academy of Arts and Sciences in Boston, and an elected honorary member of both the Moscow and London Mathematical Societies. She is a recipient of the Danie Heineman Prize of the American Physical Society and of the Marcel Grossman prize. Professor Emeritus of the University of Paris she is also a permanent visitor of the l'institut des hautes etudes scientifiques.

Very interesting studybook on GR by a theoretical physicist who has spend a lifetime of research on fundaments of mathematical physics.

This, another for which I would love to give five stars,unfortunately suffers from being too concise andcondensed to serve as a genuine introduction. That noted, this is another for which most of the materialherein is presented in a manner made most clear. Although emphatically not for the uninitiated, the bookdoes manage to convey depth and breadth most lucidly. (As examples: Pages 52&53 discuss Yang-MillsFields, a compact interlude, but far too advanced for a beginner ! Another remark, Page 70 , "The geometricequations found by Einstein...are the very simple ones...", surely far too subjective to note at this juncture !).Margin-notes accompany the main prose, they add pedagogic usefulness to the terseness: reading page 48," It is possible that all fundamental particles have zero rest- mass, and that the positive rest-mass of theparticles that appear to us...is only an interaction energy." (Also, Margin-Note #10, Page 40, should be heededfor digestion of section 2.5, Electromagnetic Field and Maxwell Equations in Minkowski Spacetime).Page 13, Remark 1.5.1.:" We adopt 'mostly plus' MTW convention. Some authors adopt the opposite, but,they give equivalent geometrical results...surprisingly this is not true of non-orientable manifolds." (!).The exercises sprinkled throughout are, in many instances, provided with hints or solutions.A few are trivial: example Page 66-67, #3.9.2&3.9.3; A few are fairly simple: example Page 150-151, Exercise 6.3.1and its solution; others are slightly more involved:Page 170, Exercise #7.92 ,Page 262,

#10.3.1: some hard Ex.4.92 !(Exercise #1.41,Page 10, has an unfortunate error/typo in the second term on the right-hand side of the equal sign).In any event, the exercises and their solutions provide enrichment alongside immediate testable understanding.Peruse author’s 1967 book Problems and Solutions in Mathematical Physics to get further acquainted with her style.The Paragraph (Page 149) devoted to Thermodynamics of Black Holes should be amplified; but, that, a minor quibblein an otherwise interesting Chapter Six devoted to Black Holes. The mathematical review in the first chapter will eludemost novices, but for those with ample background it presents a nice compendium.We read " The physically realistic problem is to link the abstract reference frames with a concrete observable one."Chapter Two: Special Relativity, again, too condensed for neophytes, but quite lucid if one already possesses requisitebackground (happily, No "ict") : We read : (Page 40) " The Lorentz Contraction and Dilation are not intrinsic to the phenomena."Also, "There is no intrinsic splitting between gravity and inertial-type forces....never-the-less Gravity is a physical realitythat can not be assimilated with the old notion of Inertia." (Page 62).Einstein’s Equations, fourth chapter, presents thoughtful discussion of WKB approximation applied to study of nonlinear effects.Advanced Topics are treated in the Final Three Chapters: Cauchy Problem, Relativistic Fluids and Kinetic Theory.Much awaits the prospective student between these covers. Careful reading will be amply rewarded.Were one to simply browse its simpler content, absent mathematical compass, it would still be possible to profit from the text.For instance, Page 91: "Lagrangians, arising from energies, play a fundamental role in physics. The Lagrangian formulationof the Einstein equations stands apart, being unrelated to a point wise, intrinsically defined, gravitational energy."However, to gain maximum utility from its contents, the student (mathematics or physics) needs minimum preparation equivalentto a four-year degree (Chapters One to Seven) or, higher-level coursework (Final Chapters).

Outstanding ! Mathematically rigorous (yet quite accessible). Very affordable too.The first seven chapters provide an excellent (graduate level) coverage of the main GR topics.Part B covers more advanced (less accessible) topics.Previous to attempting to digest this book, I’d recommend going thru an intro book (such as the excellent Ta-Pei-Cheng’s book)

Wonderfully explained by one of the very originators of Mathematical Relativity. Lots of exercises with hints to some of them help develop your familiarity with the topics.

I reviewed a review copy of this book. I was expecting more of a general text on the subject. This is

not really the case. In the promotion text (here on) it says"This introductory textbook is written for mathematics students interested in physics and physics students interested in exact mathematical formulations (or for anyone with a scientific mind who is curious to know more of the world we live in)"Take this VERY, VERY seriously. Unless you are well versed in manifolds, tensors and tensor fields, and a variety of higher (beyond diff eq) math, then this book won't mean much to you . I was going to give you a taste by writing the third sentence from the book proper (not the preface or forward), but I can't because the text editor can't do the math symbols required. The third sentence.That all being said, the few parts that were not based in fundamental math were very interesting. However, I found the grammar and word choice a little odd, even allowing for my limited (comparatively) understanding of the math involved.Make no mistake, this is a text book for the mathematical underpinnings of General Relativity. However, I did find that the discussion of black holes was very limited (one chapter, plus a chapter Scharzschild spacetime). Likewise, cosmology got a single chapter out of ten total chapters and I found that the cosmology section was very limited. Specifically it was limited to a very basic mathematical relationship to Relativity and didn't mention much about cosmology beyond that relationship. So to me, the title was somewhat misleading.With all that being said, I'm sure this is a fine book, for what it is. I'm just not qualified to discuss it at that mathematical level.

satisfied

Introduction to Black Holes, Information And The String Theory Revolution: The Holographic Universe Black Holes: A Very Short Introduction Clinical Anesthesia Procedures of the Massachusetts General Hospital: Department of Anesthesia, Critical Care and Pain Medicine, Massachusetts General ... of the Massachusetts General Hospital) Relativity: The Special and the General Theory Relativity; the Special and General Theory Relativity: The Special and General Theory [New Edition with Readable Equations] Relativity: The Special and the General Theory, 100th Anniversary Edition The Perfect Theory: A Century of Geniuses and the Battle over General Relativity