Bibliography

I have made no attempt to provide careful citations to the original literature in the text. In keeping with the philosophy of focusing on pedagogy, I have included references to recent review articles where appropriate. Here I list a number of books that might be useful supplements to the one you are reading; the list is not meant to be comprehensive, and focuses on books that are in print and with which I happen to be familiar.

There are two websites that are invaluable resources for keeping up with recent work in gravitational physics. The first is the ArXiv e-print server for general relativity and quantum cosmology:

`http://arxiv.org/form/gr-qc/`

This is where researchers all over the world put their most recent papers, which can then be easily downloaded. There are similar servers for other areas of physics. The other website is for Living Reviews in Relativity:

`http://www.livingreviews.org/`

Living Reviews is an on-line journal specializing in review articles in all areas of gravitational physics. It is an excellent starting point for anyone interested in exploring recent work in a topic of current interest.

Special Relativity

E. Taylor and J. Wheeler, *Spacetime Physics* (Freeman, 1992). A very nice introduction to special relativity, making a great effort to explain away the "paradoxes" this subject seems to engender.

A.P. French, *Special Relativity* (W.W. Norton, 1968). Somewhat less colorful than Taylor and Wheeler, but a straightforward introduction to special relativity.

Undergraduate General Relativity

B.F. Schutz, *A First Course in General Relativity* (Cambridge, 1985). This is a very nice introductory text, making a real effort to bridge the transition from common topics in undergraduate physics to the language and results of GR.

J.B. Hartle, *Gravity: An Introduction to Einstein's General Relativity* (Addison-Wesley, 2002). Eases the exploration of GR by concentrating on examples of curved spacetimes and the behavior of particles in them, putting physics before formalism whenever possible.

E.F. Taylor and J.A. Wheeler, *Exploring Black Holes: An Introduction to General Relativity* (Benjamin Cummings, 2002). Uses black holes as a way to introduce physical principles of GR.

Graduate General Relativity

R. Wald, *General Relativity* (Chicago, 1984). Thorough discussions of a number of advanced topics, including black holes, global structure, and spinors. An invaluable reference, this is the book to turn to if you need the right answer to a well-posed GR question.

C. Misner, K. Thorne and J. Wheeler, *Gravitation* (Freeman, 1973). The book that educated at least two generations of researchers in gravitational physics. Comprehensive and encyclopedic, the book is written in an often-idiosyncratic style that you will either like or not.

S. Weinberg, *Gravitation and Cosmology* (Wiley, 1972). A great book at what it does, especially strong on astrophysics, cosmology, and experimental tests. However, it takes an unusual non-geometric approach to the material, and doesn't discuss black holes. Weinberg is much better than most of us at cranking through impressive calculations.

R. D'Inverno, *Introducing Einstein's Relativity* (Oxford, 1992). A sensible and lucid introduction to general relativity, with solid coverage of the major topics necessary in a modern GR course.

A.P. Lightman, W.H. Press, R.H. Price, and S.A. Teukolsky, *Problem Book in Relativity and Gravitation* (Princeton, 1975). A sizeable collection of problems in all areas of GR, with fully worked solutions, making it all the more difficult for instructors to invent problems the students can't easily find the answers to.

Advanced General Relativity

S. Hawking and G. Ellis, *The Large-Scale Structure of Space-Time* (Cambridge, 1973). An advanced book that emphasizes global techniques, differential topology, and singularity theorems; a classic.

F. de Felice and C. Clarke, *Relativity on Curved Manifolds* (Cambridge, 1990). A mathematical approach, but with an excellent emphasis on physically measurable quantities.

R. Sachs and H. Wu, *General Relativity for Mathematicians* (Springer-Verlag, 1977). Just what the title says, although the typically dry mathematics prose style is here enlivened by frequent opinionated asides about both physics and mathematics (and the state of the world).

J. Stewart, *Advanced General Relativity* (Cambridge, 2003). A short but sweet introduction to some advanced topics, especially spinors, asymptotic structure, and the characteristic initial-value problem.

Mathematical Background

B. Schutz, *Geometrical Methods of Mathematical Physics* (Cambridge, 1980). Another good book by Schutz, this one covering some mathematical points that are left out of the GR book (but at a very accessible level). Included are discussions of Lie derivatives, differential forms, and applications to physics other than GR.

T. Frankel, *The Geometry of Physics: An Introduction* (Cambridge, 2001). A rich, readable book on topics in geometry that are of real use to physics, including manifolds, bundles, curvature, Lie groups, and algebraic topology.

M. Nakahara, *Geometry, Topology and Physics* (Institute of Physics, 2003). An accessible introduction to differential geometry and topology, with an emphasis on topics of interest to physicists.

F.W. Warner, *Foundations of Differentiable Manifolds and Lie Groups* (Springer-Verlag, 1983). A standard text in the field, includes basic topics such as manifolds and tensor fields as well as more advanced subjects.

Specialized Topics

J.D. Jackson, *Classical Electrodynamics* (Wiley, 1999). The classic reference for graduate-level electromagnetism. The problems have left indelible marks on generations of graduate students.

H. Goldstein et al., *Classical Mechanics* (Prentice-Hall, 2002). The classic reference for graduate-level mechanics. An updated edition adds more discussion of nonlinear dynamics.

V.I. Arnold, *Mathematical Methods of Classical Mechanics* (Springer-Verlag, 1989). A scary book for some physicists, but an inspiring treatment of classical mechanics from a mathematically sophisticated point of view. A lot of good differential geometry here.

E.W. Kolb and M.S. Turner, *The Early Universe* (Perseus, 1994). Has become a standard reference for early-universe cosmology, including dark matter, phase transitions, and inflation.

A.R. Liddle and D. Lyth, *Cosmological Inflation and Large-Scale Structure* (Cambridge, 2000). Focusing on inflation and its implications for large-scale structure, gives a careful treatment of cosmological perturbation theory.

B.S. Ryden, *Introduction to Cosmology* (Addison-Wesley, 2002). A very modern and physical introduction to topics in contemporary cosmology, aimed at advanced undergraduates or beginning graduate students.

S. Dodelson, *Modern Cosmology* (Academic Press, 2003). A graduate-level introduction to cosmology, emphasizing cosmological perturbations, large-scale structure, and the cosmic microwave background.

C.M. Will, *Theory and Experiment in Gravitational Physics* (Cambridge, 1993). A useful compendium of alternatives to GR and the experimental constraints on them, including a discussion of the parameterized post-Newtonian formalism.

S.L. Shapiro and S.A. Teukolsky, *Black Holes, White Dwarfs and Neutron Stars: The Physics of Compact Objects* (Wiley, 1983). A self-contained introduction to the physics and astrophysics of compact stars and black holes.

M.E. Peskin and D.V. Schroeder, *An Introduction to Quantum Field Theory* (Westview Press, 1995). Has quickly become the standard textbook in quantum field theory.

J. Polchinski, *String Theory* (Cambridge, 1998). The standard two-volume introduction to modern string theory, including discussions of D-branes and string duality.

C.V. Johnson, *D-Branes* (Cambridge, 2003). A detailed introduction to the extended objects called D-branes, which have become an indispensable part of string theory; prior knowledge of string theory itself is not required.

E.E. Falco, P. Schneider, and J. Ehlers, *Gravitational Lenses* (Springer Verlag, 1999). A thorough introduction to the theory and applications of gravitational lensing.

N.D. Birrell and P.C. Davies, *Quantum Fields in Curved Spacetime* (Cambridge, 1984). The standard book for those who want a practical introduction to quantum field theory in curved spacetime, including the Hawking effect.

R.M. Wald, *Quantum Field Theory in Curved Spacetime and Black Hole Thermodynamics* (Chicago, 1994). A careful and mathematically rigorous exposition of quantum fields in curved spacetimes; if you really want to know what a vacuum state is, look here.

Popular Books

K.S. Thorne, *Black Holes and Time Warps: Einstein's Outrageous Legacy* (W.W. Norton, 1994). Thorne is one of the world's leading researchers in gravitational physics of all kinds, and he offers both a history of work in GR and an introduction to very up-to-date research topics.

R. Geroch, *General Relativity from A to B* (Chicago, 1981). A truly beautiful exposition of the workings of spacetime.

B. Greene, *The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory* (W.W. Norton, 1999). A timely and personal introduction to the physics of string theory. Not afraid to discuss quite advanced concepts, but aims at a general audience all along; very well written.

A.H. Guth, *The Inflationary Universe: The Quest for a New Theory of Cosmic Origins* (Perseus, 1998). A thorough and lucid introduction to all of modern cosmology, focusing on inflation.

L. Smolin, *Three Roads to Quantum Gravity* (Basic Books, 2002). The "three roads" are string theory, loop quantum gravity, and something more profound; Smolin is a partisan for loop quantum gravity, but the discussion should be interesting for everyone.

G. Kane, *Supersymmetry: Unveiling the Ultimate Laws of Nature* (Perseus, 2001). A nice introduction to supersymmetry, a hypothetical symmetry between bosons and fermions that may be within the reach of particle accelerators soon.

A. Einstein, H.A. Lorentz, H. Weyl, and H. Minkowski, *The Principle of Relativity* (Dover, 1924). Actually not a "popular" book at all; rather, a collection of the original research articles on special and general relativity, translated into English.

A. Pais, *Subtle Is the Lord: The Science and the Life of Albert Einstein* (Oxford, 1983). A scientific biography of Einstein, complete with equations.