LIST OF PHYSCIS BOOKS BASED ON TOPICS

General Physics (so even mathematicians can understand it!)

1. M.S. Longair: *Theoretical concepts in physics*, 1986.
   An alternative view of theoretical reasoning in physics for final year undergrads.
2. Arnold Sommerfeld: *Lectures on Theoretical Physics*
   Sommerfeld is God for mathematical physics.
3. Richard Feynman: *The Feynman lectures on Physics (3 vols)*
   Highly recommended texts compiled from the undergraduate lecture course given by Feynman.
4. Jearle Walker: *The Flying Circus of Physics*
5. There is the entire Landau and Lifshitz series. They have volumes on classical mechanics, classical field theory, E&M, QM, QFT, statistical physics, and more. Very good series that spans the entire graduate level curriculum.
6. *The New Physics* edited by Paul Davies.
   This is one *big* book and it takes time to look through topics as diverse as general relativity, astrophysics, particle theory, quantum mechanics, chaos and nonlinearity, low-temperature physics and phase transitions. Nevertheless, this is an excellent book of recent (1989) physics articles, written by several physicists/astrophysicists.
7. Richard Feynman: *The Character of Physical Law*
   In his unique no-nonsense style, Feynman lectures about what physics is all about. Down-to-earth examples keep him from straying into the kind of metaphysics of which he is often critical.
8. David Mermin: *Boojums all the way through: Communicating science in prosaic language*
9. Frank Wilczek and Betsy Devine: *Longing for the Harmonies: Themes and variations from modern physics*
10. Greg Egan: *Permutation City*
    This is a science fiction novel which has more to say about the philosophy of physics than do most philosophers and physicists

Classical Mechanics

1. Herbert Goldstein: *Classical Mechanics*, 2nd ed, 1980.
   Intermediate to advanced; excellent bibliography.
2. Introductory: *The Feynman Lectures, vol 1.*
3. Keith Symon: *Mechanics*, 3rd ed., 1971 undergrad. level
4. H. Corbin and P. Stehle: *Classical Mechanics*, 2nd ed., 1960
5. V.I. Arnold: *Mathematical methods of classical mechanics*, translated by K. Vogtmann and A. Weinstein, 2nd ed., 1989.
   The appendices are somewhat more advanced and cover all sorts of nifty topics. Deals with geometrical aspects of classical mechanics
6. R. Resnick and D. Halliday: *Physics, vol 1*, 4th Ed., 1993
   Excellent introduction without much calculus. Lots of problems and review questions.

7. Marion & Thornton: *Classical Dynamics of Particles and Systems*, 2nd ed., 1970. Undergrad level. A useful intro to classical dynamics. Not as advanced as Goldstein, but with real worked-out examples.
8. A. Fetter and J. Walecka: *Theoretical mechanics of particles and continua* graduate level text, a little less impressive than Goldstein (and sometimes a little less obtuse)
9. Kiran Gupta: *Classical Mechanics of Particles and Rigid Bodies* (1988) At the level of Goldstein but has many more worked out problems at the end of each chapter as a good illustration of the exposed material. Very useful for preparations for the PhD Qualifying Examination (I presume this is America only — ed.).

Classical Electromagnetism

1. Jackson: *Classical Electrodynamics*, 2nd ed., 1975
   Intermediate to advanced, the definitive graduate(US)/undergraduate(UK) text.
2. Purcell: *Berkeley Physics Series Vol 2.*
   You can't beat this for the intelligent, reasonably sophisticated beginning physics student. He tells you on the very first page about the experimental proof of how charge does not vary with speed.
   plus... Chen, Min, *Berkeley Physics problems with solutions*.
3. Reitz, Milford and Christy: *Foundations of Electromagnetic Theory* 4th ed., 1992
   Undergraduate level. Pretty difficult to learn from at first, but good reference, for some calculations involving stacks of thin films and their reflectance and transmission properties, for e.g. It's a good, rigorous text as far as it goes, which is pretty far, but not all the way. For example, they have a great section on optical properties of a single thin film between two dielectric semi-infinite media, but no generalization to stacks of films.
4. Feynman: *Feynman Lectures, vol 2*
5. Lorrain & Corson: *Electromagnetism, Principles and Applications*, 1979
6. Resnick and Halliday: *Physics, vol 2*, 4th ed., 1993
7. Igor Irodov: *Problems in Physics* Excellent and extensive collection of EM problems for undergrads.
8. William Smythe: *Static and Dynamic Electricity*, 3rd ed., 1968
   For the extreme masochists. Some of the most hair-raising EM problems you'll ever see. Definitely not for the weak-of-heart.
9. Landau, Lifschitz, and Pitaevskii: *Electrodynamics of Continuous Media,* 2nd ed., 1984
   Same level as Jackson and with lots of material not in Jackson.
10. Marion and Heald: *Classical Electromagnetic Radiation*, 2nd ed., 1980
    undergraduate or low-level graduate level

Quantum Mechanics

1. *QED: The strange theory of light and matter* Richard Feynman.
   One need no longer be confused by this beautiful theory. Richard Feynman gives an

exposition that is once again and by itself a beautiful explanation of the theory of photon-matter interactions. Taken from a popular, non-technical lecture.

2. Cohen-Tannoudji: *Quantum Mechanics I & II&*, 1977.
   Introductory to intermediate.
3. Liboff *Introductory Quantum Mechanics*, 2nd ed., 1992
   Elementary level. Makes a few mistakes.
4. Sakurai: *Modern Quantum Mechanics*, 1985
5. Sakurai: *Advanced Quantum Mechanics* 1967
   Good as an introduction to the very basic beginnings of quantum field theory, except that it has the unfortunate feature of using "imaginary time" to make Minkowski space look Euclidean.
6. J. Wheeler and W. Zurek, (eds.) *Quantum Theory and Measurement*, 1983
   On the philosophical end. People who want to know about interpretations of quantum mechanics should definitely look at this collection of relevant articles.
7. C. DeWitt and N. Graham: *The Many Worlds Interpretation of Quantum Mechanics*
   Philosophical. Collection of articles.
8. H. Everett: *Theory of the Universal Wavefunction*
   An exposition which has some gems on thermodynamics and probability. Worth reading for this alone.
9. Bjorken and Drell: *Relativistic Quantum Mechanics/ Relativistic Quantum Fields*
   (for comments, see under Particle Physics)
10. Ryder: *Quantum Field Theory*, 1984
11. Guidry: *Gauge Field Theories: an introduction with applications* 1991
12. Messiah: *Quantum Mechanics*, 1961
13. Dirac:
    a] *Principles of QM*, 4th ed., 1958
    b] *Lectures in QM*, 1964
    c] *Lectures on Quantum Field Theory*, 1966
14. Itzykson and Zuber: *Quantum Field Theory*, 1980
    Advanced level.
15. Slater: *Quantum theory: Address, essays, lectures.*
    Good follow on to Schiff.
    note: Schiff, Bjorken and Drell, Fetter and Walecka, and Slater are all volumes in "International Series in pure and Applied Physics" published by McGraw-Hill.
16. Pierre Ramond: *Field Theory: A Modern Primer*, 2nd edition. Volume 74 in the FiP series.
    The so-called "revised printing" is a must, as they must've rushed the first printing of the 2nd edition because it's full of inexcusable mistakes.
17. Feynman: *Lectures - vol III*
    A non-traditional approach. A good place to get an intuitive feel for QM, if one already knows the traditional approach.
18. Heitler & London: *Quantum theory of molecules*
19. J. Bell: *Speakable and Unspeakable in Quantum Mechanics*, 1987
    An excellent collection of essays on the philosophical aspects of QM.
20. Milonni: *The quantum vacuum: an introduction to quantum electrodynamics* 1994.
21. Holland: *The Quantum Theory of Motion*
    A good bet for strong foundation in QM.
22. John Von Neumann: *Mathematical foundations of quantum mechanics*, 1955.
    For the more mathematical side of quantum theory, especially for those who are going to be arguing about measurement theory.

23. Schiff: *Quantum Mechanics*, 3rd ed., 1968
    A little old. Not much emphasis on airy-fairy things like many worlds or excessive angst over Heisenberg UP. Straight up QM for people who want to do calculations. Introductory graduate level. Mostly Schrodinger eqn. Spin included, but only in an adjunct to Schrodinger. Not much emphasis on things like Dirac eqn, etc.
24. Eisberg and Resnick: *Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles*, 2nd ed., 1985.
    This is a basic intro. to QM, and it is excellent for undergrads. It is not thorough with the mathematics, but fills in a lot of the intuitive stuff that most textbooks do not present.
25. David Saxon: *Elementary Quantum Mechanics*
    A decent undergraduate (senior level) text.
26. Bethe and Jackiw: *Intermediate Quantum Mechanics*
27. P.W.Atkins: *Quanta: A Handbook of concepts*
    Short entries, arranged alphabetically, emphasis on stuff relevant to quantum chemistry. Concentrates on the intuition and not the mathematics.
28. James Peebles: *Quantum Mechanics* (1993)
    Intermediate level, based on lectures given by the author at Princeton. Very lucid exposition of the standard material with outstanding selection of mostly original problems at the end of each chapter.

Statistical Mechanics and Entropy

1. David Chandler: *Introduction to Modern Statistical Mechanics*, 1987
2. R. Tolman: *Prinicples of Statistical Mechanics.* Dover
3. Kittel & Kroemer: *Statistical Thermodynamics*
   Best of a bad lot.
4. Reif: *Principles of statistical and thermal physics.*
   The big and little Reif statistical mechanics books. Big Reif is much better than Kittel & Kroemer. He uses clear language but avoids the handwaving that thermodynamics often gives rise to. More classical than QM oriented.
5. Felix Bloch: *Fundamentals of Statistical Mechanics.*
6. Radu Balescu *Statistical Physics*
   Graduate Level. Good description of non-equilibrium stat. mech. but difficult to read. It is all there, but often you don't realize it until after you have learned it somewhere else. Nice development in early chapters about parallels between classical and quantum statistical mechanics.
7. Abrikosov, Gorkov, and Dyzaloshinski: *Methods of Quantum Field Theory in Statistical Physics*
8. Huw Price: *Time's Arrow and Archimedes' Point*
   Semi-popular book on the direction of time by a philosopher. It has been controversial because of its criticism of physicists such as Hawking for their "double standards" in dealing with the old problem on the origin of the arrow of time. It is thought provoking and clearly written.

   The following 6 books deal with modern topics in (mostly) classical statistical mechanics, namely, the central notions of linear response theory (Forster) and critical phenomena (the rest) at level suitable for beginning graduate students.

9. *Thermodynamics*, by H. Callen.
10. *Statistical Mechanics*, by R. K. Pathria
11. *Hydrodynamic Fluctuations, Broken Symmetry, and Correlation Functions*, by D. Forster
12. *Introduction to Phase Transitions and Critical Phenomena*, by H. E. Stanley
13. *Modern Theory of Critical Phenomena*, by S. K. Ma
14. *Lectures on Phase Transitions and the Renormalization Group*, by N. Goldenfeld

Condensed Matter

1. Charles Kittel: *Introduction to Solid State Physics* (ISSP),
   introductory
2. Ashcroft and Mermin: *Solid State Physics*,
   intermediate to advanced
3. Charles Kittel: *Quantum Theory of Solids*.
   This is from before the days of his ISSP; it is a more advanced book. At a similar level. . .
4. *Solid State Theory*, by W. A. Harrison
   (a great bargain now that it's published by Dover)
5. *Theory of Solids*, by Ziman.
6. *Fundamentals of the Theory of Metals*, by Abrikosov
   Half of the book is on superconductivity.
7. *Many-Particle Physics*, G. Mahan.
   Advanced.

Special Relativity

1. Taylor and Wheeler: *Spacetime Physics* Still the best introduction out there.
2. *Relativity*: Einstein's popular exposition.
3. *Wolfgang Rindler, Essential Relativity*. Springer 1977
   With a heavy bias towards astrophysics and therefore on a more moderate level formally. Quite strong on intuition.
4. A P French: *Special Relativity*
   A through introductory text. Good discussion of the twin paradox, pole and the barn etc. Plenty of diagrams illustrating Lorentz transformed co-ordinates, giving both an algebraic and geometrical insight to SR. (Seems to be out of print)
5. *Subtle is the Lord: The Science and Life of Albert Einstein* Abraham Pais
   The best technical biography of the life and work of Albert Einstein.
6. *Special Relativity and its Experimental Foundations* Yuan Zhong Zhang
   Special relativity is so well established that its experimental foundation is often ignored. This book fills the gap and will be of relevance to many discussions in sci.physics.relativity

Particle Physics

1. Kerson Huang: *Quarks, leptons & gauge fields*, World Scientific, 1982.
   Good on mathematical aspects of gauge theory and topology.
2. L. B. Okun: *Leptons and quarks*, translated from Russian by V. I. Kisin, North-Holland, 1982.
3. T. D. Lee: *Particle physics and introduction to field theory*.
4. Itzykson: *Particle Physics*
5. Bjorken & Drell: *Relativistic Quantum Mechanics*
   One of the more terse books. The first volume on relativistic quantum mechanics covers the subject in a blinding 300 pages. Very good if you *really* want to know the subject.
6. Francis Halzen & Alan D. Martin: *Quarks & Leptons*,
   Beginner to intermediate, this is a standard textbook for graduate level courses. Good knowledge of quantum mechanics and special relativity is assumed. A very good introduction to the concepts of particle physics. Good examples, but not a lot of Feynman diagram calculation. For this, see Bjorken & Drell.
7. Donald H. Perkins: *Introduction to high energy physics*
   Regarded by many people in the field as the best introductory text at the undergraduate level. Covers basically everything with almost no mathematics.
8. Close, Marten, and Sutton: *The Particle Explosion*
   A popular exposition of the history of particle physics with terrific photography.
9. Christine Sutton: *Spaceship Neutrino*
   A good, historical, largely intuitive introduction to particle physics, seen from the neutrino viewpoint.
10. Mandl, Shaw: *Quantum Field Theory*
    Introductory textbook, concise and practically orientated. Used at many graduate departments as a textbook for the first course in QFT and a bare minimum for experimentalists in high energy physics. Chapters on Feynman diagrams and cross-section calculations particularly well written and useful.
11. F.Gross: *Relativistic Quantum Mechanics and Field Theory*
    I am familiar with first part only (rel. QM) which I warmly recommend in conjunction with Mandl, since Klein-Gordon and Dirac Equation are explained in greater detail than in Mandl. One of my professors likes a lot the rest of the book too, but I haven't spent much time on it and can't comment. Published in 1993.
12. S. Weinberg: *The Quantum Theory of Fields, Vol I,II*, 1995 It's the usual Weinberg stuff: refreshing, illuminating viewpoints on every page. Perhaps most suitable for graduate students who already know some basics of QFT. Unfortunately, this book does not conform to Bjorken-Drell metric.
13. M.B. Green, J.H. Schwarz, E. Witten: *Superstring Theory* (2 vols)
    Although these two volumes do not touch the important new developments in string theories they are still the best texts for the basics. To keep up with this fast developing subject it is necessary to download the papers and reviews as hep-th e-prints.
14. M. Kaku *Strings, Conformal Fields and Topology*
    Just a little more up-to-date than GSW
15. *Superstrings: A Theory of Everything* ed P.C.W. Davies
    Through transcripts of interviews with Schwarz, Witten, Green, Gross, Ellis, Salam, Glashow, Feynman and Weinberg we learn about string theory and how different physicists feel about its prospects as a TOE. This also predates the new developments which revolutionised string theory after 1993.

16. A Pais: *Inward Bound*
    This can be regarded as a companion volume to his biography of Einstein (see special relativity section). It covers the history of particle physics through the twentieth century but is best for the earlier half.
17. R.P. Crease, C.C. Mann *The Second Creation* 1996
    Another history of particle physics in the twentieth century. This one is especially good on the development of the standard model.. Full of personal stories taken from numerous interviews, it is difficult to put down.

General Relativity

1. Meisner, Thorne and Wheeler. *Gravitation* W. H. Freeman & Co., San Francisco 1973
   Sometimes known as "the telephone book" or just MTW. It has two tracks for different levels. In fact, while it has much interesting reading, it is not a good book to learn relativity from, as its approach is all over the place, and uses notation that is very gawdy but not very useful.
2. Robert M. Wald: *Space, Time, and Gravity: the Theory of the Big Bang and Black Holes.*
   A good non-technical introduction, with a nice mix of mathematical rigor and comprehensible physics.
3. Schutz: *A First Course in General Relativity.*
   A readable and useful book. The 1988 edition, at least, does have a slightly tangled approach to its Lambda index notation that can cause confusion. Beware the major typos in the Riemann components on page 315! The discussion about Riemann tensor signs on page 171 is also wrong.
4. Weinberg: *Gravitation and Cosmology*
   A good book that takes a somewhat different approach to the subject.
5. Hans Ohanian: *Gravitation & Spacetime* (recently back in print)
   For someone who actually wants to learn to work problems, ideal for self-teaching, and math is introduced as needed, rather than in a colossal blast.
6. Robert Wald: *General Relativity*
   A more advanced textbook than Wald's earlier book, appropriate for an introductory graduate course in GR. It strikes just the right balance, in my opinion, between mathematical rigor and physical intuition. It has great mathematics appendices for those who care about proving theorems carefully, and a good introduction to the problems behind quantum gravity (although not to their solutions). I think it's MUCH better than either MTW or Weinberg.
7. Clifford Will,*Was Einstein Right? Putting General Relativity to the Test*
   Non-technical account of the experimental support for GR, including the "classic three tests", but going well beyond them.
8. Kip Thorne: *Black Holes and Time Warps: Einstein's Outrageous Legacy*
   An award winning popular account of black holes and related objects with many historical anecdotes from the authors personal experiences. The book is famous for the final sections about time travel through wormholes.

Mathematical Methods

1. Morse and Feshbach: *Methods of Theoretical Physics*. This book used to be hard to find, but can now be bought at feshbachpublishing.com.
2. Mathews and Walker: *Mathematical Methods of Physics*. An absolute joy for those who love math, and very informative even for those who don't. [This has been severely disputed! - ed]
3. Arfken *Mathematical Methods for Physicists* Academic Press
   Good introduction at graduate level. Not comprehensive in any area, but covers many areas widely. Arfken is to math methods what numerical recipes is to numerical methods — good intro, but not the last word.
4. Zwillinger *Handbook of Differential Equations.* Academic Press
   Kind of like CRC tables but for ODEs and PDEs. Good reference book when you've got a differential equation and want to find a solution.
5. Gradshteyn and Ryzhik *Table of Integrals, Series, and Products* Academic
   THE book of integrals. Huge, but useful when you need an integral.
6. F.W. Byron and R. Fuller: *Mathematics of Classical and Quantum Physics* (2 vols) is a really terrific text for self-study; it is like a baby version of Morse & Feshbach.

Nuclear Physics

1. Preston and Bhaduri: *Structure of the Nucleus*
2. Blatt and Weisskopf *Theoretical Nuclear Physics*
3. DeShalit and Feshbach *Theoretical Nuclear Physics*
   This is serious stuff. Also quite expensive even in paper. I think the hard cover is out of print. This is volume I (structure). Volume II (scattering) is also available.
4. Satchler: *Direct Nuclear Reactions*
5. Walecka: *Theoretical Nuclear and Subnuclear Physics* (1995)
   Covers advanced topics in theoretical nuclear physics from a modern perspective and includes results of past 20 years in a field which makes it unique. Not an easy material to read but invaluable for people seeking an updated review of the present status in the field.
6. Krane: *Introductory nuclear physics*
   Introductory-to-intermediate level textbook in basic nuclear physics for senior undergraduates. Good, clear and relatively comprehensive exposition of "standard" material: nuclear models, alfa, beta, gamma radioactivity, nuclear reactions. . . Last edition issued in 1988.

Cosmology

1. J. V. Narlikar: *Introduction to Cosmology*.1983 Jones & Bartlett Publ.
   For people with a solid background in physics and higher math, THE introductory text, IMHO, because it hits the balance between mathematical accuracy (tensor calculus and stuff) and intuitive clarity/geometrical models very well for grad student level. Of course, it has flaws but only noticeable by the Real Experts (TM). . .

2. Hawking: *Brief History of Time*
   The ghost-written book that made Popular Science popular, but an odd mixture of easy physics and very advanced physics.
3. Weinberg: *First Three Minutes*
   A very good book. It's pretty old, but most of the information in it is still correct.
4. Timothy Ferris: *Coming of Age in the Milky Way* and *The Whole Shebang*
   More Popular Science, and very readable.
5. Kolb and Turner: *The Early Universe*.
   At a more advanced level, a standard reference. As the title implies, K&T cover mostly the strange physics of very early times: it's heavy on the particle physics, and skimps on the astrophysics. There's a primer on large-scale structure, which is the most active area of cosmological research, but it's really not all that good.
6. Peebles: *Principles of Physical Cosmology*. Comprehensive, and on the whole it's quite a good book, but it's rather poorly organized. I find myself jumping back and forth through the book whenever I want to find anything.
7. *Black Holes and Warped Spacetime*, by William J. Kaufmann, III.
   This is a great, fairly thorough, though non-mathematical description of black holes and spacetime as it relates to cosmology. I was impressed by how few mistakes Kaufmann makes in simplifying, while most such books tend to sacrifice accuracy for simplicity.
8. *Principles of Cosmology and Gravitation*, Berry, M. V.
   This is very well-written, and useful as an undergrad text.
9. Dennis Overbye: *Lonely Hearts of the Cosmos* The unfinished history of converge on Hubble's constant is presented, from the perspective of competing astrophysics rival teams and institute, along with a lot of background on cosmology (a lot on inflation, for instance). A good insight into the scientific process.
10. *The big bang*, Joseph Silk.
    I consider Silk's book an absolute must for those who want a quick run at the current state of big bang cosmology and some of the recent (1988) issues which have given so many of us lots of problems to solve. [of course that's eons out of date now - ed.]
11. *Bubbles, voids, and bumps in time: the new cosmology* edited by James Cornell.
    This is quite a nice and relatively short read for some of the pressing issues (as of 1987-88) in astrophysical cosmology.
12. *Structure formation in the universe* T. Padmanabhan.
    A no-nonsense book for those who want to calculate some problems strictly related to the formation of structure in the universe. The book even comes complete with problems at the end of each chapter. A bad thing about this book is that there isn't any coverage on clusters of galaxies and the one really big thing that annoys the hell outta me is that the bibliography for *each* chapter is all combined in one big bibliography towards the end of the book which makes for lots of page flipping.
13. *The large-scale structure of the universe* by P. J. E. Peebles.
    This is a definitive book for anyone who desires an understanding of the mathematics required to develop the theory for models of large scale structure. The essential techniques in the description of how mass is able to cluster under gravity from a smooth early universe are discussed. While I find it dry in some places, there are noteworthy sections (e.g. statistical tests, n-point correlation functions, etc.).
14. *Inhomogeneous Cosmological Models* by Andrzej Krasinski
    If you are blinded by the dogma of the cosmological principle this book is a real eye opener. A technical, historical and bibliographical survey of possible inhomogeous universes from solutions of general relativity.

15. *Origins: The lives and worlds of modern cosmologists* Alan Lightman and Roberta Brawer, 1990
    Transcripts of interview with 27 of the most influential cosmologists from the past few decades. This book provides a unique record of how their cosmological theories have been formed.

Astronomy

1. Hannu Karttunen et al. (eds.): *Fundamental Astronomy*.
   The best book covering all of astronomy (also for absolute beginners) AND still going into a lot of detail for special work for people more involved AND presenting excellent graphics and pictures.
2. Pasachoff: *Contemporary Astronomy*
   Good introductory textbook for the nontechnical reader. It gives a pretty good overview of the important topics, and it has good pictures.
3. Shu, Frank: *The physical universe: an introduction to astronomy*
   This is a really grand book, which covers a huge sweep of physics in its 600-odd pages. Not only does it describe the field of astronomy in great detail, but it also covers in detail the laws of classical and quantum mechanics, atrophysics and stellar evolution, cosmology, special and general relativity; and last but not least, the biochemical basis of life. In fact the last few chapters would make a great addition to a *biochemist's* library!
4. *Astrophysical formulae: a compendium for the physicist and astrophysicist* Kenneth R. Lang.
   Here is everything you wanted to know (and more!) about astrophysical formulae on a one-line/one-paragraph/one-shot deal. Of course, the formulae come complete with references (a tad old, mind you) but it's a must for everyone who's working in astronomy and astrophysics. You learn something new every time you flip through the pages!

Plasma Physics

(See Robert Heeter's sci.physics.fusion FAQ for details)

Numerical Methods/Simulations

1. Johnson and Rees *Numerical Analysis* Addison Wesley
   Undergraduate level broad intro.
2. *Numerical Recipes in X* (X=c,fortran,pascal,etc) Tueklosky and Press
3. Young and Gregory *A survey of Numerical Mathematics* Dover 2 volumes.
   Excellent overview at grad. level. Emphasis toward solution of elliptic PDEs, but good description of methods to get there including linear algebra, matrix techniques, ODE-solving methods, and interpolation theory. Biggest strength is it provides a

coherent framework and structure to attach most commonly used numerical methods. This helps understanding about why to use one method or another. 2 volumes.

4. Hockney and Eastwood *Computer Simulation Using Particles* Adam Hilger
   Good exposition of particle-in-cell (PIC) method and extensions. Applications to plasmas, astronomy, and solid state are discussed. Emphasis is on description of algorithms. Some results shown.
5. Birdsall and Langdon *Plasma Physics via Computer Simulations*
   PIC simulation applied to plasmas. Source codes shown. First part is almost a tutorial on how to do PIC. Second part is like a series of review articles on different PIC methods.
6. Tajima *Computational Plasma Physics: With Applications to Fusion and Astrophysics* Addison Wesley Frontiers in physics Series.
   Algorithms described. Emphasis on physics that can be simulated. Applications limited to plasmas, but subject areas very broad, fusion, cosmology, solar astrophysics, magnetospheric physics, plasma turbulence, general astrophysics.

Fluid Dynamics

1. D.J. Tritton *Physical Fluid Dynamics*
2. G.K. Batchelor *Introduction to Fluid Dynamics*
3. S. Chandrasekhar *Hydrodynamics and Hydromagnetic Stability*
4. Segel *Mathematics Applied to Continuum Mechanics* Dover.

Nonlinear Dynamics, Complexity, and Chaos

There is a FAQ posted regularly to sci.nonlinear.

1. Prigogine, "Exploring Complexity" Or any other Prigogine book. If you've read one, you read most of all of them (A Poincaré recurrence maybe?)
2. Guckenheimer and Holmes *Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields* Springer
   Borderline phys/math. Advanced level. Nuts and bolts how to textbook. No Saganesque visionary thing from the authors. They let the topic provide all the razz-ma-tazz, which is plenty if you pay attention and remember the physics that it applies to.
3. Lichtenberg, A. J. and M. A. Lieberman (1982). *Regular and Stochastic Motion.* New York, Springer-Verlag.
4. Ioos and Joseph *Elementary Stability and Bifurcation Theory.* New York, Springer-Verlag.
5. *The Dreams Of Reason* by Heinz Pagels. He is a very clear and interesting, captivating writer, and presents the concepts in a very intuitive way. The level is popular science, but it is still useful for physicists who know little of complexity.
6. M. Mitchell Waldrop: *Complexity*.
   A popular intro to the subject of spontaneous orders, complexity and so on. Covers implications for economics, biology etc and not just physics.

Optics (Classical and Quantum), Lasers

1. Max Born and Emil Wolf *Principles of Optics: Electromagnetic Theory of Propagation*
   Standard reference.
2. Sommerfeld, A:
   For the more classically minded.
3. Allen and Eberly's *Optical Resonance and Two-Level Atoms*. For quantum optics, the most readable but most limited.
4. Goodman *Introduction to Fourier Optics*. If it isn't in this book, it isn't Fourier optics.
5. *Quantum Optics and Electronics* (Les Houches summer school 1963 or 1964, but someone has claimed that Gordon and Breach, NY, are going to republish it in 1995), edited by DeWitt, Blandin, and Cohen- Tannoudji, is noteworthy primarily for Glauber's lectures, that form the basis of quantum optics as it is known today.
6. Sargent, Scully, & Lamb: *Laser Physics*
7. Yariv: *Quantum Electronics*
8. Siegman: *Lasers*
9. Shen: *The Principles of Nonlinear Optics*
10. Meystre & Sargent: *Elements of Quantum Optics*
11. Cohen-Tannoudji, Dupont-Roc, & Grynberg: *Photons, Atoms and Atom-Photon Interactions*.
12. Hecht: *Optics*
    A very good introductory optics book
13. *Practical Holography* by Graham Saxby, Prentice Hall: New York; 1988.
    This is a very clear and detailed book that is an excellent introduction to holography for interested undergraduate physics people, as well as advanced readers, especially those who are interested in the practical details of making holograms and the theory behind them.

Mathematical Physics

Lie Algebra, Topology, Knot Theory, Tensors, etc.

These are books that are sort of talky and fun to read (but still substantial - some harder than others). These include things mathematicians can read about physics as well as vice versa. These books are different than the "bibles" one must have on hand at all times to do mathematical physics.

1. Yvonne Choquet-Bruhat, Cecile DeWitt-Morette, and Margaret Dillard-Bleick: *Analysis, manifolds, and physics* (2 volumes)
   Something every mathematical physicist should have at her bedside until she knows it inside and out - but some people say it's not especially easy to read.
2. Jean Dieudonne: *A panorama of pure mathematics*, as seen by N. Bourbaki, translated by I.G. Macdonald.
   Gives the big picture in mathematics.
3. Robert Hermann: *Lie groups for physicists*, Benjamin-Cummings, 1966.

4. George Mackey: *Quantum mechanics from the point of view of the theory of group representations*, Mathematical Sciences Research Institute, 1984.
5. George Mackey: *Unitary group representations in physics, probability, and number theory.*
6. Charles Nash and S. Sen: *Topology and geometry for physicists.*
7. B. Booss and D.D. Bleecker: *Topology and analysis: the Atiyah-Singer index formula and gauge-theoretic physics.*
8. Bamberg and S. Sternberg: *A Course of Mathematics for Students of Physics*
9. Bishop & Goldberg: *Tensor Analysis on Manifolds.*
10. Flanders: *Differential Forms with applications to the Physical Sciences.*
11. Dodson & Poston *Tensor Geometry*.
12. von Westenholz: *Differential forms in Mathematical Physics.*
13. Abraham, Marsden & Ratiu: *Manifolds, Tensor Analysis and Applications.*
14. M. Nakahara: *Topology, Geometry and Physics.*
15. Morandi: *The Role of Topology in Classical and Quantum Physics*
16. Singer, Thorpe: *Lecture Notes on Elementary Topology and Geometry*
17. L. Kauffman: *Knots and Physics,* World Scientific, Singapore, 1991.
18. Yang, C and Ge, M: *Braid group, Knot Theory & Statistical Mechanics.*
19. Kastler, D: *C-algebras and their applications to Statistical Mechanics and Quantum Field Theory*.
20. Courant and Hilbert *Methods of Mathematical Physics* Wiley
    Really a mathematics book in disguise. Emphasis on ODEs and PDEs. Proves existence, etc. Very comprehensive. 2 volumes.
21. Cecille Dewitt is publishing a book on manifolds that should be out soon (maybe already is). Very high level, but supposedly of great importance for anyone needing to set the Feynman path integral in a firm foundation.
22. Howard Georgi: *Lie Groups for Particle Phyiscs* Addison Wesley Frontiers in Physics Series.
23. Synge and Schild.

Atomic Physics

1. Max Born: *Atomic Physics*
   A classic, though a little old.
2. Gerhard Herzberg. *Atomic spectra and atomic structure,* Translated with the co-operation of the author by J. W. T.Spinks. — New York, Dover publications, 1944
   Old but good.
3. E. U. Condon and G. H. Shortley: *The theory of atomic spectra*, CUP 1951
4. G. K. Woodgate: *Elementary atomic structure*, 2d ed. Oxford: New York: Clarendon Press, Oxford University Press, 1983, c 1980
   Introductory level.
5. Alan Corney: *Atomic and laser spectroscopy*, Oxford, New York: Clarendon Press, 1977
   Excellent,fairly advanced, large experimental bent, but good development of background. Good stuff on lasers (gas, dye)

Low Temperature Physics, Superconductivity

1. *The Theory of Quantum Liquids*, by D. Pines and P. Nozieres
2. *Superconductivity of Metals and Alloys*, P. G. DeGennes A classic introduction.
3. *Theory of Superconductivity*, J. R. Schrieffer
4. *Superconductivity*, M. Tinkham
5. *Experimental techniques in low-temperature physics*, by Guy K. White.
   This is considered by many as a "bible" for those working in experimental low-temperature physics.