Books

Sign out Sheet

Key

Weinberg Grav and Cosm.

Intro
Schutz: GR

Weinberg: first 3 Minutes

arXiv: xxx.lanl.gov.

astro-ph/0603114.
/0602117.
/1003.1745.

Courses online: (GR)

www.physics.uoguelph/poisson/toolkit
www.mth.uct.ac.za/omei/gr/menu.

MORE TO COME

Notes:

Cosmology

Inflation

Modelling Univ (Ellis)

Averaging Prob (Zalaletdinov).

Intro GR

HISTORY:

POPULAR. PLEASE

Books (Sign out).

Barrow – Silk – Left hand creation ✓

Davies – The accidental Universe. ✓

Smolin – The life of the cosmos. ✓

Wesson – STM ✓

Novikov – BH + Universe ✓
~~Matt Lewis March 10.~~ [~~also have the GR book by Schutz~~]

Silk – The Big Bang ✓

Hawking – The History of Time ✓
~~Chris April 11~~ ~~returned~~ Ap. 18

Cosmology Refs

main

Weinberg 'First Three Mins'
Davies 'The Accidental Univ'

text books

Peebles 'Physical Cosmology'
Weinberg 'Gravitation (Shutz)

other popular

Hawking 'Brief History Time'
'companion'.
Penrose 'Emperor's New Mind'
'Shadows of Mind'
H + P 'Debates'.
Barrow + Tipler 'Anthropic Principle'
Barrow + Silk 'Left Hand Creation'.

Other popular

Davies 'Are we Alone'
Schroeder 'Genesis + BB'
Novikov 'BH + Universe

Other Textbooks

Thorne 'BHs'
Hawking-Israel '300 yrs'.

RECENT REVIEW ARTICLES

arXiv:

astro/0411671	Challanges Inflation	Brandenberger *
1609.00716	Lectures on Inflation	Senatore
hep-ph/9910410	Inflation	Brandenberger.
1003.1745 (hep-th)	Cosm - early univ	
9704062/astro	Inflation	Turner.
astro/0101507	Eternal inf	Guth
1606.06112	BB: status (INTRO).	Ijjas.
astro/0602117	Cosm	Padmanabhan.
1306.6091	Cosmography	Courtois et al.
0706.1565 [astro],	Resource Letter [REFS]	Rahva and Vogeley.
astro/0401547	TASI Lectures: Intro Cosm	Trodden/Carroll.
astro/0308418	Measuring Univ.	Freedman.
astro/0409131	Current Status obs. cosm	Oshmker.
hep-th/0402051	inflation	Linde.
0503195		

GR (wald arXiv)

6 Resources

Note: E = elementary level/general interest, I = intermediate level, A = advanced level/specialized material.

6.1 Resources for introductory discussions of general relativity

Relativity: The Special and the General Theory, The Masterpiece Science Edition, A. Einstein (Pi Press, New York, 2005). This reprint of one of Einstein's early, non-technical expositions of special and general relativity contains an introduction by R. Penrose and commentary by R. Geroch and D. Cassidy. (E)

Flat and Curved Space-Times (second edition), G.F.R. Ellis and R. Williams (Cambridge University Press, Cambridge, 2000). This book provides a discussion of special relativity from a geometrical point of view and an introduction to the basic ideas of general relativity. (E)

General Relativity from A to B, R. Geroch (University of Chicago Press, Chicago, 1978). This book presents an excellent introduction to the basic ideas of general relativity from a thoroughly geometrical point of view. (E)

Gravity from the Ground Up, B. Schutz (Cambridge University Press, Cambridge, 2003). This book provides a very readable discussion of the nature of gravitation in general relativity and its implications for astrophysics and cosmology. (E)

Exploring Black Holes: Introduction to General Relativity, E.F. Taylor and J.A. Wheeler (Addison Wesley Longman, San Francisco, 2000). This book provides a very physically oriented introduction to general relativity and black holes. (E)

Black Holes and Time Warps: Einstein's Outrageous Legacy, K.S. Thorne (W.W. Norton, New York, 1994). This book provides a very well written account of some of the most fascinating ideas and speculations to arise from general relativity. (E)

Space, Time, and Gravity: The Theory of the Big Bang and Black Holes (second edition), R.M. Wald (University of Chicago Press, Chicago, 1992). (E)

Was Einstein Right?: Putting General Relativity to the Test (second edition) C.M. Will (Basic Books, New York, 1993). This book provides an excellent account of the observational and experimental tests of general relativity. (E)

6.2 Resources for differential geometry

Geometry of Manifolds, R.L. Bishop and R.J. Crittenden (American Mathematical Society, Providence, 2001). This consise book provides an excellent, high-level account of differential geometry. (A)

Tensor Analysis on Manifolds, R.L. Bishop and S. Goldberg (Dover Publications, New York, 1987). (I)

Riemannian Geometry, L.P. Eisenhart (Princeton University Press, Princeton, 1997). This is a reprint of the 1925 classic monograph, which gives an excellent presentation of the coordinate-based approach to differential geometry taken by mathematicians prior to the middle of the 20th century and still used by most physicists today. (I,A)

Foundations of Differential Geometry, volumes 1 and 2, S. Kobayashi and K. Nomizu (John Wiley and Sons, New York, 1996). This book is an excellent, high-level reference on differential geometry. (A)

Riemannian Manifolds : An Introduction to Curvature, J.H. Lee (Springer-Verlag, New York, 1997). (I)

Tensors, Differential Forms, and Variational Principles, D. Lovelock and H. Rund (Dover Publications, New York, 1989). (I)

A Comprehensive Introduction to Differential Geometry, volumes 1-5, third edition, M. Spivak (Publish or Perish Inc., Houston, 1999). (I)

Tensors and Manifolds: With Applications to Mechanics and Relativity, R.H. Wasserman (Oxford University Press, Oxford, 1992). This book provides an extremely clear an complete treatment of the basic definitions, constructions, and results associated with tensor fields on manifolds. (I)

6.3 Undergraduate level texts

Gravity: An Introduction to Einstein's General Relativity, J.B. Hartle (Addison Wesley, San Francisco, 2003). The philosophy on teaching general relativity to undergraduates expounded in this Resouce Letter is adopted directly from the approach taken by Hartle in this text. (I)

General Relativity: A Geometric Approach, M. Ludvigsen (Cambridge University Press, Cambridge, 1999). (I)

Relativity: Special, General, and Cosmological W. Rindler (Oxford University Press, Oxford, 2001). (I)

A First Course in General Relativity, B. Schutz (Cambridge University Press, Cambridge, 1985). (I)

Relativity : An Introduction to Special and General Relativity third edition, H. Stephani (Cambridge University Press, Cambridge, 2004). (I)

6.4 Graduate level texts/monographs

Spacetime and Geometry: An Introduction to General Relativity, S. Carroll (Addison Wesley, San Francisco, 2004). This book provides a well written, pedagogically oriented introduction to general relativity. (I)

The Large Scale Structure of Space-time, S.W. Hawking and G.F.R. Ellis (Cambridge University Press, Cambridge, 1973). This book is true masterpiece, containing a

complete exposition of the key global results in general relativity, including the singularity theorems and the theory of black holes. It is not light reading, however. (A)

Relativity on Curved Manifolds, F. de Felice and C.J.S. Clarke (Cambridge University Press, Cambridge, 1990). (I,A)

The Classical Theory of Fields, L.D. Landau and E.M. Lifshitz, (Elsevier, Amsterdam, 1997). This very clear and consise discussion of general relativity from a coordinate-based point of view occupies only about 150 pages of this book. (I,A)

Gravitation, K.S. Thorne, C.W. Misner, and J.A. Wheeler (W.H. Freeman, San Francisco, 1973). This book, which remains very widely used, was the first text to present general relativity from a modern point of view. It places a strong emphasis on the physical content of the theory. (I,A)

Advanced General Relativity, J. Stewart, (Cambridge Monographs on Mathematical Physics, Cambridge University Press, Cambridge, 1991). (A)

General Relativity, R.M. Wald (University of Chicago Press, Chicago, 1984). (I,A)

Gravitation and Cosmology : Principles and Applications of the General Theory of Relativity, S. Weinberg (Wiley, New York, 1972). This book takes and anti-geometrical approach and some of the discussion of cosmology is out of date, but it remains one of the best references for providing the details of calculations arising in the applications of general relativity, such as to physical processes occurring in the early universe.(I,A)

Main Page

From Universe in Problems

Contents

Dynamics of the Universe in Problems

The total number of problems on this website.

1072

About

There are thousands (https://www.google.com.ua/search?q=inurl%3Acosmology) of websites with names that contain the term "cosmology". Many of them are devoted to discussion of fundamental questions: whether there is life on Mars, what was there when there was nothing and the like. Our aim is much more modest. We present here an online living version of our book of problems on cosmology.

Why problems, which and for whom?

The only way to rise above the "popular" level in any science is to master its alphabet, that is, to learn to solve problems, even if most simple at the beginning. To our best knowledge, there are no problem books on cosmology yet, that would include its spectacular recent achievements. Of course, most of excellent modern textbooks on cosmology include problems. However, a reader, exhausted by high theory, may often be thwarted by the lack of time and strength to solve them.

You can familiarize oneself with the modern portrayal of the dynamics of the Universe, including the latest achievements of cosmology, by solving problems from the start. The perseverant will traverse the thorny path of cosmology's evolution from the traditional Big Bang model to the presently universally accepted Standard Cosmological Model. It is based on the revolutionary discovery of accelerated expansion of the Universe, made at the very end of the last century. The attempts to explain such an unexpected observation led to fundamental reconstruction of the view on the evolution of the Universe that was formed in the XX century.

One only has to be acquainted with the basics of Special and General Relativities and the theory of elementary particles in order to start solving problems. We want to show that even this minimal knowledge is sufficient to be able to solve a very wide range of cosmological problems, and moreover, to understand the essence of difficulties that are encountered by modern cosmology.

No generation of Homo sapiens could withstand the temptation to claim that the true understanding of the nature of the Universe is (almost?) within its grasp. The current generation is not an exception, of course, naturally assuming it has better reason to believe so than ever before. We hope to give our reader the means to evaluate objectively whether this is true or not by himself.

Second life online

We published the first edition of the problem book a couple of years ago, in Russian. However, a printed book, even not taking into account the language, has its obvious drawbacks in itself. The audience is limited by the number of copies printed. The inevitable misprints and errors cannot be corrected – the errors in classical problem books on physics are known to be sometimes corrected in the fifteenth edition. But the main problem that almost immediately manifested itself was that the content of the book with pretentious title "Modern Cosmology" was getting out of date by leaps and bounds. New sections and subsections demanded to be created and populated with problems. The online living problem book is the solution we have come to.

At the moment we have about 1500 problems, almost all of them with solutions, and we hope to bring them online by the fall of 2012. We tried to make references to the authors of problems whenever possible and would be happy to add the references that might still be missing. Some problems have already acquired the status of folklore and their authorship is hard to determine. We welcome all comments, suggestions and corrections to the formulations of problems and their solutions, but most valuable to us would be new problems suggested by the community.

Good luck

Finally, we hope that after getting to grip with the problems our reader not only preserves his interest to cosmology, but tries to make the next step: read original papers. If this transition is overcome seamlessly, we will have achieved our goal.

Welcome!

5. **Cosmic Microwave Background (CMB)**

6. **Thermodynamics of Universe**

9. **Dark Energy**

10. **Dark Matter**