Cosmology Seminar: Presentation Topics

1. Supernova Cosmology

Nobel Prize: http://www.nobelprize.org/nobel_prizes/physics/laureates/2011/#

SCP Website: http://supernova.lbl.gov

Popular Article: *Supernovae, Dark Energy, and the Accelerating Universe*
Perlmutter, S. 2003, Physics Today, 56, 040000
http://supernova.lbl.gov/PDFs/PhysicsTodayArticle.pdf

Review Article: *Measuring Cosmology with Supernovae*
Perlmutter, S., & Schmidt, B.~P. 2003, Supernovae and Gamma-Ray Bursters, 598, 195
http://www.springerlink.com/content/9116g28114206078/fulltext.pdf
http://arxiv.org/abs/astro-ph/0303428

Article: *Observational Evidence from Supernovae for an Accelerating Universe and a Cosmological Constant*
Riess, A. G., Filippenko, A. V., Challis, P., et al. 1998, AJ, 116, 1009
http://adsabs.harvard.edu/abs/1998AJ....116.1009R

Article: *Measurements of Omega and Lambda from 42 High-Redshift Supernovae*
Perlmutter, S., Aldering, G., Goldhaber, G., et al. 1999, ApJ, 517, 565
http://adsabs.harvard.edu/abs/1999ApJ...517..565P

Review Article: *The Cosmological Constant*
Carroll, S. M. 2001, Living Reviews in Relativity, 4, 1
http://adsabs.harvard.edu/abs/2001LRR.....4....1C

2. Cold Dark Matter & Numerical Cosmology

Millennium simulation web site:
http://www.mpa-garching.mpg.de/galform/virgo/millennium/

Mare Nostrum simulation web site:
http://astro.ft.uam.es/marenostrum/universe/index.html

Review Article:
Numerical simulations of the dark universe: State of the art and the next decade
Kuhlen, Michael; Vogelsberger, Mark; Angulo, Raul, 2012
Physics of the Dark Universe, Volume 1, Issue 1, p. 50-93.
http://adsabs.harvard.edu/abs/2012PDU.....1...50K

Article for the millennium simulation:
Springel, V., White Simon, et al. 2005, Nature, 435, 629
http://adsabs.harvard.edu/abs/2005Natur.435..629S

Seminal Article: *The evolution of large-scale structure in a universe dominated by cold dark matter*
Davis, M., Efstathiou, Frenk C., White S.D.M, 1985, ApJ, 292, 371
http://adsabs.harvard.edu/abs/1985ApJ...292..371D

3. From Dark Matter Halos to Galaxies

Seminal paper: *Core condensation in heavy halos - A two-stage theory for galaxy formation and clustering*
White, S.D.M & Rees M., 1978, MNRAS, 183, 341
http://adsabs.harvard.edu/abs/1978MNRAS.183..341W

Seminal paper: *Galaxy formation through hierarchical clustering*
White S.D.M & Frenk, C., 1991, ApJ, 379, 52
http://adsabs.harvard.edu/abs/1991ApJ...379...52W

Review Article: *A primer on hierarchical galaxy formation: the semi-analytical approach*
C.M. Baugh, 2006, Rep. Prog. Phys. 69, 3101
http://adsabs.harvard.edu/abs/2006RPPh...69.3101B

Review Article: Understanding Galaxy Formation and Evolution
Avila-Reese, 2007, Ap&SS, 115
http://arxiv.org/abs/astro-ph/0605212

4. Alternatives to a Cosmological Constant

Note: All articles are quite technical and theory oriented. We do not expect you to master the complex math of this field but to give a general overview of the alternatives to simple cosmological constant and their possible effect on structure formation.

Review Article: *The Cosmological Constant*
Carroll, S. M. 2001, Living Reviews in Relativity, 4, 1
http://adsabs.harvard.edu/abs/2001LRR.....4....1C

Review Article: *Dark matter and dark energy proposals: maintaining cosmology as a true science?*
George Ellis 2009, EAS Publications Series, Volume 36, 2009, pp.325-336
http://adsabs.harvard.edu/abs/2009EAS....36..325E

Journal Article: *Dark energy and inhomogeneity*
George Ellis 2008, Journal of Physics: Conference Series, Volume 189, Issue 1
http://adsabs.harvard.edu/abs/2009JPhCS.189a2011E

Review Article: *Dark energy and dark gravity: theory overview*
Ruth Durrer, Roy Maartens, 2008,
General Relativity and Gravitation, Volume 40, Issue 2-3, pp. 301-328
http://adsabs.harvard.edu/abs/2008GReGr..40..301D
(very technical, look mainly to page 314 tp 320)

Review Article: *Dark Energy simulations*
Marco Baldi 2012, Physics of the Dark Universe, Volume 1, Issue 1, p. 162-193
http://adsabs.harvard.edu/abs/2012PDU.....1..162B

5. Cosmic Microwave Background

WMAP Website: http://map.gsfc.nasa.gov

Movies: Sensitivity of CMB power spectrum to cosmological parameters, Martin White
http://astro.berkeley.edu/~mwhite/movies.html

CMB Tutorial: Introduction to the CMB Tutorial, Wayne Hu
http://background.uchicago.edu/~whu/beginners/introduction.html

Online Notes: Wayne Hu's Notes on CMB Fundamentals
http://background.uchicago.edu/~whu/Papers/cmbfun_hr.pdf

Popular Article: *The Cosmic Symphony*
M. White & W. Hu, Scientific American, 2003
http://astro.berkeley.edu/~mwhite/sciam03_short.pdf

Review Article: *Cosmic Microwave Background Anisotropies*
Hu, W., & Dodelson, S. 2002, ARAA, 40, 171
http://adsabs.harvard.edu/abs/2002ARA%26A..40..171H

Review Article: *The Cosmic Microwave Background*
Jones, A., & Lasenby, A. 1998, Living Reviews in Relativity, 1, 11
http://adsabs.harvard.edu/abs/1998LRR.....1...11J

Article: *First-Year Wilkinson Microwave Anisotropy Probe (WMAP) Observations: Determination of Cosmological Parameters*
Spergel, D. N., Verde, L., Peiris, H. V., et al. 2003, ApJS, 148, 175
http://adsabs.harvard.edu/abs/2003ApJS..148..175S

Article: *Three-Year Wilkinson Microwave Anisotropy Probe (WMAP) Observations: Implications for Cosmology*
Spergel, D. N., Bean, R., Dore, O., et al. 2007, ApJS, 170, 377
http://adsabs.harvard.edu/abs/2007ApJS..170..377S

Article: Planck 2013 results. XVI. Cosmological parameters
Planck Collaboration, arXiv:1303.5076
http://www.aanda.org/index.php?option=com_article&access=doi&doi=10.1051/0004-6361/201321591

6. Weak Gravitational Lensing

Euclid mission (ESA web site):
http://sci.esa.int/science-e/www/area/index.cfm?fareaid=102
http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=46661

Euclid consortium web page:
http://www.euclid-imaging.net/

Book (really long!): *Euclid Imaging Consortium Science Book*
Refregier et al. 2010
http://arxiv.org/abs/1001.0061

Review Article: *Weak Gravitational Lensing and its Cosmological Applications*
Hoekstra H. & Jain B., 2008, 85, 93
http://www.annualreviews.org/doi/abs/10.1146/annurev.nucl.58.110707.171151

Review Article: *Weak Gravitational Lensing*
Bartelmann, M. & Schneider P. 2001, 340, 291
http://xxx.lanl.gov/abs/astro-ph/9912508

Review Article: Cosmology with weak lensing survey
Dipak M, et al. 2008, PhRv, 462, 67
http://adsabs.harvard.edu/cgi-bin/bib_query?arXiv:astro-ph/0612667

7. Gravitational Lensing of the CMB

Review Article: *Weak Lensing of the CMB*
Hanson, D., Challinor, A., & Lewis, A. 2010, General Relativity and Gravitation, 42, 2197
http://adsabs.harvard.edu/cgi-bin/bib_query?arXiv:0911.0612

Review Article: *Weak gravitational lensing of the CMB*
Lewis, A., & Challinor, A. 2006, Phys. Rep., 429, 1

http://adsabs.harvard.edu/cgi-bin/bib_query?arXiv:astro-ph/0601594

Article: *Planck 2013 results. XVII. Gravitational lensing by large-scale structure*
Planck Collaboration, arXiv:1303.5077
http://adsabs.harvard.edu/cgi-bin/bib_query?arXiv:1303.5077

Article: *Detection of the Power Spectrum of Cosmic Microwave Background Lensing by the Atacama Cosmology Telescope*
Das, S., Sherwin, B. D., Aguirre, P., et al. 2011, Physical Review Letters, 107, 021301
http://adsabs.harvard.edu/cgi-bin/bib_query?arXiv:1103.2124

Article: *The Atacama Cosmology Telescope: Cross-correlation of cosmic microwave background lensing and quasars*
Sherwin, B.D., Das, S., Hajian, A., et al. 2012, PRD, 86, 083006
http://adsabs.harvard.edu/abs/2012PhRvD..86h3006S

8. BICEP2, CMB Polarization, and Gravity Waves from Inflation

Article: *Detection of B-Mode Polarization at Degree Angular Scales by BICEP2*
Planck Collaboration
http://ads.ari.uni-heidelberg.de/abs/2014PhRvL.112x1101A

Online Tutorial on CMB Polarization, by Wayne Hu:
http://background.uchicago.edu/~whu/polar/webversion/polar.html

Review Article: *A CMB Polarization Primer*
White, M. & Hu, W.
http://arxiv.org/pdf/astro-ph/9706147.pdf
http://ads.ari.uni-heidelberg.de/abs/1997NewA....2..323H

Article: *Signature of Gravity Waves in the Polarization of the Microwave Background*
Seljak, U & Zaldarriaga, Matias, 1997, Physical Review Letters, 78, 2054
http://ads.ari.uni-heidelberg.de/abs/1997PhRvL..78.2054S

Article: *Planck* 2013 results. XXII. Constraints on inflation, Planck Collaboration
Planck Collaboration, 2013, arXiv:1303.5082
http://www.aanda.org/articles/aa/pdf/forth/aa21569-13.pdf
See in particular the "Lighting Review of Inflation" in Section 2

Article: *Planck intermediate results. XXX. The angular power spectrum of polarized dust emission at intermediate and high Galactic latitudes*
Planck Collaboration, arXiv: 1409.5738
http://arxiv.org/abs/1409.5738

Commentary: *Big Bang blunder bursts the multiverse bubble*
Steinhardt, P. 2014, Nat, 510, 9
http://www.nature.com/news/big-bang-blunder-bursts-the-multiverse-bubble-1.15346
http://adsabs.harvard.edu/abs/2014Natur.510....9S

Article: *A joint analysis of Planck and BICEP2 B modes including dust polarization uncertainty*
Mortonson, M. J., & Seljak, U. 2014, arXiv:1405.5857
http://ads.ari.uni-heidelberg.de/abs/2014arXiv1405.5857M

Article: *Toward an understanding of foreground emission in the BICEP2 region*
Flauger, R, Hill, J. C., & Spergel, D. N, 2014, JCAP, 8, 39
http://ads.ari.uni-heidelberg.de/abs/2014JCAP...08..039F

9. Galaxy Clusters as Cosmological Probes

X-ray Satellites
Chandra satellite: http://chandra.si.edu/about/
XMM-Newton satellite: http://sci.esa.int/science-e/www/area/index.cfm?fareaid=23

Review Article: *Tracing cosmic evolution with clusters of galaxies*
Voit, G. M. 2005, Reviews of Modern Physics, 77, 207
http://rmp.aps.org/abstract/RMP/v77/i1/p207_1

Review Article: *Cosmology with Clusters of Galaxies*
Borgani, S.: 2008, LNP, 740, 287
http://adsabs.harvard.edu/abs/2008LNP...740..287B

Article: *Chandra Cluster Cosmology Project III: Cosmological Parameter Constraints*
Vikhlinin, A., et al. 2009, ApJ, 692, 1060
http://adsabs.harvard.edu/abs/2009ApJ...692.1060V

10. The Sunyaev-Zel'dovich Effect

South Pole Telescope: http://pole.uchicago.edu

Atacama Cosmology Telescope: http://www.physics.princeton.edu/act

Planck Satellite: http://sci.esa.int/planck/

Review Article: *Cosmology with the Sunyaev-Zel'dovich Effect*
Carlstrom, J. E., Holder, G. P., & Reese, E. D. 2002, ARAA, 40, 643
http://adsabs.harvard.edu/abs/2002ARA%26A..40..643C

Review Article: *Tracing cosmic evolution with clusters of galaxies*
Voit, G. M. 2005, Reviews of Modern Physics, 77, 207
http://rmp.aps.org/abstract/RMP/v77/i1/p207_1

Article: *The Atacama Cosmology Telescope: Cosmology from Galaxy Clusters Detected via the Sunyaev-Zel'dovich Effect*
Sehgal, N., Trac, H., Acquaviva, V., et al. 2011, ApJ, 732, 44
http://adsabs.harvard.edu/abs/2011ApJ...732...44S

Article: *A Sunyaev-Zel'dovich-selected Sample of the Most Massive Galaxy Clusters in the 2500 deg2 South Pole Telescope Survey*
Williamson, R., Benson, B. A., High, F. W., et al. 2011, ApJ, 738, 139
http://adsabs.harvard.edu/abs/2011ApJ...738..139W

Article: *Discovery and Cosmological Implications of SPT-CL J2106-5844, the Most Massive Known Cluster at z>1*
Foley, R. J., Andersson, K., Bazin, G., et al. 2011, ApJ, 731, 86
http://adsabs.harvard.edu/abs/2011ApJ...731...86F

Article: *Planck 2013 results. XX. Cosmology from Sunyaev-Zeldovich cluster counts*
Planck Collaboration 2013, arXiv:1303.5080
http://adsabs.harvard.edu/abs/2013arXiv1303.5080P

11. Strong Gravitational Lensing

Book: *Gravitational Lensing: Strong, Weak, and Micro*
Schneider, P, Kochanek, C., Wambsganss, 2006
http://link.springer.com/book/10.1007/978-3-540-30310-7/page/1
Saas-Fee Advanced Course. Entire book available for download. Lots of theoretical details, but instead focus on Part 2 by C.S. Kochanek, on the different types of lenses observed, and primary observational results.

Review Article: *Cluster Lenses*
Kneib, J. P., Natarajan, P. 2011, A&ARvr, 19, 47
http://link.springer.com/article/10.1007/s00159-011-0047-3

Review Article: *Arc Statistics*
Meneghetti, M., Bartelmann, M., Dahle, H., & Limousin, M. 2013, SSRv, 177, 31
http://link.springer.com/article/10.1007%2Fs11214-013-9981-x

Review Article: *Applications of Gravitational Lensing in Cosmology*
Bartelmann, M. 2006, Astrophysics Update 2, 213
http://link.springer.com/chapter/10.1007/3-540-30313-8_7

Article: *Characterizing the Cluster Lens Population*
Hennawi, J. F., Dalal, N., Bode, P., & Ostriker, J.~P. 2007, ApJ, 654, 714
http://adsabs.harvard.edu/abs/2007ApJ...654..714H

Article: *CLASH: The Concentration-Mass Relation of Galaxy Clusters*
Merten, J., Meneghetti, M., Postman, M., et al.\ 2014, arXiv:1404.1376
http://arxiv.org/abs/1404.1376

Review Article: *Strong Lensing by Galaxies*
Treu, T. 2010, ARA&A 48, 87
http://www.annualreviews.org/doi/full/10.1146/annurev-astro-081309-130924

12. The Bullet Cluster

Astronomy picture of the day: http://apod.nasa.gov/apod/ap060824.html

Stanford University press release:
http://home.slac.stanford.edu/pressreleases/2006/20060821.htm

Article: *A Direct Empirical Proof of the Existence of Dark Matter*
Clowe, D., Bradac M., et al. 2006, ApJ, 648, 109
http://adsabs.harvard.edu/abs/2006ApJ...648L.109C

Review on **MOND**
Modified Newtonian Dynamics as an Alternative to Dark Matter
Sanders & McGaugh: 2002, ARA&A, 40, 263
http://adsabs.harvard.edu/abs/2002ARA%26A..40..263S

Article: *The speed of the `bullet' in the merging galaxy cluster 1E0657-56*
Springel, V. & Farrar G., 2007, MNRAS, 380, 911
http://adsabs.harvard.edu/abs/2007MNRAS.380..911S

Article: *Bullet Cluster: A Challenge to ΛCDM Cosmology*
Lee J, & Komatsu E., 2010, ApJ, 718, 60L
http://adsabs.harvard.edu/abs/2010ApJ...718...60L

13. The Growth of Supermassive Black Holes and Active Galactic Nuclei

Note: This is a broad area of research, and the observational aspects, though very interesting, are at first glance complicated and involve lots of observational astronomy jargon. You are strongly encouraged to consult with Joe Hennawi to help choose a set of topics to focus on.

Review Article: *What drives the growth of black holes?*
Alexander, D. M., & Hickox, R. C. 2012, New Astronomy Reviews, 56, 93
http://adsabs.harvard.edu/abs/2012NewAR..56...93A

Popular Article: *Supermassive Black Holes and the Growth of Galaxies?*
http://www.dartmouth.edu/~hickox/files/blackholes_galaxies_TA.pdf

Review Article: *The Cosmic History of Black Hole Growth from Deep Multiwavelength Surveys*
Treister, E., & Urry, C. M. 2012, Advances in Astronomy, 2012
http://adsabs.harvard.edu/abs/2011arXiv1112.0320T

Review Article: *Supermassive Black Holes in Galactic Nuclei: Past, Present and Future Research*
Ferrarese, L., & Ford, H. 2005, Space Science Reviews, 116, 523
http://adsabs.harvard.edu/abs/2005SSRv..116..523F

Review Article: *Deep Extragalactic X-ray Surveys*
Brandt, W. N., & Hasinger, G. 2005, ARA&A, 43, 827
http://adsabs.harvard.edu/abs/2005ARA%26A..43..827B

Review Article: *The Origins and the Early Evolution of Quasars and Supermassive Black Holes*
Djorgovski, S. G., Volonteri, M., Springel, V., Bromm, V., & Meylan, G. 2008, GR meeting
http://www.astro.caltech.edu/~george/mg11/Djorgovski_etal_MG11_preprint.pdf

14. Galaxy Clustering & Baryon Acoustic Oscillations

SDSS Web Site: http://www.sdss.org

Martin White's BAO Page: http://astro.berkeley.edu/~mwhite/bao/

Review Article: *Baryon Acoustic Oscillations*
Basset, B. & Hlozek, R., chapter contributed to the book "Dark Energy", Ed. P. Ruiz-Lapuente, Cambridge University Press
http://arxiv.org/abs/0910.5224

Review Article: *Dark Energy and Cosmic Sound*
Eisenstein, D. J. 2005, NAR, 49, 360
http://adsabs.harvard.edu/abs/2005NewAR..49..360E

Article: *Detection of the Baryon Acoustic Peak in the Large-Scale Correlation Function of SDSS Luminous Red Galaxies*
Eisenstein, D. J., Zehavi, I., Hogg, D. W., et al. 2005, ApJ, 633, 560
http://adsabs.harvard.edu/abs/2005ApJ...633..560E

Review Article: *Measuring our Universe from Galaxy Redshift Surveys*
Lahav, O., & Suto, Y. 2004, Living Reviews in Relativity, 7, 8
http://adsabs.harvard.edu/abs/2004LRR.....7....8L

15. The Lyα Forest & the Intergalactic Medium

Review Article: *The physics of the intergalactic medium*
Meiksin, A. A. 2009, Reviews of Modern Physics, 81, 1405
http://adsabs.harvard.edu/abs/2009RvMP...81.1405M

Review Article: *The Lyman Alpha Forest in the Spectra of QSOs*
Rauch, M. 1998, ARAA, 36, 267
http://adsabs.harvard.edu/abs/1998ARA%26A..36..267R

Review Article: *The Lyα Forest as a Cosmological Tool*
Weinberg, D. H. et al. 2003, The Emergence of Cosmic Structure, 666, 157
http://arxiv.org/abs/astro-ph/0301186

Article: *Can Sterile Neutrinos Be the Dark Matter?*
Seljak, U., Makarov, A., McDonald, P., & Trac, H. 2006, PRL, 97, 191303
http://adsabs.harvard.edu/abs/2006PhRvL..97s1303S

Article: *Cosmological parameters from combining the Lyman-α forest with CMB, galaxy clustering and SN constraints*
Seljak, U., Slosar, A., & McDonald, P. 2006, JCAP, 10, 14
http://adsabs.harvard.edu/abs/2006JCAP...10..014S

Article: *The Thermal Memory of Reionization History*
Hui, L., & Haiman, Z. 2003, ApJ, 596, 9
http://adsabs.harvard.edu/abs/2003ApJ...596....9H

Article: *Constraints from the Lyα Forest Power Spectrum*
Zaldarriaga, M., Hui, L., & Tegmark, M. 2001, ApJ, 557, 519
http://adsabs.harvard.edu/abs/2001ApJ...557..519Z

Article: *Detection of extended He II reionization in the temperature evolution of the intergalactic medium*
Becker, G. D., Bolton, J. S., Haehnelt, M. G., & Sargent, W. L. W. 2011, MNRAS, 410, 1096

http://adsabs.harvard.edu/abs/2011MNRAS.410.1096B

16. First Light & Cosmic Reionization

Popular Article: *The First Stars in the Universe and Cosmic Reionization*
Barkana, R. 2006, Science, 313, 931
http://www.sciencemag.org/content/313/5789/931.full.pdf

Review Article: *Observational Constraints on Cosmic Reionization*
Fan, X., Carilli, C. L., & Keating, B. 2006, ARAA, 44, 415
http://adsabs.harvard.edu/abs/2006ARA%26A..44..415F

Review Article: *In the beginning: the first sources of light and the reionization of the universe*
Barkana, R., & Loeb, A. 2001, Phys. Rep., 349, 125
http://adsabs.harvard.edu/abs/2001PhR...349..125B

Review Article: *The physics and early history of the intergalactic medium*
Barkana, R., & Loeb, A. 2007, Reports on Progress in Physics, 70, 627
http://adsabs.harvard.edu/abs/2007RPPh...70..627B

Article: *A luminous quasar at a redshift of z = 7.085*
Mortlock, D. J., Warren, S. J., Venemans, B. P., et al. 2011, Nature, 474, 616
http://adsabs.harvard.edu/abs/2011Natur.474..616M

Article: *Constraining the Evolution of the Ionizing Background and the Epoch of Reionization with z~6 Quasars. II. A Sample of 19 Quasars*
Fan, X., Strauss, M. A., Becker, R. H., et al. 2006, AJ, 132, 117
http://adsabs.harvard.edu/abs/2006AJ....132..117F

Article: *Lower-Luminosity Galaxies could reionize the Universe: Very Steep Faint-End Slopes to the UV Luminosity Functions at z>=5-8 from the HUDF09 WFC3/IR Observations*
Bouwens, R. J., Illingworth, G. D., Oesch, P. A., et al. 2011, arXiv:1105.2038
http://adsabs.harvard.edu/abs/2011arXiv1105.2038B

Article: *New Constraints on Cosmic Reionization from the 2012 Hubble Ultra Deep Field Campaign*
Robertson, B. E., Furlanetto, S. R., Schneider, E., et al. 2013, ApJ, 768, 71
http://adsabs.harvard.edu/abs/2013ApJ...768...71R