

Cover Page



Universiteit Leiden



The handle <http://hdl.handle.net/1887/19062> holds various files of this Leiden University dissertation.

Author: Hardeman, Sjoerd Reimer

Title: Non-decoupling of heavy scalars in cosmology

Date: 2012-06-08

Bibliography

- H. Abe. *Sequestering in models of F-term uplifting*. AIP Conf. Proc. **1078**, 411–413, 2009. arXiv:0809.0991 [hep-th].
- H. Abe, T. Higaki, and T. Kobayashi. *More about f-term uplifting*. Phys. Rev. **D76**, 105003, 2007a. arXiv:0707.2671.
- H. Abe, T. Higaki, T. Kobayashi, and Y. Omura. *Moduli stabilization, f-term uplifting and soft supersymmetry breaking terms*. Phys. Rev. **D75**, 025019, 2007b. hep-th/0611024.
- H. Abe, T. Higaki, T. Kobayashi, and Y. Omura. *Dynamically sequestered F-term uplifting in extra dimension*. JHEP **04**, 072, 2008. arXiv:0801.0998 [hep-th].
- A. Achúcarro and K. Sousa. *F-term uplifting and moduli stabilization consistent with Kahler invariance*. JHEP **03**, 002, 2008. arXiv:0712.3460 [hep-th].
- V. Acquaviva, N. Bartolo, S. Matarrese, and A. Riotto. *Second-order cosmological perturbations from inflation*. Nucl. Phys. **B667**, 119–148, 2003. astro-ph/0209156.
- J. A. Adams, B. Cresswell, and R. Easther. *Inflationary perturbations from a potential with a step*. Phys. Rev. **D64**, 123514, 2001. astro-ph/0102236.
- A. Albrecht and P. J. Steinhardt. *Cosmology for Grand Unified Theories with Radiatively Induced Symmetry Breaking*. Phys. Rev. Lett. **48**, 1220–1223, 1982.
- M. Alishahiha, E. Silverstein, and D. Tong. *DBI in the sky*. Phys. Rev. **D70**, 123505, 2004. hep-th/0404084.
- R. A. Alpher and R. C. Herman. *On the Relative Abundance of the Elements*. Physical Review **74**, 1737–1742, 1948.
- S. P. de Alwis. *Effective potentials for light moduli*. Phys. Lett. **B626**, 223–229, 2005a. hep-th/0506266.
- S. P. de Alwis. *On integrating out heavy fields in susy theories*. Phys. Lett. **B628**, 183–187, 2005b. hep-th/0506267.
- S. P. de Alwis. *Mediation of Supersymmetry Breaking in a Class of String Theory*

BIBLIOGRAPHY

- Models*. JHEP **03**, 023, 2009. arXiv:0806.2672 [hep-th].
- S. P. de Alwis. *Classical and Quantum SUSY Breaking Effects in IIB Local Models*. JHEP **03**, 078, 2010. arXiv:0912.2950 [hep-th].
- L. Amendola, C. Gordon, D. Wands, and M. Sasaki. *Correlated perturbations from inflation and the cosmic microwave background*. Phys. Rev. Lett. **88**, 211302, 2002. astro-ph/0107089.
- L. Aparicio, D. G. Cerdeno, and L. E. Ibanez. *Modulus-dominated SUSY-breaking soft terms in F-theory and their test at LHC*. JHEP **07**, 099, 2008. arXiv:0805.2943 [hep-ph].
- T. Appelquist and J. Carazzone. *Infrared Singularities and Massive Fields*. Phys. Rev. **D11**, 2856, 1975.
- C. Armendariz-Picon, T. Damour, and V. F. Mukhanov. *k-Inflation*. Phys. Lett. **B458**, 209–218, 1999. hep-th/9904075.
- P. S. Aspinwall. *Compactification, geometry and duality: $N = 2$* 2000. hep-th/0001001.
- D. J. Bacon, A. R. Refregier, and R. S. Ellis. *Detection of Weak Gravitational Lensing by Large-scale Structure*. Mon. Not. Roy. Astron. Soc. **318**, 625, 2000. astro-ph/0003008.
- M. Badziak. *F-term uplifted racetrack inflation* 2010. arXiv:1005.5537 [hep-th].
- M. Badziak and M. Olechowski. *Volume modulus inflation and a low scale of SUSY breaking*. JCAP **0807**, 021, 2008. arXiv:0802.1014 [hep-th].
- M. Badziak and M. Olechowski. *Volume modulus inflection point inflation and the gravitino mass problem*. JCAP **0902**, 010, 2009. arXiv:0810.4251 [hep-th].
- V. Balasubramanian, P. Berglund, J. P. Conlon, and F. Quevedo. *Systematics of Moduli Stabilisation in Calabi-Yau Flux Compactifications*. JHEP **03**, 007, 2005. hep-th/0502058.
- J. M. Bardeen, P. J. Steinhardt, and M. S. Turner. *Spontaneous Creation of Almost Scale - Free Density Perturbations in an Inflationary Universe*. Phys. Rev. **D28**, 679, 1983.
- N. Barnaby. *On Features and Nongaussianity from Inflationary Particle Production*. Phys. Rev. **D82**, 106009, 2010. arXiv:1006.4615 [astro-ph.CO].
- N. Barnaby and Z. Huang. *Particle Production During Inflation: Observational Constraints and Signatures*. Phys. Rev. **D80**, 126018, 2009. arXiv:0909.0751 [astro-ph.CO].
- N. Bartolo, E. Komatsu, S. Matarrese, and A. Riotto. *Non-Gaussianity from inflation: Theory and observations*. Phys. Rept. **402**, 103–266, 2004. astro-ph/0406398.
- A. O. Barvinsky, A. Y. Kamenshchik, and A. A. Starobinsky. *Inflation scenario via the Standard Model Higgs boson and LHC*. JCAP **0811**, 021, 2008.

- arXiv:0809.2104 [hep-ph].
- D. Baumann, A. Dymarsky, I. R. Klebanov, and L. McAllister. *Towards an Explicit Model of D-brane Inflation*. JCAP **0801**, 024, 2008. arXiv:0706.0360 [hep-th].
- D. Baumann, A. Dymarsky, I. R. Klebanov, L. McAllister, and P. J. Steinhardt. *A Delicate Universe*. Phys. Rev. Lett. **99**, 141601, 2007. arXiv:0705.3837 [hep-th].
- D. Baumann and L. McAllister. *Advances in Inflation in String Theory*. Ann. Rev. Nucl. Part. Sci. **59**, 67–94, 2009. arXiv:0901.0265 [hep-th].
- I. Ben-Dayan, R. Brustein, and S. P. de Alwis. *Models of Modular Inflation and Their Phenomenological Consequences*. JCAP **0807**, 011, 2008. arXiv:0802.3160 [hep-th].
- M. Berg, M. Haack, and E. Pajer. *Jumping Through Loops: On Soft Terms from Large Volume Compactifications*. JHEP **09**, 031, 2007. arXiv:0704.0737 [hep-th].
- F. Bernardeau and J.-P. Uzan. *Non-Gaussianity in multi-field inflation*. Phys. Rev. **D66**, 103506, 2002. hep-ph/0207295.
- F. L. Bezrukov and M. Shaposhnikov. *The Standard Model Higgs boson as the inflaton*. Phys. Lett. **B659**, 703–706, 2008. arXiv:0710.3755 [hep-th].
- P. Binetruy, G. Dvali, R. Kallosh, and A. Van Proeyen. *Fayet-iliopoulos terms in supergravity and cosmology*. Class. Quant. Grav. **21**, 3137–3170, 2004. hep-th/0402046.
- P. Binetruy and M. K. Gaillard. *Temperature corrections, supersymmetric effective potentials and inflation*. Nucl. Phys. **B254**, 388, 1985.
- P. Binetruy and M. K. Gaillard. *Candidates for the Inflaton Field in Superstring Models*. Phys. Rev. **D34**, 3069–3083, 1986.
- J. J. Blanco-Pillado, D. Buck, E. J. Copeland, M. Gomez-Reino, and N. J. Nunes. *Kahler Moduli Inflation Revisited*. JHEP **01**, 081, 2010. arXiv:0906.3711 [hep-th].
- J. J. Blanco-Pillado, R. Kallosh, and A. Linde. *Supersymmetry and stability of flux vacua*. JHEP **05**, 053, 2006a. hep-th/0511042.
- J. J. Blanco-Pillado et al. *Racetrack inflation*. JHEP **11**, 063, 2004. hep-th/0406230.
- J. J. Blanco-Pillado et al. *Inflating in a better racetrack*. JHEP **09**, 002, 2006b. hep-th/0603129.
- R. Blumenhagen, J. P. Conlon, S. Krippendorff, S. Moster, and F. Quevedo. *SUSY Breaking in Local String/F-Theory Models*. JHEP **09**, 007, 2009. arXiv:0906.3297 [hep-th].
- R. Blumenhagen, S. Moster, and E. Plauschinn. *String GUT Scenarios with Stabilised Moduli*. Phys. Rev. **D78**, 066008, 2008. arXiv:0806.2667 [hep-th].
- J. R. Bond, L. Kofman, S. Prokushkin, and P. M. Vaudrevange. *Roulette inflation with Kahler moduli and their axions*. Phys. Rev. **D75**, 123511, 2007. hep-th/0612197.

BIBLIOGRAPHY

- R. Brandenberger, D. A. Easson, and A. Mazumdar. *Inflation and brane gases*. Phys. Rev. **D69**, 083502, 2004. hep-th/0307043.
- R. H. Brandenberger and C. Vafa. *Superstrings in the Early Universe*. Nucl. Phys. **B316**, 391, 1989.
- P. Brax, A.-C. Davis, S. C. Davis, R. Jeannerot, and M. Postma. *Warping and f-term uplifting*. JHEP **09**, 125, 2007. arXiv:0707.4583.
- P. Breitenlohner and D. Z. Freedman. *Positive energy in anti-de sitter backgrounds and gauged extended supergravity*. Phys. Lett. **B115**, 197, 1982.
- T. S. Bunch and P. C. W. Davies. *Quantum Field Theory in de Sitter Space: Renormalization by Point Splitting*. Proc. Roy. Soc. Lond. **A360**, 117–134, 1978.
- C. P. Burgess, R. Holman, L. Leblond, and S. Shandera. *Breakdown of Semiclassical Methods in de Sitter Space*. JCAP **1010**, 017, 2010. arXiv:1005.3551 [hep-th].
- C. T. Byrnes and D. Wands. *Curvature and isocurvature perturbations from two-field inflation in a slow-roll expansion*. Phys. Rev. **D74**, 043529, 2006. astro-ph/0605679.
- P. Candelas and X. de la Ossa. *Moduli space of calabi-yau manifolds*. Nucl. Phys. **B355**, 455–481, 1991.
- B. de Carlos, J. A. Casas, A. Guarino, J. M. Moreno, and O. Seto. *Inflation in uplifted supergravities*. JCAP **0705**, 002, 2007. hep-th/0702103.
- X. Chen and Y. Wang. *Large non-Gaussianities with Intermediate Shapes from Quasi-Single Field Inflation*. Phys. Rev. **D81**, 063511, 2010a. arXiv:0909.0496 [astro-ph.CO].
- X. Chen and Y. Wang. *Quasi-Single Field Inflation and Non-Gaussianities*. JCAP **1004**, 027, 2010b. arXiv:0911.3380 [hep-th].
- J.-P. L. d. Cheseaux. *Traité de la comète*. M.M. Bousequet, Lausanne, 1744.
- C. Cheung, P. Creminelli, A. L. Fitzpatrick, J. Kaplan, and L. Senatore. *The Effective Field Theory of Inflation*. JHEP **03**, 014, 2008. arXiv:0709.0293 [hep-th].
- D. Chialva and U. H. Danielsson. *Chain inflation and the imprint of fundamental physics in the CMBR*. JCAP **0903**, 007, 2009. arXiv:0809.2707 [hep-th].
- K. Choi, A. Falkowski, H. P. Nilles, and M. Olechowski. *Soft supersymmetry breaking in KKL flux compactification*. Nucl. Phys. **B718**, 113–133, 2005. hep-th/0503216.
- K. Choi, A. Falkowski, H. P. Nilles, M. Olechowski, and S. Pokorski. *Stability of flux compactifications and the pattern of supersymmetry breaking*. JHEP **11**, 076, 2004. hep-th/0411066.
- D. J. H. Chung, E. W. Kolb, A. Riotto, and I. I. Tkachev. *Probing Planckian physics: Resonant production of particles during inflation and features in the primordial power spectrum*. Phys. Rev. **D62**, 043508, 2000. hep-ph/9910437.

- M. Cicoli, C. P. Burgess, and F. Quevedo. *Fibre Inflation: Observable Gravity Waves from IIB String Compactifications*. JCAP **0903**, 013, 2009. arXiv:0808.0691 [hep-th].
- M. Cicoli, J. P. Conlon, and F. Quevedo. *Systematics of String Loop Corrections in Type IIB Calabi- Yau Flux Compactifications*. JHEP **01**, 052, 2008. arXiv:0708.1873 [hep-th].
- D. Clowe, A. Gonzalez, and M. Markevitch. *Weak lensing mass reconstruction of the interacting cluster 1E0657-558: Direct evidence for the existence of dark matter*. Astrophys. J. **604**, 596–603, 2004. astro-ph/0312273.
- A. Coc, E. Vangioni-Flam, P. Descouvemont, A. Adahchour, and C. Angulo. *Updated Big Bang Nucleosynthesis confronted to WMAP observations and to the Abundance of Light Elements*. Astrophys. J. **600**, 544–552, 2004. astro-ph/0309480.
- J. P. Conlon. *Mirror Mediation*. JHEP **03**, 025, 2008. arXiv:0710.0873 [hep-th].
- J. P. Conlon, S. S. Abdussalam, F. Quevedo, and K. Suruliz. *Soft SUSY breaking terms for chiral matter in IIB string compactifications*. JHEP **01**, 032, 2007. hep-th/0610129.
- J. P. Conlon, R. Kallosh, A. Linde, and F. Quevedo. *Volume Modulus Inflation and the Gravitino Mass Problem*. JCAP **0809**, 011, 2008. arXiv:0806.0809 [hep-th].
- J. P. Conlon and F. Quevedo. *Kaehler moduli inflation*. JHEP **01**, 146, 2006. hep-th/0509012.
- J. P. Conlon, F. Quevedo, and K. Suruliz. *Large-volume flux compactifications: Moduli spectrum and D3/D7 soft supersymmetry breaking*. JHEP **08**, 007, 2005. hep-th/0505076.
- E. J. Copeland, I. J. Grivell, and A. R. Liddle. *Cosmological parameter estimation and the spectral index from inflation*. Mon. Not. Roy. Astron. Soc. **298**, 1233, 1998. astro-ph/9712028.
- C. J. Copi, D. N. Schramm, and M. S. Turner. *Big bang nucleosynthesis and the baryon density of the universe*. Science **267**, 192–199, 1995. astro-ph/9407006.
- F. P. Correia and M. G. Schmidt. *F-term Uplift in Heterotic M-theory*. Nucl. Phys. **B826**, 379–398, 2010. arXiv:0905.0846 [hep-th].
- L. Covi, J. Hamann, A. Melchiorri, A. Slosar, and I. Sorbera. *Inflation and WMAP three year data: Features have a future!*. Phys. Rev. **D74**, 083509, 2006. astro-ph/0606452.
- L. Covi et al. *Constraints on modular inflation in supergravity and string theory*. JHEP **08**, 055, 2008a. arXiv:0805.3290 [hep-th].
- L. Covi et al. *de Sitter vacua in no-scale supergravities and Calabi-Yau string models*. JHEP **06**, 057, 2008b. arXiv:0804.1073 [hep-th].
- P. Creminelli. *On non-gaussianities in single-field inflation*. JCAP **0310**, 003, 2003.

BIBLIOGRAPHY

- astro-ph/0306122.
- E. Cremmer, P. Fayet, and L. Girardello. *Gravity Induced Supersymmetry Breaking and Low-Energy Mass Spectrum*. Phys. Lett. **B122**, 41, 1983a.
- E. Cremmer, S. Ferrara, C. Kounnas, and D. V. Nanopoulos. *Naturally Vanishing Cosmological Constant in $N=1$ Supergravity*. Phys. Lett. **B133**, 61, 1983b.
- S. Cremonini, Z. Lalak, and K. Turzyński. *On Non-Canonical Kinetic Terms and the Tilt of the Power Spectrum*. Phys. Rev. **D82**, 047301, 2010a. arXiv:1005.4347 [hep-th].
- S. Cremonini, Z. Lalak, and K. Turzyński. *Strongly Coupled Perturbations in Two-Field Inflationary Models* 2010b. arXiv:1010.3021 [hep-th].
- G. Curio and V. Spillner. *On the modified KKLT procedure: A case study for the $P(11169)(18)$ model*. Int. J. Mod. Phys. **A22**, 3463–3492, 2007. hep-th/0606047.
- U. H. Danielsson. *A note on inflation and transplanckian physics*. Phys. Rev. **D66**, 023511, 2002. hep-th/0203198.
- K. Dasgupta, G. Rajesh, and S. Sethi. *M theory, orientifolds and G-flux*. JHEP **08**, 023, 1999. hep-th/9908088.
- S. C. Davis and M. Postma. *Successfully combining SUGRA hybrid inflation and moduli stabilisation*. JCAP **0804**, 022, 2008. arXiv:0801.2116 [hep-th].
- T. Digges. *Perfit Description of the Celestiall Orbes* 1576.
- M. Dine, R. Kitano, A. Morisse, and Y. Shirman. *Moduli decays and gravitinos*. Phys. Rev. **D73**, 123518, 2006. hep-ph/0604140.
- X. Dong, B. Horn, E. Silverstein, and A. Westphal. *Simple exercises to flatten your potential* 2010. arXiv:1011.4521 [hep-th].
- E. Dudas, C. Papineau, and S. Pokorski. *Moduli stabilization and uplifting with dynamically generated f -terms*. JHEP **02**, 028, 2007. hep-th/0610297.
- J. Dunkley et al. *Five-Year Wilkinson Microwave Anisotropy Probe (WMAP) Observations: Likelihoods and Parameters from the WMAP data*. Astrophys. J. Suppl. **180**, 306–329, 2009. arXiv:0803.0586 [astro-ph].
- R. Easther, B. R. Greene, W. H. Kinney, and G. Shiu. *Inflation as a probe of short distance physics*. Phys. Rev. **D64**, 103502, 2001. hep-th/0104102.
- A. Einstein. *The Field Equations of Gravitation*. Sitzungsber. Preuss. Akad. Wiss. Berlin (Math. Phys.) **1915**, 844–847, 1915.
- A. Einstein. *The foundation of the general theory of relativity*. Annalen Phys. **49**, 769–822, 1916.
- A. Einstein. *Cosmological Considerations in the General Theory of Relativity*. Sitzungsber. Preuss. Akad. Wiss. Berlin (Math. Phys.) **1917**, 142–152, 1917.
- O. Elgaroy, S. Hannestad, and T. Haugboelle. *Observational constraints on particle production during inflation*. JCAP **0309**, 008, 2003. astro-ph/0306229.

- L. L. Everett, I.-W. Kim, P. Ouyang, and K. M. Zurek. *Deflected Mirage Mediation: A Framework for Generalized Supersymmetry Breaking*. Phys. Rev. Lett. **101**, 101803, 2008a. arXiv:0804.0592 [hep-ph].
- L. L. Everett, I.-W. Kim, P. Ouyang, and K. M. Zurek. *Moduli Stabilization and Supersymmetry Breaking in Deflected Mirage Mediation*. JHEP **08**, 102, 2008b. arXiv:0806.2330 [hep-ph].
- P. Fayet and J. Iliopoulos. *Spontaneously Broken Supergauge Symmetries and Goldstone Spinors*. Phys. Lett. **B51**, 461–464, 1974.
- J. Fowler et al. *The Atacama Cosmology Telescope: A Measurement of the $600 < \ell < 8000$ Cosmic Microwave Background Power Spectrum at 148 GHz*. Astrophys. J. **722**, 1148–1161, 2010. arXiv:1001.2934 [astro-ph.CO].
- D. Freedman and A. van Proeyen. *Supergravity*, 2009. Lecture notes, to be published as a text book.
- A. Friedmann. *On the curvature of space*. Z. Phys. **10**, 377–386, 1922.
- J. Frieman, M. Turner, and D. Huterer. *Dark Energy and the Accelerating Universe*. Ann. Rev. Astron. Astrophys. **46**, 385–432, 2008. arXiv:0803.0982 [astro-ph].
- D. Gallego and M. Serone. *An Effective Description of the Landscape - I*. JHEP **01**, 056, 2009. arXiv:0812.0369 [hep-th].
- G. Gamow. *The Evolution of the Universe*. Nature **162**, 680–682, 1948a.
- G. Gamow. *The Origin of Elements and the Separation of Galaxies*. Physical Review **74**, 505–506, 1948b.
- J. Garriga and V. F. Mukhanov. *Perturbations in k -inflation*. Phys. Lett. **B458**, 219–225, 1999. hep-th/9904176.
- S. B. Giddings, S. Kachru, and J. Polchinski. *Hierarchies from fluxes in string compactifications*. Phys. Rev. **D66**, 106006, 2002. hep-th/0105097.
- M. Gomez-Reino and C. A. Scrucca. *Constraints for the existence of flat and stable non-supersymmetric vacua in supergravity*. JHEP **09**, 008, 2006a. hep-th/0606273.
- M. Gomez-Reino and C. A. Scrucca. *Locally stable non-supersymmetric minkowski vacua in supergravity*. JHEP **05**, 015, 2006b. hep-th/0602246.
- M. Gomez-Reino and C. A. Scrucca. *Metastable supergravity vacua with f and d supersymmetry breaking*. JHEP **08**, 091, 2007. arXiv:0706.2785.
- J.-O. Gong. *Breaking scale invariance from a singular inflaton potential*. JCAP **0507**, 015, 2005. astro-ph/0504383.
- J.-O. Gong and E. D. Stewart. *The power spectrum for a multi-component inflaton to second-order corrections in the slow-roll expansion*. Phys. Lett. **B538**, 213–222, 2002. astro-ph/0202098.
- C. Gordon, D. Wands, B. A. Bassett, and R. Maartens. *Adiabatic and entropy pertur-*

BIBLIOGRAPHY

- bations from inflation*. Phys. Rev. **D63**, 023506, 2001. astro-ph/0009131.
- B. R. Greene, K. Schalm, and G. Shiu. *Warped compactifications in M and F theory*. Nucl. Phys. **B584**, 480–508, 2000. hep-th/0004103.
- T. W. Grimm. *Axion Inflation in Type II String Theory*. Phys. Rev. **D77**, 126007, 2008. arXiv:0710.3883 [hep-th].
- S. Groot Nibbelink and J. W. van Holten. *Consistent sigma-models in N = 1 supergravity*. Nucl. Phys. **B588**, 57–89, 2000. hep-th/9903006.
- S. Groot Nibbelink, T. S. Nyawelo, and J. W. van Holten. *Construction and analysis of anomaly free supersymmetric SO(2N)/U(N) sigma-models*. Nucl. Phys. **B594**, 441–476, 2001. hep-th/0008097.
- S. Groot Nibbelink and B. J. W. van Tent. *Density perturbations arising from multiple field slow-roll inflation* 2000. hep-ph/0011325.
- S. Groot Nibbelink and B. J. W. van Tent. *Scalar perturbations during multiple field slow-roll inflation*. Class. Quant. Grav. **19**, 613–640, 2002. hep-ph/0107272.
- S. Gukov, C. Vafa, and E. Witten. *CFT's from Calabi-Yau four-folds*. Nucl. Phys. **B584**, 69–108, 2000. hep-th/9906070.
- A. H. Guth. *The Inflationary Universe: A Possible Solution to the Horizon and Flatness Problems*. Phys. Rev. **D23**, 347–356, 1981.
- A. H. Guth and S. Y. Pi. *Fluctuations in the New Inflationary Universe*. Phys. Rev. Lett. **49**, 1110–1113, 1982.
- E. Halley. *O the Infinity of the Sphere of Fix'd Stars*. by Edmund Halley, L. L. D. R. S. Royal Society of London Philosophical Transactions Series I **31**, 22–24, 1720a.
- E. Halley. *O the Number, Order, and Light of the Fix'd Stars*. by the Same. Royal Society of London Philosophical Transactions Series I **31**, 24–26, 1720b.
- J. Hamann, A. Shafieloo, and T. Souradeep. *Features in the primordial power spectrum? A frequentist analysis*. JCAP **1004**, 010, 2010. arXiv:0912.2728 [astro-ph.CO].
- S. Hanany et al. *MAXIMA-I: A Measurement of the Cosmic Microwave Background Anisotropy on angular scales of 10 arcminutes to 5 degrees*. Astrophys. J. **545**, L5, 2000. astro-ph/0005123.
- S. Hardeman, J. M. Oberreuter, G. A. Palma, K. Schalm, and T. van der Aalst. *The everpresent eta-problem: knowledge of all hidden sectors required* 2010. arXiv:1012.5966 [hep-ph].
- E. Harrison. *Darkness at Night: A Riddle of the Universe*. Harvard University Press, 1987.
- S. W. Hawking. *The Development of Irregularities in a Single Bubble Inflationary Universe*. Phys. Lett. **B115**, 295, 1982.
- G. Hinshaw et al. *Five-Year Wilkinson Microwave Anisotropy Probe (WMAP) Ob-*

- servations: Data Processing, Sky Maps, & Basic Results*. *Astrophys. J. Suppl.* **180**, 225–245, 2009. arXiv:0803.0732 [astro-ph].
- J. P. Hsu, R. Kallosh, and S. Prokushkin. *On brane inflation with volume stabilization*. *JCAP* **0312**, 009, 2003. hep-th/0311077.
- E. Hubble. *A relation between distance and radial velocity among extra-galactic nebulae*. *Proc. Nat. Acad. Sci.* **15**, 168–173, 1929.
- P. Hunt and S. Sarkar. *Multiple inflation and the WMAP 'glitches' II. Data analysis and cosmological parameter extraction*. *Phys. Rev.* **D76**, 123504, 2007. arXiv:0706.2443 [astro-ph].
- J.-c. Hwang and H. Noh. *Cosmological perturbations with multiple fluids and fields*. *Class. Quant. Grav.* **19**, 527–550, 2002. astro-ph/0103244.
- K. Ichiki, R. Nagata, and J. Yokoyama. *Cosmic Discordance: Detection of a modulation in the primordial fluctuation spectrum*. *Phys. Rev.* **D81**, 083010, 2010. arXiv:0911.5108 [astro-ph.CO].
- M. G. Jackson and K. Schalm. *Model Independent Signatures of New Physics in the Inflationary Power Spectrum* 2010. arXiv:1007.0185 [hep-th].
- N. Jarosik et al. *Seven-Year Wilkinson Microwave Anisotropy Probe (WMAP) Observations: Sky Maps, Systematic Errors, and Basic Results* 2010. arXiv:1001.4744 [astro-ph.CO].
- K. S. Jeong and S. Shin. *Moduli stabilization with F-term uplifting in heterotic string theory*. *Phys. Rev.* **D79**, 046001, 2009. arXiv:0811.0332 [hep-th].
- W. C. Jones et al. *A Measurement of the Angular Power Spectrum of the CMB Temperature Anisotropy from the 2003 Flight of Boomerang*. *Astrophys. J.* **647**, 823–832, 2006. astro-ph/0507494.
- S. Kachru, R. Kallosh, A. Linde, and S. P. Trivedi. *De sitter vacua in string theory*. *Phys. Rev.* **D68**, 046005, 2003a. hep-th/0301240.
- S. Kachru et al. *Towards inflation in string theory*. *JCAP* **0310**, 013, 2003b. hep-th/0308055.
- R. Kallosh and A. Linde. *Landscape, the scale of susy breaking, and inflation*. *JHEP* **12**, 004, 2004. hep-th/0411011.
- R. Kallosh and A. Linde. *O'kklt*. *JHEP* **02**, 002, 2007a. hep-th/0611183.
- R. Kallosh and A. Linde. *New models of chaotic inflation in supergravity*. *JCAP* **1011**, 011, 2010. arXiv:1008.3375 [hep-th].
- R. Kallosh and A. D. Linde. *Testing String Theory with CMB*. *JCAP* **0704**, 017, 2007b. arXiv:0704.0647 [hep-th].
- N. Kaloper, M. Kleban, A. E. Lawrence, and S. Shenker. *Signatures of short distance physics in the cosmic microwave background*. *Phys. Rev.* **D66**, 123510, 2002. hep-th/0201158.

BIBLIOGRAPHY

- N. Kaloper and L. Sorbo. *A Natural Framework for Chaotic Inflation*. Phys. Rev. Lett. **102**, 121301, 2009. arXiv:0811.1989 [hep-th].
- L. Kelvin. *On ether and gravitational matter through infinite space*. Philosophical Magazine, series 6 **2**, 161–177, 1901.
- A. Kempf and J. C. Niemeyer. *Perturbation spectrum in inflation with cutoff*. Phys. Rev. **D64**, 103501, 2001. astro-ph/0103225.
- J. J. Kepler. *Conversation with Galileo's Sidereal Messenger*. Johnson Reprint Corporation, 1610. Translation by E. ROsen, 1965.
- P. J. Kernan and L. M. Krauss. *Refined big bang nucleosynthesis constraints on Omega (baryon) and N (neutrino)*. Phys. Rev. Lett. **72**, 3309–3312, 1994. astro-ph/9402010.
- J. Khoury, B. A. Ovrut, P. J. Steinhardt, and N. Turok. *Density perturbations in the ekpyrotic scenario*. Phys. Rev. **D66**, 046005, 2002. hep-th/0109050.
- W. H. Kinney. *Horizon crossing and inflation with large eta*. Phys. Rev. **D72**, 023515, 2005. gr-qc/0503017.
- R. Kitano. *Dynamical gut breaking and mu-term driven supersymmetry breaking*. Phys. Rev. **D74**, 115002, 2006. hep-ph/0606129.
- I. R. Klebanov and M. J. Strassler. *Supergravity and a confining gauge theory: Duality cascades and chiSB-resolution of naked singularities*. JHEP **08**, 052, 2000. hep-th/0007191.
- E. Komatsu et al. *Seven-Year Wilkinson Microwave Anisotropy Probe (WMAP) Observations: Cosmological Interpretation 2010*. arXiv:1001.4538 [astro-ph.CO].
- A. Kosowsky and M. S. Turner. *CBR anisotropy and the running of the scalar spectral index*. Phys. Rev. **D52**, 1739–1743, 1995. astro-ph/9504071.
- A. Krause and E. Pajer. *Chasing Brane Inflation in String-Theory*. JCAP **0807**, 023, 2008. arXiv:0705.4682 [hep-th].
- Z. Lalak, O. J. Eyton-Williams, and R. Matyszkiewicz. *F-term uplifting via consistent d-terms*. JHEP **05**, 085, 2007a. hep-th/0702026.
- Z. Lalak, D. Langlois, S. Pokorski, and K. Turzyński. *Curvature and isocurvature perturbations in two-field inflation*. JCAP **0707**, 014, 2007b. arXiv:0704.0212 [hep-th].
- Z. Lalak, G. G. Ross, and S. Sarkar. *Racetrack inflation and assisted moduli stabilisation*. Nucl. Phys. **B766**, 1–20, 2007c. hep-th/0503178.
- D. Langlois and S. Renaux-Petel. *Perturbations in generalized multi-field inflation*. JCAP **0804**, 017, 2008. arXiv:0801.1085 [hep-th].
- D. Langlois, S. Renaux-Petel, D. A. Steer, and T. Tanaka. *Primordial fluctuations and non-Gaussianities in multi-field DBI inflation*. Phys. Rev. Lett. **101**, 061301, 2008a. arXiv:0804.3139 [hep-th].

- D. Langlois, S. Renaux-Petel, D. A. Steer, and T. Tanaka. *Primordial perturbations and non-Gaussianities in DBI and general multi-field inflation*. Phys. Rev. **D78**, 063523, 2008b. arXiv:0806.0336 [hep-th].
- D. Langlois, F. Vernizzi, and D. Wands. *Non-linear isocurvature perturbations and non-Gaussianities*. JCAP **0812**, 004, 2008c. arXiv:0809.4646 [astro-ph].
- D. Larson et al. *Seven-Year Wilkinson Microwave Anisotropy Probe (WMAP) Observations: Power Spectra and WMAP-Derived Parameters* 2010. arXiv:1001.4635 [astro-ph.CO].
- O. Lebedev, V. Lowen, Y. Mambrini, H. P. Nilles, and M. Ratz. *Metastable vacua in flux compactifications and their phenomenology*. JHEP **02**, 063, 2007. hep-ph/0612035.
- O. Lebedev, H. P. Nilles, and M. Ratz. *de sitter vacua from matter superpotentials*. Phys. Lett. **B636**, 126–131, 2006. hep-th/0603047.
- G. Lemaître. *Un Univers homogène de masse constante et de rayon croissant rendant compte de la vitesse radiale des nébuleuses extra-galactiques*. Annales de la Societe Scietifique de Bruxelles **47**, 49–59, 1927.
- G. Lemaître. *Expansion of the universe, A homogeneous universe of constant mass and increasing radius accounting for the radial velocity of extra-galactic nebulae*. Monthly Notices of the Royal Astronomical Society **91**, 483–490, 1931.
- A. R. Liddle and D. H. Lyth. *COBE, gravitational waves, inflation and extended inflation*. Phys. Lett. **B291**, 391–398, 1992. astro-ph/9208007.
- A. D. Linde. *A New Inflationary Universe Scenario: A Possible Solution of the Horizon, Flatness, Homogeneity, Isotropy and Primordial Monopole Problems*. Phys. Lett. **B108**, 389–393, 1982.
- A. D. Linde and A. Westphal. *Accidental Inflation in String Theory*. JCAP **0803**, 005, 2008. arXiv:0712.1610 [hep-th].
- D. H. Lyth. *What would we learn by detecting a gravitational wave signal in the cosmic microwave background anisotropy?*. Phys. Rev. Lett. **78**, 1861–1863, 1997. hep-ph/9606387.
- D. H. Lyth and A. R. Liddle. *The primordial density perturbation: Cosmology, inflation and the origin of structure*. Cambridge University Press, Cambridge (UK), 2009.
- J. M. Maldacena. *Non-Gaussian features of primordial fluctuations in single field inflationary models*. JHEP **05**, 013, 2003. astro-ph/0210603.
- K. A. Malik and D. Wands. *Cosmological perturbations*. Phys. Rept. **475**, 1–51, 2009. arXiv:0809.4944 [astro-ph].
- J. Martin and R. H. Brandenberger. *The trans-Planckian problem of inflationary cosmology*. Phys. Rev. **D63**, 123501, 2001. hep-th/0005209.

BIBLIOGRAPHY

- N. Maru. *Direct Gauge Mediation of Uplifted Metastable Supersymmetry Breaking in Supergravity*. Phys. Rev. **D82**, 075015, 2010. arXiv:1008.1440 [hep-ph].
- G. J. Mathews, D. J. H. Chung, K. Ichiki, T. Kajino, and M. Orito. *Constraints on resonant particle production during inflation from the matter and CMB power spectra*. Phys. Rev. **D70**, 083505, 2004. astro-ph/0406046.
- L. McAllister and E. Silverstein. *String Cosmology: A Review*. Gen. Rel. Grav. **40**, 565–605, 2008. arXiv:0710.2951 [hep-th].
- L. McAllister, E. Silverstein, and A. Westphal. *Gravity Waves and Linear Inflation from Axion Monodromy*. Phys. Rev. **D82**, 046003, 2010. arXiv:0808.0706 [hep-th].
- P. McFadden and K. Skenderis. *Holography for Cosmology*. Phys. Rev. **D81**, 021301, 2010a. arXiv:0907.5542 [hep-th].
- P. McFadden and K. Skenderis. *The Holographic Universe*. J. Phys. Conf. Ser. **222**, 012007, 2010b. arXiv:1001.2007 [hep-th].
- A. Melchiorri et al. *A measurement of Omega from the North American test flight of BOOMERANG*. Astrophys. J. **536**, L63–L66, 2000. astro-ph/9911445.
- A. Misra and P. Shukla. *Large Volume Axionic Swiss-Cheese Inflation*. Nucl. Phys. **B800**, 384–400, 2008. arXiv:0712.1260 [hep-th].
- V. F. Mukhanov. *Gravitational Instability of the Universe Filled with a Scalar Field*. JETP Lett. **41**, 493–496, 1985.
- V. F. Mukhanov. *Quantum Theory of Gauge Invariant Cosmological Perturbations*. Sov. Phys. JETP **67**, 1297–1302, 1988.
- V. F. Mukhanov. *CMB-slow, or How to Estimate Cosmological Parameters by Hand*. Int. J. Theor. Phys. **43**, 623–668, 2004. astro-ph/0303072.
- V. F. Mukhanov and G. V. Chibisov. *Quantum Fluctuation and Nonsingular Universe. (In Russian)*. JETP Lett. **33**, 532–535, 1981.
- H. P. Nilles, M. Peloso, and L. Sorbo. *Coupled fields in external background with application to nonthermal production of gravitinos*. JHEP **04**, 004, 2001. hep-th/0103202.
- M. R. Nolta et al. *Five-Year Wilkinson Microwave Anisotropy Probe (WMAP) Observations: Angular Power Spectra*. Astrophys. J. Suppl. **180**, 296–305, 2009. arXiv:0803.0593 [astro-ph].
- H. W. M. Olbers. *Über die durchsichtigkeit des weltraums*. Astronomische Jahrbuch f. 1826 **51**, 110–121, 1823.
- C. Papineau. *Finite temperature behaviour of the ISS-uplifted KKLТ model*. JHEP **05**, 068, 2008. arXiv:0802.1861 [hep-th].
- H. V. Peiris and L. Verde. *The Shape of the Primordial Power Spectrum: A Last Stand Before Planck*. Phys. Rev. **D81**, 021302, 2010. arXiv:0912.0268 [astro-ph.CO].

- A. A. Penzias and R. W. Wilson. *A Measurement of excess antenna temperature at 4080- Mc/s*. *Astrophys. J.* **142**, 419–421, 1965.
- S. Perlmutter et al. *Discovery of a Supernova Explosion at Half the Age of the Universe and its Cosmological Implications*. *Nature* **391**, 51–54, 1998. astro-ph/9712212.
- S. Perlmutter et al. *Measurements of Omega and Lambda from 42 High-Redshift Supernovae*. *Astrophys. J.* **517**, 565–586, 1999. astro-ph/9812133.
- C. M. Peterson and M. Tegmark. *Testing Two-Field Inflation* 2010. arXiv:1005.4056 [astro-ph.CO].
- Planck collaboration. *Planck: The scientific programme* 2006. astro-ph/0604069.
- A. C. S. Readhead et al. *Extended Mosaic Observations with the Cosmic Background Imager*. *Astrophys. J.* **609**, 498–512, 2004. astro-ph/0402359.
- A. Refregier. *Weak Gravitational Lensing by Large-Scale Structure*. *Ann. Rev. Astron. Astrophys.* **41**, 645–668, 2003. astro-ph/0307212.
- C. L. Reichardt et al. *High resolution CMB power spectrum from the complete ACBAR data set*. *Astrophys. J.* **694**, 1200–1219, 2009. arXiv:0801.1491 [astro-ph].
- B. A. Reid et al. *Baryon Acoustic Oscillations in the Sloan Digital Sky Survey Data Release 7 Galaxy Sample*. *Mon. Not. Roy. Astron. Soc.* **401**, 2148–2168, 2010. arXiv:0907.1660 [astro-ph.CO].
- A. G. Riess et al. *Observational Evidence from Supernovae for an Accelerating Universe and a Cosmological Constant*. *Astron. J.* **116**, 1009–1038, 1998. astro-ph/9805201.
- G. I. Rigopoulos, E. P. S. Shellard, and B. J. W. van Tent. *Large non-Gaussianity in multiple-field inflation*. *Phys. Rev.* **D73**, 083522, 2006a. astro-ph/0506704.
- G. I. Rigopoulos, E. P. S. Shellard, and B. J. W. van Tent. *Non-linear perturbations in multiple-field inflation*. *Phys. Rev.* **D73**, 083521, 2006b. astro-ph/0504508.
- G. I. Rigopoulos, E. P. S. Shellard, and B. J. W. van Tent. *Quantitative bispectra from multifield inflation*. *Phys. Rev.* **D76**, 083512, 2007. astro-ph/0511041.
- H. P. Robertson. *On the Foundations of Relativistic Cosmology*. *Proceedings of the National Academy of Science* **15**, 822–829, 1929.
- A. E. Romano and M. Sasaki. *Effects of particle production during inflation*. *Phys. Rev.* **D78**, 103522, 2008. arXiv:0809.5142 [gr-qc].
- S. G. Rubin. *Effect of massive fields on inflation*. *JETP Lett.* ,74 pages 247–250, 2001. hep-ph/0110132.
- V. C. Rubin and W. K. Ford, Jr. *Rotation of the Andromeda Nebula from a Spectroscopic Survey of Emission Regions*. *Astrophys. J.* **159**, 379–403, 1970.
- D. S. Salopek and J. R. Bond. *Nonlinear evolution of long wavelength metric fluctu-*

- ations in inflationary models.* Phys. Rev. **D42**, 3936–3962, 1990.
- A. Saltman and E. Silverstein. *The scaling of the no-scale potential and de sitter model building.* JHEP **11**, 066, 2004. hep-th/0402135.
- M. Sasaki. *Large Scale Quantum Fluctuations in the Inflationary Universe.* Prog. Theor. Phys. **76**, 1036, 1986.
- M. Sasaki and E. D. Stewart. *A General analytic formula for the spectral index of the density perturbations produced during inflation.* Prog. Theor. Phys. **95**, 71–78, 1996. astro-ph/9507001.
- K. Schalm, G. Shiu, and J. P. van der Schaar. *Decoupling in an expanding universe: Boundary RG-flow affects initial conditions for inflation.* JHEP **04**, 076, 2004. hep-th/0401164.
- D. Seery and J. E. Lidsey. *Primordial non-gaussianities from multiple-field inflation.* JCAP **0509**, 011, 2005. astro-ph/0506056.
- E. Silverstein and D. Tong. *Scalar Speed Limits and Cosmology: Acceleration from D-cceleration.* Phys. Rev. **D70**, 103505, 2004. hep-th/0310221.
- E. Silverstein and A. Westphal. *Monodromy in the CMB: Gravity Waves and String Inflation.* Phys. Rev. **D78**, 106003, 2008. arXiv:0803.3085 [hep-th].
- J. Simon, R. Jimenez, L. Verde, P. Berglund, and V. Balasubramanian. *Using cosmology to constrain the topology of hidden dimensions* 2006. astro-ph/0605371.
- W. de Sitter. *Further remarks on the solutions of the field-equations of the Einstein's theory of gravitation.* Koninklijke Nederlandse Akademie van Wetenschappen Proceedings Series B Physical Sciences **20**, 1309–1312, 1918a.
- W. de Sitter. *On the curvature of space.* Koninklijke Nederlandse Akademie van Wetenschappen Proceedings Series B Physical Sciences **20**, 1918b.
- G. F. Smoot et al. *Structure in the COBE differential microwave radiometer first year maps.* Astrophys. J. **396**, L1–L5, 1992.
- D. N. Spergel et al. *First Year Wilkinson Microwave Anisotropy Probe (WMAP) Observations: Determination of Cosmological Parameters.* Astrophys. J. Suppl. **148**, 175–194, 2003. astro-ph/0302209.
- V. Springel et al. *Simulating the joint evolution of quasars, galaxies and their large-scale distribution.* Nature **435**, 629–636, 2005. astro-ph/0504097.
- A. A. Starobinsky. *Dynamics of Phase Transition in the New Inflationary Universe Scenario and Generation of Perturbations.* Phys. Lett. **B117**, 175–178, 1982.
- A. A. Starobinsky. *Multicomponent de Sitter (Inflationary) Stages and the Generation of Perturbations.* JETP Lett. **42**, 152–155, 1985.
- A. A. Starobinsky. *Spectrum of adiabatic perturbations in the universe when there are singularities in the inflation potential.* JETP Lett. **55**, 489–494, 1992.
- P. J. Steinhardt and M. S. Turner. *A Prescription for Successful New Inflation.* Phys.

- Rev. **D29**, 2162–2171, 1984.
- P. J. Steinhardt and N. Turok. *A cyclic model of the universe* 2001. hep-th/0111030.
- P. J. Steinhardt and N. Turok. *A cyclic model of the universe*. Science **296**, 1436–1439, 2002.
- S. H. Suyu et al. *Dissecting the Gravitational Lens B1608+656. II. Precision Measurements of the Hubble Constant, Spatial Curvature, and the Dark Energy Equation of State*. Astrophys. J. **711**, 201–221, 2010. arXiv:0910.2773 [astro-ph.CO].
- M. Tegmark et al. *Cosmological Constraints from the SDSS Luminous Red Galaxies*. Phys. Rev. **D74**, 123507, 2006. astro-ph/0608632.
- B. J. W. van Tent. *Multiple-field inflation and the CMB*. Class. Quant. Grav. **21**, 349–370, 2004. astro-ph/0307048.
- D. Tocchini-Valentini, M. Douspis, and J. Silk. *Are there features in the primordial power spectrum?*. Mon. Not. Roy. Astron. Soc. **359**, 31–35, 2005. astro-ph/0402583.
- A. J. Tolley and M. Wyman. *The Gelaton Scenario: Equilateral non-Gaussianity from multi-field dynamics*. Phys. Rev. **D81**, 043502, 2010. arXiv:0910.1853 [hep-th].
- E. Torbet et al. *A Measurement of the Angular Power Spectrum of the Microwave Background Made from the High Chilean Andes*. Astrophys. J. **521**, L79–L82, 1999. astro-ph/9905100.
- S. Tsujikawa, D. Parkinson, and B. A. Bassett. *Correlation-consistency cartography of the double inflation landscape*. Phys. Rev. **D67**, 083516, 2003. astro-ph/0210322.
- N. Turok. *A Causal Source which Mimics Inflation*. Phys. Rev. Lett. **77**, 4138–4141, 1996. astro-ph/9607109.
- S. H. H. Tye and J. Xu. *A Meandering Inflaton*. Phys. Lett. **B683**, 326–330, 2010. arXiv:0910.0849 [hep-th].
- S. H. H. Tye, J. Xu, and Y. Zhang. *Multi-field Inflation with a Random Potential*. JCAP **0904**, 018, 2009. arXiv:0812.1944 [hep-th].
- A. G. Walker. *Distance in an expanding universe*. Monthly Notices of the Royal Astronomical Society **94**, 159–+, 1933.
- D. Wands. *Multiple field inflation*. Lect. Notes Phys. **738**, 275–304, 2008. astro-ph/0702187.
- D. Wands, N. Bartolo, S. Matarrese, and A. Riotto. *An observational test of two-field inflation*. Phys. Rev. **D66**, 043520, 2002. astro-ph/0205253.
- S. Weinberg. *Effective Field Theory for Inflation*. Phys. Rev. **D77**, 123541, 2008. arXiv:0804.4291 [hep-th].
- F. Zwicky. *Spectral displacement of extra galactic nebulae*. Helv. Phys. Acta **6**,

BIBLIOGRAPHY

110–127, 1933.