

Nojiri, Shin'ichi; Odintsov, Sergei D.; Saridakis, Emmanuel N.; Myrzakulov, R.
Correspondence of cosmology from non-extensive thermodynamics with fluids of generalized equation of state. (English) [Zbl 1472.83120](#)
Nucl. Phys., B 950, Article ID 114850, 12 p. (2020).

Summary: We show that there is a correspondence between cosmology from non-extensive thermodynamics and cosmology with fluids of redefined and generalized equation of state. We first establish the correspondence in the case of basic non-extensive thermodynamics, and then we proceed by investigating the more consistent case, from the quantum field theoretical point of view, of varying exponent, namely depending on the scale. The obtained duality provides a way of explaining the complicated phenomenological forms of the effective fluid equation-of-state parameters that are being broadly used in the literature, since their microphysical origin may indeed lie in the non-extensive thermodynamics of spacetime. Finally, concerning the cosmological behavior, we show that at late times the effective fluid may drive the universe acceleration even in the absence of an explicit cosmological constant, and even if the initial fluid is the standard dust matter one. Similarly, at early times we obtain an effective cosmological constant which is enhanced through screening, and hence it can drive a successful inflation without spoiling the correct late-time acceleration.

MSC:

- 83F05 Relativistic cosmology
- 80A10 Classical and relativistic thermodynamics
- 83C55 Macroscopic interaction of the gravitational field with matter (hydrodynamics, etc.)
- 76E20 Stability and instability of geophysical and astrophysical flows
- 81T20 Quantum field theory on curved space or space-time backgrounds
- 83E05 Geometrodynamics and the holographic principle

Keywords:

[inflation](#); [late-time acceleration](#); [dust matter](#)

Full Text: [DOI](#) [arXiv](#)

References:

- [1] Capozziello, S.; De Laurentis, M., Phys. Rep., 509, 167 (2011)
- [2] Nojiri, S.; Odintsov, S. D., Phys. Rep., 505, 59 (2011)
- [3] Nojiri, S.; Odintsov, S. D.; Oikonomou, V. K., Phys. Rep., 692, 1 (2017)
- [4] Bartolo, N.; Komatsu, E.; Matarrese, S.; Riotto, A., Phys. Rep., 402, 103 (2004)
- [5] Peebles, P. J.E.; Ratra, B., Rev. Mod. Phys., 75, 559 (2003)
- [6] Cai, Y.-F.; Saridakis, E. N.; Setare, M. R.; Xia, J.-Q., Phys. Rep., 493, 1 (2010)
- [7] Jacobson, T., Phys. Rev. Lett., 75, 1260 (1995)
- [8] Padmanabhan, T., Phys. Rep., 406, 49 (2005)
- [9] Padmanabhan, T., Rep. Prog. Phys., 73, Article 046901 pp. (2010)
- [10] Cai, R. G.; Kim, S. P., J. High Energy Phys., 0502, Article 050 pp. (2005)
- [11] Akbar, M.; Cai, R. G., Phys. Rev. D, 75, Article 084003 pp. (2007)
- [12] Cai, R. G.; Cao, L. M., Phys. Rev. D, 75, Article 064008 pp. (2007)
- [13] Paranjape, A.; Sarkar, S.; Padmanabhan, T., Phys. Rev. D, 74, Article 104015 pp. (2006)
- [14] Sheykhi, A.; Wang, B.; Cai, R. G., Nucl. Phys. B, 779, 1 (2007)
- [15] Akbar, M.; Cai, R. G., Phys. Lett. B, 635, 7 (2006)
- [16] Jamil, M.; Saridakis, E. N.; Setare, M. R., Phys. Rev. D, 81, Article 023007 pp. (2010)
- [17] Cai, R. G.; Ohta, N., Phys. Rev. D, 81, Article 084061 pp. (2010)
- [18] Wang, M.; Jing, J.; Ding, C.; Chen, S., Phys. Rev. D, 81, Article 083006 pp. (2010)

- [19] Jamil, M.; Saridakis, E. N.; Setare, M. R., *J. Cosmol. Astropart. Phys.*, 1011, Article 032 pp. (2010)
- [20] Gim, Y.; Kim, W.; Yi, S. H., *J. High Energy Phys.*, 1407, Article 002 pp. (2014)
- [21] Fan, Z. Y.; Lu, H., *Phys. Rev. D*, 91, 6, Article 064009 pp. (2015)
- [22] D'Agostino, R., *Phys. Rev. D*, 99, 10, Article 103524 pp. (2019)
- [23] Tsallis, C., *J. Stat. Phys.*, 52, 479 (1988)
- [24] Lyra, M. L.; Tsallis, C., *Phys. Rev. Lett.*, 80, 53 (1998)
- [25] Wilk, G.; Wlodarczyk, Z., *Phys. Rev. Lett.*, 84, 2770 (2000)
- [26] Tsallis, C.; Cirto, L. J.L., *Eur. Phys. J. C*, 73, 2487 (2013)
- [27] Komatsu, N.; Kimura, S., *Phys. Rev. D*, 88, Article 083534 pp. (2013)
- [28] Barboza, E. M.; Nunes, R.d. C.; Abreu, E. M.C.; Ananias Neto, J., *Physica A*, 436, 301 (2015)
- [29] Lymperis, A.; Saridakis, E. N., *Eur. Phys. J. C*, 78, 12, 993 (2018)
- [30] Saridakis, E. N.; Bamba, K.; Myrzakulov, R.; Anagnostopoulos, F. K., *J. Cosmol. Astropart. Phys.*, 1812, 12, Article 012 pp. (2018)
- [31] Sheykhi, A., *Phys. Lett. B*, 785, 118 (2018)
- [32] Artymowski, M.; Mielczarek, J.
- [33] Abreu, E. M.C.; Neto, J. A.; Mendes, A. C.R.; Bonilla, A., *Europhys. Lett.*, 121, 4, Article 45002 pp. (2018)
- [34] Jawad, A.; Iqbal, A., *Int. J. Geom. Methods Mod. Phys.*, 15, 08, Article 1850130 pp. (2018)
- [35] Abdollahi Zadeh, M.; Sheykhi, A.; Moradpour, H., *Mod. Phys. Lett. A*, 34, 11, Article 1950086 pp. (2019)
- [36] da Silva, W. J.C.; Silva, R., *J. Cosmol. Astropart. Phys.*, 1905, Article 036 pp. (2019)
- [37] Nojiri, S.; Odintsov, S. D.; Saridakis, E. N., *Eur. Phys. J. C*, 79, 3, 242 (2019)
- [38] Barrow, J. D.; Mimoso, J. P., *Phys. Rev. D*, 50, 3746 (1994)
- [39] Tsagas, C. G.; Barrow, J. D., *Class. Quantum Gravity*, 15, 3523 (1998)
- [40] Buchert, T., *Gen. Relativ. Gravit.*, 33, 1381 (2001)
- [41] Hwang, J.c.; Noh, H., *Class. Quantum Gravity*, 19, 527 (2002)
- [42] Carturan, D.; Finelli, F., *Phys. Rev. D*, 68, Article 103501 pp. (2003)
- [43] Kremer, G. M., *Phys. Rev. D*, 68, Article 123507 pp. (2003)
- [44] Gorini, V.; Kamenshchik, A.; Moschella, U.; Pasquier, V.; Starobinsky, A., *Phys. Rev. D*, 72, Article 103518 pp. (2005)
- [45] Capozziello, S.; Nojiri, S.; Odintsov, S. D.; Troisi, A., *Phys. Lett. B*, 639, 135 (2006)
- [46] Hipolito-Ricaldi, W. S.; Velten, H. E.S.; Zimdahl, W., *J. Cosmol. Astropart. Phys.*, 0906, Article 016 pp. (2009)
- [47] Basilakos, S.; Plionis, M.; Sola, J., *Phys. Rev. D*, 80, Article 083511 pp. (2009)
- [48] Elizalde, E.; Saez-Gomez, D., *Phys. Rev. D*, 80, Article 044030 pp. (2009)
- [49] Grande, J.; Sola, J.; Basilakos, S.; Plionis, M., *J. Cosmol. Astropart. Phys.*, 1108, Article 007 pp. (2011)
- [50] Li, M.; Li, X. D.; Wang, S.; Wang, Y., *Commun. Theor. Phys.*, 56, 525 (2011)
- [51] Cruz, N.; Lepe, S.; Pena, F., *Phys. Lett. B*, 699, 135 (2011)
- [52] Lima, J. A.S.; Basilakos, S.; Sola, J., *Mon. Not. R. Astron. Soc.*, 431, 923 (2013)
- [53] Balakin, A. B.; Bochkarev, V. V., *Phys. Rev. D*, 87, 2, Article 024006 pp. (2013)
- [54] Koivisto, T. S.; Saridakis, E. N.; Tamanini, N., *J. Cosmol. Astropart. Phys.*, 1509, Article 047 pp. (2015)
- [55] Paliathanasis, A.; Tsamparlis, M.; Basilakos, S.; Barrow, J. D., *Phys. Rev. D*, 93, 4, Article 043528 pp. (2016)
- [56] Brevik, I.; Timoshkin, A. V., *Int. J. Geom. Methods Mod. Phys.*, 14, 04, Article 1750061 pp. (2017)
- [57] Oikonomou, V. K., *Int. J. Mod. Phys. D*, 26, 10, Article 1750110 pp. (2017)
- [58] Brevik, I.; Elizalde, E.; Odintsov, S. D.; Timoshkin, A. V., *Int. J. Geom. Methods Mod. Phys.*, 14, 12, Article 1750185 pp. (2017)
- [59] Elizalde, E.; Khurshudyan, M.
- [60] Brevik, I.; Obukhov, V. V.; Timoshkin, A. V., *Int. J. Geom. Methods Mod. Phys.*, 15, 09, Article 1850150 pp. (2018)
- [61] Nojiri, S.; Odintsov, S. D., *Phys. Rev. D*, 72, Article 023003 pp. (2005)
- [62] Nojiri, S.; Odintsov, S. D., *Phys. Lett. B*, 639, 144 (2006)
- [63] Elizalde, E.; Nojiri, S.; Odintsov, S. D.; Wang, P., *Phys. Rev. D*, 71, Article 103504 pp. (2005)
- [64] Brevik, I.; Gron, O.; de Haro, J.; Odintsov, S. D.; Saridakis, E. N., *Int. J. Mod. Phys. D*, 26, 14, Article 1730024 pp. (2017)
- [65] Cai, R. G.; Cao, L. M.; Hu, Y. P., *Class. Quantum Gravity*, 26, Article 155018 pp. (2009)
- [66] Cai, Y. F.; Liu, J.; Li, H., *Phys. Lett. B*, 690, 213 (2010)
- [67] Cai, Y. F.; Saridakis, E. N., *Phys. Lett. B*, 697, 280 (2011)

This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.