

# Scalar field dark energy with a minimal coupling in a spherically symmetric background

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## Abstract

© 2018 World Scientific Publishing Company. Dark energy models and modified gravity theories have been actively studied and the behaviors in the solar system have been also carefully investigated in a part of the models. However, the isotropic solutions of the field equations in the simple models of dark energy, e.g. quintessence model without matter coupling, have not been well investigated. One of the reason would be the nonlinearity of the field equations. In this paper, a method to evaluate the solution of the field equations is constructed, and it is shown that there is a model that can easily pass the solar system tests, whereas, there is also a model that is constrained from the solar system tests.

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## Keywords

Dark energy,  $k$ -essence, quintessence, spherically symmetric solutions

## References

- [1] Supernova Search Team Collab. (A. G. Riess et al), *Astron. J.* 116 (1998) 1009, arXiv:astro-ph/9805201
- [2] Supernova Cosmology Project Collab. (S. Perlmutter et al), *Astrophys. J.* 517 (1999) 565, arXiv:astro-ph/9812133
- [3] C. Armendariz-Picon, T. Damour and V. F. Mukhanov, *Phys. Lett. B* 458 (1999) 209, arXiv:hep-th/9904075
- [4] J. Garriga and V. F. Mukhanov, *Phys. Lett. B* 458 (1999) 219, arXiv:hep-th/9904176
- [5] C. Armendariz-Picon, V. F. Mukhanov and P. J. Steinhardt, *Phys. Rev. D* 63 (2001) 103510, arXiv:astro-ph/0006373
- [6] P. J. E. Peebles and B. Ratra, *Astrophys. J.* 325 (1988) L17
- [7] B. Ratra and P. J. E. Peebles, *Phys. Rev. D* 37 (1988) 3406
- [8] T. Chiba, N. Sugiyama and T. Nakamura, *Mon. Not. R. Astron. Soc.* 289 (1997) L5, arXiv:astro-ph/9704199
- [9] I. Zlatev, L. M. Wang and P. J. Steinhardt, *Phys. Rev. Lett.* 82 (1999) 896, arXiv:astro-ph/9807002
- [10] J. Khoury and A. Weltman, *Phys. Rev. D* 69 (2004) 044026, arXiv:astro-ph/0309411
- [11] C. M. Will, *Living Rev. Rel.* 17 (2014) 4, arXiv:1403.7377 [gr-qc]
- [12] V. Kagramanova, J. Kunz and C. Lammerzahl, *Phys. Lett. B* 634 (2006) 465, arXiv:gr-qc/0602002
- [13] O. Bergmann and R. Leipnik, *Phys. Rev.* 107 (1957) 1157
- [14] M. Mehrpooya and D. Momeni, *Int. J. Mod. Phys. A* 25 (2010) 1429, arXiv:0903.1185 [gr-qc]
- [15] A. D. Chernin, D. I. Santiago and A. S. Silbergleit, *Phys. Lett. A* 294 (2002) 79, arXiv:astro-ph/0106144
- [16] P. F. Gonzalez-Diaz, *Phys. Lett. B* 522 (2001) 211, arXiv:astro-ph/0110335
- [17] V. V. Kiselev, *Class. Quantum Grav.* 20 (2003) 1187, arXiv:gr-qc/0210040
- [18] V. Sahni and A. A. Starobinsky, *Int. J. Mod. Phys. D* 9 (2000) 373, arXiv:astro-ph/9904398

- [19] T. Chiba, A. Felice and S. Tsujikawa, Phys. Rev. D 87 (2013) 083505, arXiv: 1210.3859 [astro-ph.CO]
- [20] L. Amendola and S. Tsujikawa, Dark Energy: Theory and Observations (Cambridge University Press, New York, 2010)
- [21] B. Bertotti, L. Iess and P. Tortora, Nature 425 (2003) 374
- [22] L. Iess, G. Giampieri, J. D. Anderson and B. Bertotti, Class. Quantum Grav. 16 (1999) 1487
- [23] O. Farooq, D. Mania and B. Ratra, Astrophys. J. 764 (2013) 138, arXiv:1211.4253 [astro-ph.CO]