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Publication list

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Peer Reviewed Articles

- [1] J. M. Yao, B. Bally, J. Engel, R. Wirth, T. R. Rodríguez, and H. Hergert. Ab initio treatment of collective correlations and the neutrinoless double beta decay of ^{48}Ca . *Phys. Rev. Lett.*, 124:232501, Jun 2020.
- [2] R.A.M. Basili, J. M. Yao, J. Engel, H. Hergert, M. Lockner, P. Maris, and J.P. Vary. Benchmark neutrinoless double-beta decay matrix elements in a light nucleus. *Phys. Rev. C*, 2020.
- [3] X. Y. Wu and J. M. Yao. Quadrupole collectivity and shell closure in neutron-rich nuclei near $n = 126$. *Phys. Rev. C*, 99:054329, May 2019.
- [4] J. M. Yao, J. Engel, L. J. Wang, C. F. Jiao, and H. Hergert. Generator-coordinate reference states for spectra and $0\nu\beta\beta$ decay in the in-medium similarity renormalization group. *Phys. Rev. C*, 98:054311, Nov 2018.
- [5] Long-Jun Wang, Jonathan Engel, and J. M. Yao. Quenching of nuclear matrix elements for $0\nu\beta\beta$ decay by chiral two-body currents. *Phys. Rev. C*, 98:031301, Sep 2018.
- [6] H. Mei, K. Hagino, J. M. Yao, and T. Motoba. Disappearance of nuclear deformation in hypernuclei: A perspective from a beyond-mean-field study. *Phys. Rev. C*, 97:064318, Jun 2018.
- [7] Y. Fu, H. Tong, X. F. Wang, H. Wang, D. Q. Wang, X. Y. Wang, and J. M. Yao. Microscopic analysis of shape transition in neutron-deficient yb isotopes. *Phys. Rev. C*, 97:014311, Jan 2018.
- [8] Y. Fu, H. Wang, L.-J. Wang, and J. M. Yao. Odd-even parity splittings and octupole correlations in neutron-rich ba isotopes. *Phys. Rev. C*, 97:024338, Feb 2018.
- [9] X. Y. Wu, H. Mei, J. M. Yao, and Xian-Rong Zhou. Beyond-mean-field study of the hyperon impurity effect in hypernuclei with shape coexistence. *Phys. Rev. C*, 95:034309, Mar 2017.
- [10] H. Xia, H. Mei, and J. M. Yao. Configuration mixing in low-lying spectra of carbon hypernuclei. *Science China Physics, Mechanics & Astronomy*, 60(10):102021, Jul 2017.

- [11] L. S. Song, [J. M. Yao](#), P. Ring, and J. Meng. Nuclear matrix element of neutrinoless double- β decay: Relativity and short-range correlations. *Phys. Rev. C*, 95:024305, Feb 2017.
- [12] H. Mei, K. Hagino, [J. M. Yao](#), and T. Motoba. Transition from vibrational to rotational character in low-lying states of hypernuclei. *Phys. Rev. C*, 96:014308, Jul 2017.
- [13] E.F. Zhou, [J. M. Yao](#), Z.P. Li, J. Meng, and P. Ring. Anatomy of molecular structures in ^{20}ne . *Physics Letters B*, 753:227 – 231, 2016.
- [14] [J. M. Yao](#) and K. Hagino. Anharmonicity of multi-octupole-phonon excitations in ^{208}Pb : Analysis with multireference covariant density functional theory and subbarrier fusion of $^{16}\text{O} + ^{208}\text{Pb}$. *Phys. Rev. C*, 94:011303, Jul 2016.
- [15] H. Mei, K. Hagino, and [J. M. Yao](#). Generator coordinate method for hypernuclear spectroscopy with a covariant density functional. *Phys. Rev. C*, 93:011301, Jan 2016.
- [16] H. Mei, K. Hagino, [J. M. Yao](#), and T. Motoba. Low-energy hypernuclear spectra within a microscopic particle-rotor model with a relativistic point-coupling hyperon-nucleon interaction. *Phys. Rev. C*, 93:044307, Apr 2016.
- [17] J. Xiang, [J. M. Yao](#), Y. Fu, Z. H. Wang, Z. P. Li, and W. H. Long. Novel triaxial structure in low-lying states of neutron-rich nuclei around $a \approx 100$. *Phys. Rev. C*, 93:054324, May 2016.
- [18] [J. M. Yao](#) and J. Engel. Octupole correlations in low-lying states of ^{150}Nd and ^{150}Sm and their impact on neutrinoless double- β decay. *Phys. Rev. C*, 94:014306, Jul 2016.
- [19] [J. M. Yao](#), E. F. Zhou, and Z. P. Li. Beyond relativistic mean-field approach for nuclear octupole excitations. *Phys. Rev. C*, 92:041304, Oct 2015.
- [20] [J. M. Yao](#), M. Bender, and P.-H. Heenen. Beyond-mean-field study of elastic and inelastic electron scattering off nuclei. *Phys. Rev. C*, 91:024301, Feb 2015.
- [21] K. Q. Lu, Z. X. Li, Z. P. Li, [J. M. Yao](#), and J. Meng. Global study of beyond-mean-field correlation energies in covariant energy density functional theory using a collective hamiltonian method. *Phys. Rev. C*, 91:027304, Feb 2015.
- [22] H. Mei, K. Hagino, [J. M. Yao](#), and T. Motoba. Microscopic study of low-lying spectra of Λ hypernuclei based on a beyond-mean-field approach with a covariant energy density functional. *Phys. Rev. C*, 91:064305, Jun 2015.
- [23] K. Hagino and [J. M. Yao](#). Semimicroscopic modeling of heavy-ion fusion reactions with multireference covariant density functional theory. *Phys. Rev. C*, 91:064606, Jun 2015.
- [24] [J. M. Yao](#), L. S. Song, K. Hagino, P. Ring, and J. Meng. Systematic study of nuclear matrix elements in neutrinoless double- β decay with a beyond-mean-field covariant density functional theory. *Phys. Rev. C*, 91:024316, Feb 2015.

- [25] W. X. Xue, J. M. Yao, K. Hagino, Z. P. Li, H. Mei, and Y. Tanimura. Triaxially deformed relativistic point-coupling model for Λ hypernuclei: A quantitative analysis of the hyperon impurity effect on nuclear collective properties. *Phys. Rev. C*, 91:024327, Feb 2015.
- [26] Ying Wang, Jian Li, Jing Bin Lu, and J. M. Yao. A systematic study of even–even nuclei from ne to ca in covariant density functional theory with triaxiality. *Progress of Theoretical and Experimental Physics*, 2014(11):113D03, 2014.
- [27] Qian-Shun Zhang, Zhong-Ming Niu, Zhi-Pan Li, J. M. Yao, and Jie Meng. Global dynamical correlation energies in covariant density functional theory: Cranking approximation. *Frontiers of Physics*, 9(4):529–536, Aug 2014.
- [28] X. Y. Wu, J. M. Yao, and Z. P. Li. Low-energy structure and anti-bubble effect of dynamical correlations in ^{46}Ar . *Phys. Rev. C*, 89:017304, Jan 2014.
- [29] J. M. Yao, K. Hagino, Z. P. Li, J. Meng, and P. Ring. Microscopic benchmark study of triaxiality in low-lying states of ^{76}Kr . *Phys. Rev. C*, 89:054306, May 2014.
- [30] H. Mei, K. Hagino, J. M. Yao, and T. Motoba. Microscopic particle-rotor model for the low-lying spectrum of Λ hypernuclei. *Phys. Rev. C*, 90:064302, Dec 2014.
- [31] L. S. Song, J. M. Yao, P. Ring, and J. Meng. Relativistic description of nuclear matrix elements in neutrinoless double- β decay. *Phys. Rev. C*, 90:054309, Nov 2014.
- [32] J. M. Yao, N. Itagaki, and J. Meng. Searching for a 4α linear-chain structure in excited states of ^{16}O with covariant density functional theory. *Phys. Rev. C*, 90:054307, Nov 2014.
- [33] Y. Fu, H. Mei, J. Xiang, Z. P. Li, J. M. Yao, and J. Meng. Beyond relativistic mean-field studies of low-lying states in neutron-deficient krypton isotopes. *Phys. Rev. C*, 87:054305, May 2013.
- [34] J. M. Yao, H. Mei, and Z.P. Li. Does a proton bubble structure exist in the low-lying states of ^{34}Si ? *Physics Letters B*, 723(4):459 – 463, 2013.
- [35] J. Xiang, Z. P. Li, J. M. Yao, W. H. Long, P. Ring, and J. Meng. Effect of pairing correlations on nuclear low-energy structure: Bcs and general bogoliubov transformation. *Phys. Rev. C*, 88:057301, Nov 2013.
- [36] H. Y. Sang, X. S. Wang, H. F. Lü, J. M. Yao, and H. Sagawa. Magnetic moments of Λ hypernuclei within the time-odd triaxial relativistic mean-field approach. *Phys. Rev. C*, 88:064304, Dec 2013.
- [37] Z.P. Li, B.Y. Song, J. M. Yao, D. Vretenar, and J. Meng. Simultaneous quadrupole and octupole shape phase transitions in thorium. *Physics Letters B*, 726(4):866 – 869, 2013.
- [38] X. S. Wang, H. Y. Sang, H. F. Lü, J. M. Yao, and H. Sagawa. Systematic study of hypernuclear magnetic moments under a perturb treatment. *The European Physical Journal A*, 49(8):101, Aug 2013.

- [39] J. M. Yao, M. Bender, and P.-H. Heenen. Systematics of low-lying states of even-even nuclei in the neutron-deficient lead region from a beyond-mean-field calculation. *Phys. Rev. C*, 87:034322, Mar 2013.
- [40] J. M. Yao, Simone Baroni, Michael Bender, and Paul-Henri Heenen. Beyond-mean-field study of the possible “bubble” structure of ^{34}Si . *Phys. Rev. C*, 86:014310, Jul 2012.
- [41] J. Xiang, Z.P. Li, Z.X. Li, J. M. Yao, and J. Meng. Covariant description of shape evolution and shape coexistence in neutron-rich nuclei at $n = 60$. *Nuclear Physics A*, 873:1 – 16, 2012.
- [42] Z. P. Li, T. Nikšić, P. Ring, D. Vretenar, J. M. Yao, and J. Meng. Efficient method for computing the Thouless-valatin inertia parameters. *Phys. Rev. C*, 86:034334, Sep 2012.
- [43] Z.P. Li, C.Y. Li, J. Xiang, J. M. Yao, and J. Meng. Enhanced collectivity in neutron-deficient Sn isotopes in energy functional based collective hamiltonian. *Physics Letters B*, 717(4):470 – 473, 2012.
- [44] H. Mei, J. Xiang, J. M. Yao, Z. P. Li, and J. Meng. Rapid structural change in low-lying states of neutron-rich Sr and Zr isotopes. *Phys. Rev. C*, 85:034321, Mar 2012.
- [45] H. Mei, Y. Huang, J. M. Yao, and H. Chen. Systematic study of the symmetry energy coefficient in finite nuclei. *Journal of Physics G: Nuclear and Particle Physics*, 39(1):015107, 2012.
- [46] J. M. Yao, H. Mei, H. Chen, J. Meng, P. Ring, and D. Vretenar. Configuration mixing of angular-momentum-projected triaxial relativistic mean-field wave functions. ii. microscopic analysis of low-lying states in magnesium isotopes. *Phys. Rev. C*, 83:014308, Jan 2011.
- [47] Z. P. Li, J. M. Yao, D. Vretenar, T. Nikšić, H. Chen, and J. Meng. Energy density functional analysis of shape evolution in $n = 28$ isotones. *Phys. Rev. C*, 84:054304, Nov 2011.
- [48] J. M. Yao, Jing Peng, Jie Meng, and Peter Ring. g factors of nuclear low-lying states: A covariant description. *Science China Physics, Mechanics and Astronomy*, 54(2):198–203, Feb 2011.
- [49] J. M. Yao, Z.P. Li, K. Hagino, M.Thi Win, Y. Zhang, and J. Meng. Impurity effect of lambda hyperon on collective excitations of nuclear core in mg25. *Nuclear Physics A*, 868-869:12 – 24, 2011.
- [50] J. M. Yao, J. Meng, P. Ring, Z. X. Li, Z. P. Li, and K. Hagino. Microscopic description of quantum shape fluctuation in c isotopes. *Phys. Rev. C*, 84:024306, Aug 2011.
- [51] Jian Li, J. M. Yao, Jie Meng, and Akito Arima. One-pion exchange current corrections for nuclear magnetic moments in relativistic mean field theory. *Progress of Theoretical Physics*, 125(6):1185–1192, 2011.

- [52] Q. B. Chen, J. M. Yao, S. Q. Zhang, and B. Qi. Chiral geometry of higher excited bands in triaxial nuclei with particle-hole configuration. *Phys. Rev. C*, 82:067302, Dec 2010.
- [53] S. Y. Wang, D. P. Sun, B. T. Duan, X. L. Ren, B. Qi, X. X. Zhu, F. Z. Lv, C. Liu, C. J. Xu, J. Meng, H. Hua, F. R. Xu, Z. Y. Li, S. Q. Zhang, Y. Shi, J. M. Yao, L. H. Zhu, X. G. Wu, G. S. Li, Y. Liu, X. Q. Li, Y. Zheng, L. L. Wang, and L. Wang. Coexistence of collective and noncollective structures in ^{118}Sn . *Phys. Rev. C*, 81:017301, Jan 2010.
- [54] J. M. Yao, J. Meng, P. Ring, and D. Vretenar. Configuration mixing of angular-momentum-projected triaxial relativistic mean-field wave functions. *Phys. Rev. C*, 81:044311, Apr 2010.
- [55] P. W. Zhao, Z. P. Li, J. M. Yao, and J. Meng. New parametrization for the nuclear covariant energy density functional with a point-coupling interaction. *Phys. Rev. C*, 82:054319, Nov 2010.
- [56] S. Y. Wang, B. Qi, D. P. Sun, X. L. Ren, B. T. Duan, F. Chen, C. Liu, C. J. Xu, L. Liu, H. Hua, Z. Y. Li, J. M. Yao, L. H. Zhu, X. G. Wu, G. S. Li, Y. Liu, X. Q. Li, Y. Zheng, L. L. Wang, and L. Wang. Shape coexistence and strongly coupled bands in ^{118}Sb . *Phys. Rev. C*, 82:057303, Nov 2010.
- [57] J. M. Yao, B. Qi, S. Q. Zhang, J. Peng, S. Y. Wang, and J. Meng. Candidate multiple chiral doublets nucleus ^{106}Rh in a triaxial relativistic mean-field approach with time-odd fields. *Phys. Rev. C*, 79:067302, Jun 2009.
- [58] B. Qi, S. Q. Zhang, S. Y. Wang, J. M. Yao, and J. Meng. Examining $b(m1)$ staggering as a fingerprint for chiral doublet bands. *Phys. Rev. C*, 79:041302, Apr 2009.
- [59] J. M. Yao, J. Meng, P. Ring, and D. Pena Arteaga. Three-dimensional angular momentum projection in relativistic mean-field theory. *Phys. Rev. C*, 79:044312, Apr 2009.
- [60] J. M. Yao, Meng Jie, D. Pena Arteaga, and P. Ring. Three-dimensional angular momentum projected relativistic point-coupling approach for low-lying excited states in 24 mg. *Chinese Physics Letters*, 25(10):3609, 2008.
- [61] J. Peng, H. Sagawa, S. Q. Zhang, J. M. Yao, Y. Zhang, and J. Meng. Search for multiple chiral doublets in rhodium isotopes. *Phys. Rev. C*, 77:024309, Feb 2008.
- [62] J. M. Yao, B. Sun, P. J. Woods, and J. Meng. Effects of triaxial deformation and pairing correlation on the proton emitter ^{145}Tm . *Phys. Rev. C*, 77:024315, Feb 2008.
- [63] S. Y. Wang, S. Q. Zhang, B. Qi, J. Peng, J. M. Yao, and J. Meng. Description of doublet bands in ^{106}Rh . *Phys. Rev. C*, 77:034314, Mar 2008.

- [64] [J. M. Yao](#), Lu Hong-Feng, Hillhouse Greg, and Meng Jie. Core polarization and tensor coupling effects on magnetic moments of hypernuclei. *Chinese Physics Letters*, 25(5):1629, 2008.
- [65] H. Chen, H. Mei, J. Meng, and [J. M. Yao](#). Binding energy differences of mirror nuclei in a time-odd triaxial relativistic mean field approach. *Phys. Rev. C*, 76:044325, Oct 2007.
- [66] [J. M. Yao](#), H. Chen, and J. Meng. Time-odd triaxial relativistic mean field approach for nuclear magnetic moments. *Phys. Rev. C*, 74:024307, Aug 2006.

Book Chapters

- [1] "Beyond the relativistic mean-field approximation - collective correlations, Z. P. Li, T. Niksic, D. Vretenar, and [J. M. Yao](#), A chapter in the book "Relativistic Density Functional for Nuclear Structure", World Scientific Publishing Company (Singapore), Editor Prof. Jie Meng, <http://www.worldscientific.com/worldscibooks/10.1142/9872>
- [2] "Structure of hypernuclei in relativistic approaches", K. Hagino, [J. M. Yao](#), A chapter in the book "Relativistic Density Functional for Nuclear Structure", World Scientific Publishing Company (Singapore), Editor Prof. Jie Meng, <http://www.worldscientific.com/worldscibooks/10.1142/9872>
- [3] "Nuclear matrix elements for the neutrinoless double beta decay in covariant density functional theory", J. Meng, L. S. Song, and [J. M. Yao](#), *Int. J. Mod. Phys. Vol. 26* (2017) 1740020 (26 pages) <http://www.worldscientific.com/doi/abs/10.1142/S0218301317400201> Contribution to the Gerry Brown 90th birthday memorial book published by World Scientific Publishing Company (Singapore).

Conference Proceedings

- [1] Relativistic Mean-Field and Beyond Approaches for Deformed Hypernuclei, [J. M. Yao](#), H. Mei, K. Hagino, T. Motoba, arXiv:1808.04042 (2018). Proceedings of the 13th International Conference on Hypernuclear and Strange Particle Physics (HYP2018).
- [2] Nuclear Structure from the In-Medium Similarity Renormalization Group, H. Hergert, [J. M. Yao](#), T. D. Morris, N. M. Parzuchowski, S. K. Bogner, J. Engel, *Journal of Physics: Conference Series* 1041 (1), 012007.
- [3] Beyond-mean-field approach to low-lying spectra of Λ hypernuclei, K. Hagino, H. Mei, [J. M. Yao](#), T. Motoba, *JPS Conf. Proc.* 17, 012007 (2017), Proceedings of the 12th International Conference on Hypernuclear and Strange Particle Physics (HYP2015)
- [4] Recent developments in heavy-ion fusion reactions around the Coulomb barrier, K. Hagino, N. Rowley, and [J. M. Yao](#), in the proceedings of the 5th International

Workshop on Compound-Nuclear Reactions and Related Topics (CNR*15), October 9-23, 2015, Tokyo, Japan. Published in EPJ Web Conf. 122 (2016) 07002

- [5] "Present status of coupled-channels calculations for heavy-ion subbarrier fusion reactions" K. Hagino, [J. M. Yao](#), in the proceedings of the 12th International Conference on Nucleus-Nucleus Collisions (NN2015), June 21-26, 2015, Catania, Italy. EPJ Web of Conferences 117 (2016) 08003/1-10. DOI: 10.1051/epjconf/201611708003 Conference: C15-06-21.1 Proceedings, e-Print: arXiv:1508.04222 [nucl-th]
- [6] Neutrinoless double-beta decay in covariant density functional theory, P. Ring, [J. M. Yao](#), L.S. Song, K. Hagino, J. Meng, in the proceedings of the International Conference on Nuclear Structure and Dynamics '15, June 14-19, 2015, Portoroz, Slovenia. Published in AIP Conf.Proc. 1681 (2015) 050008
- [7] Collective excitations of Λ hypernuclei, K. Hagino, [J. M. Yao](#), F. Minato, Z.P. Li, M. Thi Win. Published in Nucl.Phys. A914 (2013) 151-159 DOI: 10.1016/j.nuclphysa.2012.12.077 Conference: C12-10-01 Proceedings, e-Print: arXiv:1211.5871 [nucl-th]
- [8] Microscopic description of quantum phase transitions in nuclei, P. Ring, G. A. Lalazisis, J. Meng, T. Niksic, D. Vretenar, [J. M. Yao](#), Published in AIP Conf.Proc. 1488 (2012) 292-299 DOI: 10.1063/1.4759410, Conference: C12-05-14.5 Proceedings
- [9] Low-lying states in ^{30}Mg : a beyond relativistic mean-field investigation, [J. M. Yao](#), Z.X. Li, J. Xiang, H. Mei, J. Meng, Int. J. Mod. Phys. E20, 482-487 (2011).
- [10] Sensitivity of the nuclear collectivity to the pairing strength in ^{150}Nd , Z.P. Li, J. Xiang, [J. M. Yao](#), H. Chen, J. Meng, Int. J. Mod. Phys. E20, 494-499 (2011).
- [11] Covariant Density Functional Theory for Nuclear Structure and Application in Astrophysics, J. Meng, Z. P. Li, H. Z. Liang, Z. M. Niu, J. Peng, B. Qi, B. Sun, S. Y. Wang, [J. M. Yao](#), S. Q. Zhang, Nuclear Physics A Volume 834, 436C-439C (2010).
- [12] Polarization effect on the spin symmetry for anti-Lambda spectrum in $^{16}\text{O}+\bar{\Lambda}$, C. Y. Song, [J. M. Yao](#), Chinese Physics C Volume: 34 Issue: 9 Pages: 1425-1427 (2010)
- [13] Lambda and Anti-Lambda Hypernuclei in Relativistic Mean-Field Theory, C. Y. Song, [J. M. Yao](#), H. F. Lu, J. Men, International Journal of Modern Physics E-Nuclear Physics Volume 19, 2538-2545 (2010).
- [14] Towards Lambda-nucleon coupling constants in relativistic mean field theory, H. F. Lu, [J. M. Yao](#), Chin. Phys. C33S1, 64-66 (2009).
- [15] Restoration of rotational symmetry in deformed relativistic mean-field theory, [J. M. Yao](#), J. Meng, D. P. Arteaga, P. Ring, Published in Chin.Phys. C33S1, 21-23 (2009).
- [16] Single-particle resonance states of ^{122}Zr in relativistic mean-field theory combined with real stabilization method, H. Mei, H. Chen, [J. M. Yao](#), Chinese Physics C Volume: 33 Pages: 101-104 (2009)

- [17] Deformation constrained relativistic mean-field approach with fixed configuration and time-odd component, Jian Li, [J. M. Yao](#), J. Meng, Chinese Physics C Volume: 33 Pages: 98-100 (2009)
- [18] Structural evolution of the intruder band in Sn-118, Wang, Shou-Yu; Duan, Bo-Tao; Zhu, Xin-Xin; Ren, Xiu-Lei; Yang, Xiao-Ling; Xi, Juan; Lu, Feng-Zheng; Sun, Da-Peng; Lu, Ying-Bo; Liu, Xi-Ju; Hua, Hui; Li, Zhong-Yu; Zhang, Shuang-Quan; Qi, Bin; [J. M. Yao](#); Zhu, Li-Hua; Wu, Xiao-Guang; Li, Guang-Sheng; Liu, Ying; Li, Xue-Qin; Zheng, Yun; Wang, Lie-Lin; Wang, Lei, Chinese Physics C Volume: 33 Issue: 10 Pages: 838-841 Published: 2009
- [19] Structure of nuclei far from the stability in relativistic approach, S. F. Ban, L.S. Geng, W.H. Long, J. Meng, J. Peng, [J. M. Yao](#), S.Q. Zhang, S.G. Zhou, Eur.Phys.J.ST 150, 139-144 (2007).
- [20] Mirror nuclei ^{12}N and ^{12}B in relativistic mean field theory", H. Mei, H. Chen, [J. M. Yao](#), J. Meng, HIGH ENERGY PHYSICS AND NUCLEAR PHYSICS-CHINESE EDITION Volume 30, 53-55 (2006).
- [21] Magnetic moment in relativistic mean field theory, [J. M. Yao](#), H. Mei, J. Meng, H. Chen, HIGH ENERGY PHYSICS AND NUCLEAR PHYSICS-CHINESE EDITION Volume 30, 42-44 (2006).
- [22] Recent progress in relativistic many-body approach, S. F. Ban, L.S. Geng, L. Liu, W.H. Long, J. Meng, J. Peng, [J. M. Yao](#), S.Q. Zhang, S.G. Zhou, Int. J. Mod. Phys. E15, 1447-1464 (2006).