# Dr. LIJING SHAO

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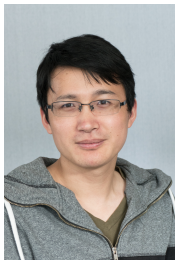

## Scientific Interests

| | |
|---|---|
| Physics | tests of gravity, gravitational waves, new physics beyond standard model |
| Astrophysics | pulsar timing, neutron stars, black holes, dark matter, cosmology |
| Statistics | data analysis, Bayesian inference, Monte Carlo experiments |

## Education & Profession

2017–present **Scientific Staff**, *Max Planck Institute for Radio Astronomy, Bonn*.
In the group "Fundamental Physics in Radio Astronomy" supervised by Michael Kramer

2015–2017 **Junior Scientist**, *Max Planck Institute for Gravitational Physics (Albert Einstein Institute)*.
In the group "Astrophysical and Cosmological Relativity" supervised by Alessandra Buonanno

2010–2015 **Doctor of Theoretical Physics**, *School of Physics, Peking University*.
Jointly supervised by Michael Kramer, Bo-Qiang Ma, and Norbert Wex

2011–2013 **Visiting Scholar**, *Max Planck Institute for Radio Astronomy, Bonn*.
Supported by China Scholarship Council (CSC)

2007–2010 **Bachelor of Physics**, *School of Physics, Peking University*.
Grade-Point Average (GPA): 3.64/4.00

2007–2010 **Double Degree of Economics**, *National School of Development, Peking University*.
Grade-Point Average (GPA): 3.30/4.00

Summer 2009 **Intercourse**, *Institute of Astronomy, National Tsing Hua University*.
Supported by Hui-Chun Chin and Tsung-Dao Lee Chinese Undergraduate Research Endowment

2005–2007 **Electronics**, *School of Electronics Engineering and Computer Science, Peking University*.
Changing Major to Physics in July 2007

## Selected Publication

2017 **L. Shao**, N. Sennett, A. Buonanno, M. Kramer, N. Wex, *Phys. Rev. X* 7 (2017) 041025.
Constraining nonperturbative strong-field effects in scalar-tensor gravity by combining pulsar timing and laser-interferometer gravitational-wave detectors.
⋆ Featured by the Max Planck Institute for Gravitational Physics (Albert Einstein Institute)

2017 A. Bohé, **L. Shao**, A. Taracchini, A. Buonanno, *et al.*, *Phys. Rev. D* 95 (2017) 044028.
Improved effective-one-body model of spinning, nonprecessing binary black holes for the era of gravitational-wave astrophysics with advanced detectors.
⋆ Implemented as the SEOBNRv4 waveform model in LIGO Algorithm Library (LAL)

2016 **L. Shao**, *Phys. Rev. D* 93 (2016) 084023.
Testing the strong equivalence principle with the triple pulsar PSR J0337+1715.
⋆ Featured by PRD editors as an *Editors' Suggestion*

2014 **L. Shao**, *Phys. Rev. Lett.* 112 (2014) 111103.
Tests of local Lorentz invariance violation of gravity in the standard model extension with pulsars.
⋆ Featured by School of Physics, Peking University

2013 **L. Shao**, R.N. Caballero, M. Kramer, N. Wex, D.J. Champion, A. Jessner, *Class. Quantum Grav.* 30 (2013) 165019.
A new limit on local Lorentz invariance violation of gravity from solitary pulsars.
⋆ Communicated by Editor-in-Chief & Selected in *Highlights of 2013–2014*

2013 **L. Shao**, N. Wex, *Class. Quantum Grav.* 30 (2013) 165020.
New limits on the violation of local position invariance of gravity.
⋆ Communicated by Editor-in-Chief & Selected in *Highlights of 2013–2014*

2012 **L. Shao**, N. Wex, *Class. Quantum Grav.* 29 (2012) 215018.
New tests of local Lorentz invariance of gravity with small-eccentricity binary pulsars.
⋆ Communicated by Editor-in-Chief & Selected in *Highlights of 2012–2013*

2010 **L. Shao**, B.-Q. Ma, *Physica A* 389 (2010) 3109.
The significant digit law in statistical physics.
⋆ Invited to *Wolfram Demonstrations* ("Benford's law in statistical physics," by D. Pan, L. Shao, B.-Q. Ma)

## Academic Service for Journals

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## Teaching Experience

Autumn 2013 **Teaching Assistant**, *School of Physics, Peking University*.
Quantum Statistical Physics

Autumn 2010 **Teaching Assistant**, *Peking University*.
What is Science?

Spring 2010 **Teaching Assistant**, *National School of Development, Peking University*.
Probability Theory and Statistics

Autumn 2009 **Teaching Assistant**, *National School of Development, Peking University*.
Linear Algebra (awarded as an *Excellent Teaching Assistant)*

Summer 2007 **Aid Education**, *Luodian City, Guizhou Province*.

Summer 2006 **Aid Education**, *Daning City, Shanxi Province*.

## Publication List ◁◁ with stars (⋆) marking first-author/corresponding-author papers ▷▷

◁ **63** ▷ 2018 B.P. Abbott, *et al.* [arXiv:1802.10194].
A Search for tensor, vector, and scalar polarizations in the stochastic gravitational-wave background.

◁ **62** ▷ 2018 B.P. Abbott, *et al.* [arXiv:1802.05241].
Full band all-sky search for periodic gravitational waves in the O1 LIGO data.

◁ **61** ▷ 2018 B.P. Gong, Y.P. Li, J.P. Yuan, J. Tian, Y.Y. Zhang, D. Li, B. Jiang, X.D. Li, H.G. Wang, Y.C. Zou, **L. Shao**, *Astrophys. J.* 855 (2018) 35.
Searching ultra-compact pulsar binaries with abnormal timing behavior.

◁ **60** ▷ 2018 B.P. Abbott, *et al.*, *Phys. Rev. Lett.* 120 (2018) 091101 [arXiv:1710.05837].
GW170817: Implications for the stochastic gravitational-wave background from compact binary coalescences.

◁ **59** ▷ 2018 B.P. Abbott, *et al.*, *Phys. Rev. Lett.* 120 (2018) 031104 [arXiv:1709.09203].
First search for nontensorial gravitational waves from known pulsars.

◁ **58** ▷ 2018 Y.W. Wu, G. Torricelli-Ciamponi, M. Massi, R.J. Reid, B. Zhang, **L. Shao**, X.W. Zheng, *Mon. Not. R. Astron. Soc.* 474 (2018) 4245 [arXiv:1711.07598].
Revisiting LS I $+61^{\circ}303$ with VLBI astrometry.

◁ **57** ▷ 2018 B.P. Abbott, *et al.*, *Phys. Rev. D* (submitted) [arXiv:1712.01168].
Constraints on cosmic strings using data from the first Advanced LIGO observing run.

◁ **56** ▷ 2017 B.P. Abbott, *et al.*, *Phys. Rev. D* 96 (2017) 122006 [arXiv:1710.02327].
First narrow-band search for continuous gravitational waves from known pulsars in advanced detector data.

◁ **55** ▷ 2017 B.P. Abbott, *et al.*, *Astrophys. J. Lett.* 850 (2017) L40 [arXiv:1710.05838].
On the progenitor of binary neutron star merger GW170817.

◁ **54** ▷ 2017 B.P. Abbott, *et al.*, *Astrophys. J. Lett.* 850 (2017) L39 [arXiv:1710.05836].
Estimating the contribution of dynamical ejecta in the kilonova associated with GW170817.

◁ **53** ▷ 2017 B.P. Abbott, *et al.*, *Nature* 551 (2017) 85 [arXiv:1710.05835].
A gravitational-wave standard siren measurement of the Hubble constant.

◁ **52** ▷ 2017 B.P. Abbott, *et al.*, *Astrophys. J. Lett.* 848 (2017) L13 [arXiv:1710.05834].
Gravitational waves and gamma-rays from a binary neutron star merger: GW170817 and GRB170817A.

◁ **51** ▷ 2017 B.P. Abbott, *et al.*, *Phys. Rev. Lett.* 119 (2017) 161101 [arXiv:1710.05832].
GW170817: Observation of gravitational waves from a binary neutron star inspiral.

◁ **50** ▷ 2017 B.P. Abbott, *et al.*, *Astrophys. J. Lett.* 848 (2017) L12 [arXiv:1710.05833].
Multi-messenger observations of a binary neutron star merger.

◁ **49** ▷ 2017 A. Albert, *et al.*, *Astrophys. J. Lett.* 850 (2017) L35 [arXiv:1710.05839].
Search for high-energy neutrinos from binary neutron star merger GW170817 with ANTARES, IceCube, and the Pierre Auger Observatory.

◁ **48** ▷ 2017 B.P. Abbott, *et al.*, *Astrophys. J. Lett.* 851 (2017) L16 [arXiv:1710.09320].
Search for post-merger gravitational waves from the remnant of the binary neutron star merger GW170817.

◁ **47** ▷ 2017 B.P. Abbott, *et al.*, *Phys. Rev. Lett.* 119 (2017) 141101 [arXiv:1709.09660].
GW170814: A three-detector observation of gravitational waves from a binary black hole coalescence.

◁ **46** ▷ 2017 B.P. Abbott, *et al.*, *Astrophys. J. Lett.* 851 (2017) L35 [arXiv:1711.05578].
GW170608: Observation of a 19-solar-mass binary black hole coalescence.

* ◁ **45** ▷ 2017 N. Sennett, **L. Shao**, J. Steinhoff, *Phys. Rev. D* 96 (2017) 084019 [arXiv:1708.08285].
Effective action model of dynamically scalarizing binary neutron stars.

◁ **44** ▷ 2017 B.P. Abbott, *et al.*, *Phys. Rev. D* 96 (2017) 062002 [arXiv:1707.02667].
All-sky search for periodic gravitational waves in the O1 LIGO data.

◁ **43** ▷ 2017 B.P. Abbott, *et al.*, *Phys. Rev. D* 96 (2017) 122004 [arXiv:1707.02669].
First low-frequency Einstein@Home all-sky search for continuous gravitational waves in Advanced LIGO data.

* ◁ **42** ▷ 2017 **L. Shao**, *Class. Quantum Grav.* 34 (2017) 175011 [arXiv:1707.06535].
An independent test on the local position invariance of gravity with the triple pulsar PSR J0337+1715.

◁ **41** ▷ 2017 B.P. Abbott, *et al.*, *Astrophys. J.* 847 (2017) 47 [arXiv:1706.03119].
Upper limits on gravitational waves from Scorpius X-1 from a model-based cross-correlation search in Advanced LIGO data.

◁ **40** ▷ 2017 B.P. Abbott, *et al.*, *Phys. Rev. Lett.* 118 (2017) 221101 [arXiv:1706.01812].
GW170104: Observation of a 50-solar-mass binary black hole coalescence at redshift 0.2.

* ◁ **39** ▷ 2017 **L. Shao**, B. Zhang, *Phys. Rev. D* 95 (2017) 123010 [arXiv:1705.01278].
Bayesian framework to constrain the photon mass with a catalog of fast radio bursts.

◁ **38** ▷ 2017 B.P. Abbott, *et al.*, *Phys. Rev. D* 96 (2017) 022001 [arXiv:1704.04628].
Search for intermediate mass black hole binaries in the first observing run of Advanced LIGO.

◁ **37** ▷ 2017 B.P. Abbott, *et al.*, *Phys. Rev. D* 95 (2017) 122003 [arXiv:1704.03719].
Search for gravitational waves from Scorpius X-1 in the first Advanced LIGO observing run with a hidden Markov model.

* ◁ **36** ▷ 2017 **L. Shao**, N. Sennett, A. Buonanno, M. Kramer, N. Wex, *Phys. Rev. X* 7 (2017) 041025 [arXiv:1704.07561].
Constraining nonperturbative strong-field effects in scalar-tensor gravity by combining pulsar timing and laser-interferometer gravitational-wave detectors.

* ◁ **35** ▷ 2017 A. Bohé, **L. Shao**, A. Taracchini, A. Buonanno, S. Babak, I.W. Harry, I. Hinder, S. Ossokine, M. Pürrer, V. Raymond, T. Chu, H. Fong, P. Kumar, H.P. Pfeiffer, M. Boyle, D.A. Hemberger, L.E. Kidder, G. Lovelace, M.A. Scheel, B. Szilágyi, *Phys. Rev. D* 95 (2017) 044028 [arXiv:1611.03703].
Improved effective-one-body model of spinning, nonprecessing binary black holes for the era of gravitational-wave astrophysics with advanced detectors.

◁ **34** ▷ 2016 D. Muna, *et al.* [arXiv:1610.03159].
The astropy problem.

* ◁ **33** ▷ 2016 **L. Shao**, *Universe* 2 (2016) 29.
Experimental studies on the Lorentz symmetry in post-Newtonian gravity with pulsars.

* ◁ **32** ▷ 2016 J. Liu, G. Wang, Y.-M. Hu, T. Zhang, Z. Luo, Q.-L. Wang, **L. Shao**, *Chin. Sci. Bull.* 61 (2016) 1502 [LIGO-P1600108].
GW 150914 and gravitational-wave astronomy (in Chinese).

* ◁ **31** ▷ 2016 **L. Shao**, N. Wex, *Sci. China Phys. Mech. Astron.* 59 (2016) 699501 [arXiv:1604.03662].
Tests of gravitational symmetries with radio pulsars.

* ◁ **30** ▷ 2016 **L. Shao**, *Phys. Rev. D* 93 (2016) 084023 [arXiv:1602.05725].
Testing the strong equivalence principle with the triple pulsar PSR J0337+1715.

* ◁ **29** ▷ 2015 **L. Shao**, I.H. Stairs, J. Antoniadis, A.T. Deller, P.C.C. Freire, J.W.T. Hessels, G.H. Janssen, M. Kramer, J. Kunz, C. Lämmerzahl, V. Perlick, A. Possenti, S. Ransom, B.W. Stappers, W. van Straten, *PoS* (AASKA14) 042 [arXiv:1501.00058].
Testing gravity with pulsars in the SKA era.

◁ **28** ▷ 2015 G.H. Janssen, G. Hobbs, M. McLaughlin, C.G. Bassa, A.T. Deller, M. Kramer, K.J. Lee, C.M.F. Mingarelli, P.A. Rosado, S. Sanidas, A. Sesana, **L. Shao**, I.H. Stairs, B.W. Stappers, J.P.W. Verbiest, *PoS* (AASKA14) 037 [arXiv:1501.00127].
Gravitational wave astronomy with the SKA.

◁ **27** ▷ 2015 A. Li, J. Wang, **L. Shao**, R.-X. Xu, *Acta Astron. Sin. Suppl.* 56 (2015) 22.
The type of Vela-like pulsars: a normal neutron star or a hybrid star?

* ◁ **26** ▷ 2015 **L. Shao**, N. Wex, M. Kramer, in *Proceedings of the Thirteenth Marcel Grossmann Meeting on General Relativity* (World Scientific, Singapore, 2015), p. 1704 [arXiv:1211.6558].
New tests of local Lorentz invariance and local position invariance of gravity with pulsars.

* ◁ **25** ▷ 2014 **L. Shao**, *Phys. Rev. D* 90 (2014) 122009 [arXiv:1412.2320].
New pulsar limit on local Lorentz invariance violation of gravity in the standard-model extension.

* ◁ **24** ▷ 2014 **L. Shao**, *Phys. Rev. Lett.* 112 (2014) 111103 [arXiv:1402.6452].
Tests of local Lorentz invariance violation of gravity in the standard model extension with pulsars.

◁ **23** ▷ 2014 A. Li, J. Wang, **L. Shao**, R.-X. Xu [arXiv:1406.4994].
The amount of crustal entrainment and the type of Vela-like pulsars.

* ◁ **22** ▷ 2013 **L. Shao**, N. Wex, *Class. Quantum Grav.* 30 (2013) 165020 [arXiv:1307.2637].
New limits on the violation of local position invariance of gravity.

* ◁ **21** ▷ 2013 **L. Shao**, R.N. Caballero, M. Kramer, N. Wex, D.J. Champion, A. Jessner, *Class. Quantum Grav.* 30 (2013) 165019 [arXiv:1307.2552]
A new limit on local Lorentz invariance violation of gravity from solitary pulsars.

* ◁ **20** ▷ 2013 **L. Shao**, N. Wex, M. Kramer, in *Proceedings of the International Astronomical Union*, Symposium S291 (Cambridge University Press, 2013), p. 496 [arXiv:1209.5171].
New constraints on preferred frame effects from binary pulsars.

* ◁ **19** ▷ 2012 **L. Shao**, N. Wex, *Class. Quantum Grav.* 29 (2012) 215018 [arXiv:1209.4503].
New tests of local Lorentz invariance of gravity with small-eccentricity binary pulsars.

* ◁ **18** ▷ 2011 **L. Shao**, B.-Q. Ma, *Sci. China Phys. Mech. Astron.* 54 (2011) 1771 [arXiv:1006.3031].
Note on a new fundamental length scale $l$ instead of the Newtonian constant $G$.

* ◁ **17** ▷ 2011 **L. Shao**, B.-Q. Ma, *Phys. Rev. D* 83 (2011) 127702 [arXiv:1104.4438].
Lorentz violation induced vacuum birefringence and its astrophysical consequences.

* ◁ **16** ▷ 2011 **L. Shao**, B.-Q. Ma, *Frontier Sci.* 5 (2011) 4.
OPERA superluminal neutrinos and evolutions of spacetime concepts (in Chinese).

* ◁ **15** ▷ 2011 **L. Shao**, B.-Q. Ma, *J. Shanxi Datong Univ.* 27 (2011) 19.
Quantum gravitational relic effects on low energy photons (in Chinese).

◁ **14** ▷ 2011 H. Liu, Y. Chi, **L. Shao**, B.-Q. Ma, *Europhys. Lett.* 94 (2011) 31001 [arXiv:1104.3737].
Octet quark contents from SU(3) flavor symmetry.

◁ **13** ▷ 2011 X. Zhang, **L. Shao**, B.-Q. Ma, *Astropart. Phys.* 34 (2011) 840 [arXiv:1102.2613].
Photon gas thermodynamics in doubly special relativity.

◁ **12** ▷ 2010 Z. Xiao, **L. Shao**, B.-Q. Ma, *Eur. Phys. J. C* 70 (2010) 1153 [arXiv:1011.5074].
Eikonal equation of the Lorentz-violating Maxwell theory.

* ◁ **11** ▷ 2010 **L. Shao**, B.-Q. Ma, *Mod. Phys. Lett. A* 25 (2010) 3251 [arXiv:1007.2269].
Lorentz violation effects on astrophysical propagation of very high energy photons.

* ◁ **10** ▷ 2010 **L. Shao**, B.-Q. Ma, *Phys. Rev. E* 82 (2010) 041110 [arXiv:1010.2699].
First digit law in non-extensive statistics.

* ◁ **09** ▷ 2010 **L. Shao**, B.-Q. Ma, *Physica A* 389 (2010) 3109 [arXiv:1005.0660].
The significant digit law in statistical physics.

* ◁ **08** ▷ 2010 **L. Shao**, B.-Q. Ma, *Sci. Tech. Rev.* 28 (2010) 98.
Applications of the first digit law in physics (in Chinese).

* ◁ **07** ▷ 2010 **L. Shao**, Z. Xiao, B.-Q. Ma, *Astropart. Phys.* 33 (2010) 312 [arXiv:0911.2276].
Lorentz violation from cosmological objects with very high energy photon emissions.

* ◁ **06** ▷ 2010 **L. Shao**, B.-Q. Ma, *Astropart. Phys.* 33 (2010) 255 [arXiv:1005.1702].
Empirical mantissa distributions of pulsars.

* ◁ **05** ▷ 2010 **L. Shao**, Y.-J. Zhang, B.-Q. Ma, *Phys. Lett. B* 686 (2010) 136 [arXiv:1002.4747].
Sea quark contents of octet baryons.

* ◁ **04** ▷ 2010 **L. Shao**, Y. Zhang, B.-Q. Ma, *Chin. Phys. C* 34 (2010) 1417 [arXiv:1008.1689].
Parton distribution functions and nuclear EMC effect in a statistical model.

* ◁ **03** ▷ 2009 **L. Shao**, B.-Q. Ma, *Mod. Phys. Lett. A* 24 (2009) 3275 [arXiv:1004.3077].
First digit distribution of hadron full width.

◁ **02** ▷ 2009 Y. Zhang, **L. Shao**, B.-Q. Ma, *Nucl. Phys. A* 828 (2009) 390 [arXiv:0909.0454].
Nuclear EMC effect in a statistical model.

◁ **01** ▷ 2009 Y. Zhang, **L. Shao**, B.-Q. Ma, *Phys. Lett. B* 671 (2009) 30 [arXiv:0812.3294].
Statistical effect in the parton distribution functions of the nucleon.