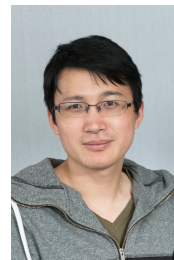


Dr. LIJING SHAO

Scientific Staff / Postdoc

MPI für Radioastronomie
Auf dem Hügel 69
D-53121 Bonn
Germany

☎ +49-(0)228-525-505
✉ lishao@mpifr-bonn.mpg.de
📄 [friendshao.github.io](https://github.com/friendshao)



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-Institut für Radioastronomie, Bonn*.
In the group “Fundamental Physics in Radio Astronomy” supervised by Michael Kramer
- 2015–2017 **Junior Scientist**, *Max-Planck-Institut für Gravitationsphysik (Albert-Einstein-Institut)*.
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-Institut für Radioastronomie, 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

Memberships in Research Activities

- 2014–present Pulsar Science Working Group of The Square Kilometre Array (SKA)
- 2016–present Synergy with GWs Working Group of the enhanced X-ray Timing and Polarimetry (eXTP) Mission
- 2017–present Laser Interferometer Space Antenna (LISA) Data Challenge
- 2017–present BlackHoleCam / Event Horizon Telescope
- 2015–2017 The Laser Interferometer Gravitational-wave Observatory (LIGO) Scientific Collaboration

Selected Publication

- 2017 **L. Shao**, N. Sennett, A. Buonanno, M. Kramer, N. Wex, *Physical Review X* (accepted) [LIGO-P1700073; arXiv:1704.07561].
Constraining nonperturbative strong-field effects in scalar-tensor gravity by combining pulsar timing and laser-interferometer gravitational-wave detectors.
- 2017 A. Bohé, **L. Shao**, A. Taracchini, A. Buonanno, et al., *Physical Review D* 95 (2017) 044028 [LIGO-P1600315; arXiv:1611.03703].
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**, Physical Review D 93 (2016) 084023. [arXiv:1602.05725].
Testing the strong equivalence principle with the triple pulsar PSR J0337+1715.
★ Featured by PRD editors as an *Editors' Suggestion*
- 2014 **L. Shao**, Physical Review Letters 112 (2014) 111103 [arXiv:1402.6452].
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, Classical and Quantum Gravity 30 (2013) 165019 [arXiv:1307.2552]
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, Classical and Quantum Gravity 30 (2013) 165020 [arXiv:1307.2637].
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, Classical and Quantum Gravity 29 (2012) 215018 [arXiv:1209.4503].
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 [arXiv:1005.0660].
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

Referee Astrophysical Journal @[IOPscience](#)
Communications in Theoretical Physics @[IOPscience](#)
Entropy @[MDPI](#)
Frontiers of Physics @[Springer](#)
International Journal of Modern Physics D @[World Scientific](#)
New Astronomy @[Elsevier](#)
Physical Review D @[APS](#)
Physical Review Letters @[APS](#)
Research in Astronomy and Astrophysics @[IOPscience](#)
Science China – Physics, Mechanics and Astronomy @[Springer](#)
Symmetry @[MDPI](#)
Universe @[MDPI](#)

Supervising Graduates

2017–present **George Lampropoulos**, *Master thesis, Universität Bonn; co-supervised with Dr. Norbert Wex.*
Tests of scalar-tensor theories with binary pulsars

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**, *Danling City, Shanxi Province.*

Academic Activities

Dec 2017 **Invited Talk**, *Max Planck Institut für Radioastronomie & Universität Bonn.*
The 11th Bonn Workshop on Formation and Evolution of Neutron Stars

- Oct 2017 **Invited Talk**, *The 656th WE-Heraeus-Seminar, Bremen, Germany.*
Fundamental Physics in Space
- Aug 2017 **Invited as a Key Participant**, *CERN, Geneva, Switzerland.*
Probing the Dark Sector and General Relativity at All Scales
- May 2017 **Oral Presentation**, *La Pirogue Resort, Flic en Flac, Mauritius.*
Fundamental Physics with the Square Kilometre Array
- Sep 2016 **Oral Presentation**, *University of Szczecin, Poland.*
Varying Constants and Fundamental Cosmology
- July 2016 **Oral Presentation**, *Zunyi, Guizhou, China.*
FAST Pulsar Symposium 5
- Mar 2016 **Invited Talk**, *Chinese Embassy in Berlin, Germany.*
The First Detection of Gravitational Waves and Related Astrophysics
- Nov 2015 **Seminar Talk**, *Max Planck Institute for Gravitational Physics.*
Tests of Local Lorentz Invariance of post-Newtonian Gravity
- July 2015 **Invited Talk**, *Huazhong University of Science and Technology.*
Testing Spacetime Symmetries with Radio Pulsars
- July 2015 **Oral Presentation**, *Mingantu, Inner Mongolia, China.*
FAST Pulsar Symposium 4
- Apr 2015 **Invited Talk**, *National Astronomical Observatories, Chinese Academy of Sciences.*
Testing Spacetime Symmetries with Radio Pulsars
- Mar 2015 **Oral Talk**, *The Kavli Institute for Astronomy and Astrophysics, Peking University.*
Testing Spacetime Symmetries with Radio Pulsars
- Aug 2014 **Invited Talk**, *Indiana University, Bloomington, US.*
Gravitational Tests of Lorentz Invariance
- July 2014 **Oral Presentation**, *Shanghai Astronomical Observatory, Shanghai, China.*
FAST Pulsar Symposium 3
- June 2014 **Oral Presentation**, *Giardini Naxos, Italy.*
Advancing Astrophysics with the Square Kilometre Array
- Apr 2013 **Oral Presentation**, *Max Planck Institut für Radioastronomie & Universität Bonn.*
The 3rd Bonn Workshop on Gravitational Waves and Gravity Tests
- Jan 2013 **Invited Talk**, *Aspen Center for Physics, Aspen CO, US.*
Physical Applications of Millisecond Pulsars
- Aug 2012 **Poster Presentation**, *China National Convention Center.*
The 28th General Assembly of the International Astronomical Union (IAU)
- July 2012 **Invited Talk**, *Stockholm University, Stockholm Sweden.*
The 13th Marcel Grossmann Meeting
- May 2011 **Oral Presentation**, *Institute of High Energy Physics, Chinese Academy of Sciences.*
Workshop on Lorentz and CPT Violation in Astrophysics and Cosmology
- Jan 2011 **Oral Presentation**, *Department of Physics, National Taiwan University.*
The Second APCosPA Winter School/Workshop on Cosmology and Particle Astrophysics
- Aug 2010 **Summer School**, *Department of Astronomy, Nanjing University.*
Summer School on Frontiers of Astronomy and Astrophysics
- Jan 2010 **Oral Presentation**, *Department of Physics, National Taiwan University.*
The First APCosPA Winter School on Cosmology and Particle Astrophysics
- Sept 2009 **Oral Presentation**, *Institute of High Energy Physics, Chinese Academy of Sciences.*
The 5-th International Conference on Quarks and Nuclear Physics

Publication List << with stars (*) marking first-author/corresponding-author papers >>

- < 57 > 2017 A. Albert, *et al.*, The Astrophysical Journal Letters (submitted) [LIGO-P1700344; arXiv:1710.05839].
Search for high-energy neutrinos from binary neutron star merger GW170817 with ANTARES, IceCube, and the Pierre Auger Observatory.

- ◁ 56 ▷ 2017 B.P. Abbott, *et al.*, The Astrophysical Journal Letters (accepted) [LIGO-P1700264; arXiv:1710.05838].
On the progenitor of binary neutron star merger GW170817.
- ◁ 55 ▷ 2017 B.P. Abbott, *et al.*, Physical Review Letters (submitted) [LIGO-P1700272; arXiv:1710.05837].
GW170817: Implications for the stochastic gravitational-wave background from compact binary coalescences.
- ◁ 54 ▷ 2017 B.P. Abbott, *et al.*, The Astrophysical Journal Letters (accepted) [LIGO-P1700309; arXiv:1710.05836].
Estimating the contribution of dynamical ejecta in the kilonova associated with GW170817.
- ◁ 53 ▷ 2017 B.P. Abbott, *et al.*, Nature (accepted) [LIGO-P1700296; 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 [LIGO-P1700308; arXiv:1710.05834].
Gravitational waves and gamma-rays from a binary neutron star merger: GW170817 and GRB170817A.
- ◁ 51 ▷ 2017 B.P. Abbott, *et al.*, Physical Review Letters 119 (2017) 161101 [LIGO-P170817; 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 [LIGO-P1700294; arXiv:1710.05833v1].
Multi-messenger observations of a binary neutron star merger.
- ◁ 49 ▷ 2017 B.P. Abbott, *et al.*, Physical Review D (submitted) [LIGO-P1700221; arXiv:1710.02327].
First narrow-band search for continuous gravitational waves from known pulsars in advanced detector data.
- ◁ 48 ▷ 2017 B.P. Abbott, *et al.*, Physical Review Letters 119 (2017) 141101 [arXiv:1709.09660].
GW170814: A three-detector observation of gravitational waves from a binary black hole coalescence.
- ◁ 47 ▷ 2017 B.P. Abbott, *et al.*, Physical Review Letters (submitted) [LIGO-P1700009; arXiv:1709.09203].
First search for nontensorial gravitational waves from known pulsars.
- ◁ 46 ▷ 2017 Y.W. Wu, M. Massi, R.J. Reid, G. Torricelli-Ciamponi, B. Zhang, **L. Shao**, X.W. Zheng, Monthly
Notices of the Royal Astronomical Society (submitted).
Revisit LS I +61°303 with VLBI astrometry.
- * ▷ 45 ▷ 2017 N. Sennett, **L. Shao**, J. Steinhoff, Physical Review D 96 (2017) 084019 [arXiv:1708.08285].
Effective action model of dynamically scalarizing binary neutron stars.
- ◁ 44 ▷ 2017 B.P. Abbott, *et al.*, Physical Review D 96 (2017) 062002 [LIGO-P1700052; arXiv:1707.02667].
All-sky search for periodic gravitational waves in the O1 LIGO data.
- ◁ 43 ▷ 2017 B.P. Abbott, *et al.*, Physical Review D (submitted) [LIGO-P1700127; arXiv:1707.02669].
First low frequency Einstein@Home all-sky search for continuous gravitational waves in advanced LIGO data.
- * ▷ 42 ▷ 2017 **L. Shao**, Classical and Quantum Gravity 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.*, The Astrophysical Journal 847 (2017) 47 [LIGO-P1600297; 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.*, Physical Review Letters 118 (2017) 221101 [LIGO-P170104; arXiv:1706.01812].
GW170104: Observation of a 50-solar-mass binary black hole coalescence at redshift 0.2.
- * ▷ 39 ▷ 2017 **L. Shao**, B. Zhang, Physical Review 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.*, Physical Review D 96 (2017) 022001 [LIGO-P1600273; 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.*, Physical Review D 95 (2017) 122003 [LIGO-P1700019; 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, Physical Review X (accepted) [LIGO-P1700073; 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, Physical Review D 95 (2017) 044028 [LIGO-P1600315; 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**, Chinese Science Bulletin 61 (2016) 1502 [LIGO-P1600108].
GW150914 and gravitational-wave astronomy (in Chinese).
- * ▷ 31 ▷ 2016 **L. Shao**, N. Wex, SCIENCE CHINA Phys., Mech. & Astron. 59 (2016) 699501 [arXiv:1604.03662].
Tests of gravitational symmetries with radio pulsars.
- * ▷ 30 ▷ 2016 **L. Shao**, Physical Review 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 Astronomica Sinica Supplement 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**, Physical Review 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**, Physical Review Letters 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, Classical and Quantum Gravity 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, Classical and Quantum Gravity 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, Classical and Quantum Gravity 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, SCIENCE 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 Science 20 (2011) 4.
OPERA superluminal neutrinos and evolutions of spacetime concepts (in Chinese).
- * ▷ 15 ▷ 2011 **L. Shao**, B.-Q. Ma, Journal of Shanxi Datong University 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.
First digit law of the Nature (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.