

# Rui LUO

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Postal Address: PO Box 76, Epping, NSW 1710, Australia

## EDUCATION

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### Peking University

Sep 2013 – Jul 2019

Department of Astronomy, School of Physics

*Doctor of Philosophy, Astrophysics*

Dissertation: *Measurement of the luminosity function of Fast Radio Bursts*

Advisor: Prof. Kejia Lee (KIAA-PKU)

### Huazhong University of Science and Technology

Sep 2009 – Jun 2013

School of Physics

*Bachelor of Science, Applied Physics*

## EMPLOYMENT

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### CSIRO Space and Astronomy

Aug 2019 – present

Australia Telescope National Facility

*Research Plus Postdoctoral Fellow*

Supervisor: Dr. George Hobbs (CSIRO-ATNF)

## RESEARCH INTERESTS

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**Radio Astronomy:** Fast Radio Bursts, Pulsars, Radio Frequency Interference, the unknown unknowns

**Statistics:** Bayesian inference, Markov Chain Monte Carlo

**Machine Learning:** Convolutional Neural Network, Out-of-Distribution detection

## AWARDS AND HONOURS

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Ranking No.1, Top 10 Research Progresses, Chinese Astronomy (Team Award) 2020

Vela Prize for oral presentations, FAST/Future Pulsar Symposium 8 2019

Kwang-Hua Scholarship, Peking University 2016

Second Prize of Chen Hu-Xiong Scholarship, Peking University 2015

Annual Scholarship, National Astronomical Observatories, Chinese Academy of Sciences 2013

## OBSERVING EXPERIENCE

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### Five-hundred-meter Aperture Spherical radio Telescope

PI: *Searching for fast radio transients from short gamma-ray bursts*, 15 hours 2021 – 2022

PI: *Monitoring the repeating FRB candidates*, 12 hours 2019

Instrumentation: *Configuring ROACH2 and monitoring the real-time bandpass* Apr 2016

### Parkes 64-m radio telescope (Murriyang)

PI: *Searching for fast radio bursts from short gamma-ray bursts*, 22 hours 2021OCTS

PI: *Observing the repeating FRB 180301 with the Parkes UWL*, 32.5 hours 2020OCTS

PI: *Monitoring the repeating FRB candidates in the Southern Sky*, 16 hours 2020APRS

Contributions: Parkes Pulsar Timing Array, 110+ hours 2020 – present

### Australia Telescope Compact Array

PI: *Observing CU Virginis at 16cm wavelength using the Green Time*, 9 hours 2019OCTS

## Kunming 40-m radio telescope

Instrumentation: *Installing the FRB backend and configuring its searching software*

Aug 2017

Instrumentation: *Calibration for two polarization channels from the feed*

Oct 2014

## Miyun 50-m radio telescope

Instrumentation: *Testing ROACH2 and observing pulsars*

Aug 2015

## INVITED TALKS IN COLLOQUIA AND SEMINARS

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(Notes: \* – in virtual; Others – in person; Blue hyperlink – video recording)

<a href="#">CSIRO S&amp;A Co-learnium*</a> , Marsfield, NSW, Australia	May 2022
Seminar*, Yukawa Institute for Theoretical Physics, Kyoto University, Japan	Apr 2022
<a href="#">AUS-NZ-PSR Australasia (Orange) Pulsar Meeting*</a> , Australia and New Zealand	Apr 2022
Colloquium*, Department of Astronomy, Xiamen University, Xiamen, China	Feb 2022
MQ AAASeminar, Macquarie University, Sydney, Australia	May 2021
ASKAP-CRAFT Group Meeting*, ATNF-Swinburne-Curtin, Australia	Mar 2021
Pulsar Group Meeting*, MPIfR, Bonn, Germany	Feb 2021
Colloquium*, Curtin Institute of Radio Astronomy, Perth, Australia	Jan 2021
Colloquium*, Department of Astrophysics, University of Radboud, Netherlands	Dec 2020
Lunch Talk*, Kavli IPMU, University of Tokyo, Japan	Dec 2020
<a href="#">CSIRO S&amp;A Co-learnium*</a> , Marsfield, NSW, Australia	Dec 2020
<a href="#">CHIME/FRB Journal Club*</a> , Canada	Dec 2020
<a href="#">AUS-NZ-PSR Australasia (Orange) Pulsar Meeting*</a> , Australia and New Zealand	Nov 2020
<a href="#">CSIRO S&amp;A Co-learnium</a> , Marsfield, NSW, Australia	Dec 2019
CSIRO ATNF Colloquium, Marsfield, NSW, Australia	Sep 2019
KIAA Graduate Dinner Talk, Peking University, Beijing, China	Dec 2018
NAOC Graduate Student Seminar, NAOC, Beijing, China	Apr 2018

## CONTRIBUTED TALKS IN CONFERENCES AND WORKSHOPS

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<a href="#">ACAMAR 7*</a> : Australia-China Workshop on Astrophysics	Nov 2021
ACAMAR Fast Radio Bursts Virtual Workshop*	Oct 2021
FRB 2021 International Meeting*: <a href="#">[Plenary 3A]</a> and <a href="#">[Plenary 3B]</a>	Jul – Aug 2021
C3DIS 2021 Conference*, Australia	Jul 2021
<a href="#">FRB 2020 International Meeting*</a>	Jul 2020
ATNF Bolton Symposium, Kensington, WA, Australia	Mar 2020
FAST/Future Pulsar Symposium 8, Xi'an, China	Jun 2019
Radio Astronomy Forum 2017, Pingtang, China	Sep 2017
FAST/Future Pulsar Symposium 6, Wuhan, China,	Jun 2017
Chinese Astronomical Society Annual Meeting 2016, Wuhan, China	Nov 2016
Jing-Guang-Xia Astrophysics Meeting, Xiamen, China	Jul 2016
QTT Colloquium Series 2016, Zunyi, China	Jul 2016
PKU-XAO Bilateral Meeting, Urumqi, China	Jun 2016
Chinese Astronomical Society Annual Meeting 2015, Beijing, China	Oct 2015
QTT Colloquium Series 2015, Ming'antu, China	Jul 2015
KIAA-SHAO Bilateral Workshop, Beijing, China	May 2015

## STUDENT MENTORING

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<b>Tommy Marshman:</b> Co-advised. Joint-PhD student at MQ Uni. and CSIRO	2021 – present
<i>Research projects: Searching for Fast Radio Bursts from the Parkes Baades' Window Survey</i>	
<b>Lunhua Shang:</b> Co-advised. Joint-PhD student at NJUST and CSIRO	2020 – 2021

*Research projects: Studies on the pulsed variable stars with radio observations*

**Weiyang Wang:** Co-advised. PhD at UCAS, now a postdoc at PKU

2017 – 2020

*Research projects: Theoretical studies on Fast Radio Bursts*

## TEACHING AND OUTREACH

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**Seeking the secret of nature:** A public Chinese science documentary series 2022

Narrative in Episode 4 Season 2: *What are Fast Radio Bursts?*

**Mr Science · Astronomy:** A Chinese special column for public sciences Nov 2020

Article: [Hunting for fast radio bursts with the FAST telescope \(Chinese\)](#)

**PULSE@Parkes:** An educational program for high-school students to use the CSIRO Parkes radio telescope to observe pulsars 2019 – present

**Special session on the National Youth Science Forum** Jan 2022

**TA:** GENERAL PHYSICS, School of Earth and Space Sciences, Peking University 2017

**TA:** ATOMIC PHYSICS, School of Physics, Peking University 2015

## PROFESSIONAL SERVICE

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### Journal Referee

*Monthly Notices of the Royal Astronomical Society* 2021 – present

*The Astrophysical Journal* 2021 – present

### Proposal Reviewer

*Call for FAST Science Observing Proposals* 2022

*Call for FAST Science Observing Proposals* 2021

## DUTIES AND SUPPORT

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[ACAMAR Fast Radio Bursts Virtual Workshop](#): Served as SOC member Oct 2021

Commissioning the Parkes Cryogenic PAF Receiver: Data benchmark 2021 – present

Updates on the [ATNF-PSRCAT](#) 2020 – present

[The CSIRO-ATNF Co-learnia](#): Main chair 2019 – 2021

The ATCA [Duty Astronomer](#): On duty for every semester 2019 – present

The first Chinese Pulsar Timing Array Meeting: Served as LOC member May 2017

## TECHNICAL SKILLS

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**Programming** PYTHON (Proficient), C, C++, UNIX

**Softwares** MATLAB, MATHEMATICA, PRESTO, TEMPO2, PSRCHIVE, MULTINEST

**Tools** GIT, LATEX, WIKI, HTML

## CODES DEVELOPMENT

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- [SIMULATESEARCH](#): A software for simulating high-time resolution radio observations.
- [BAYESWEIB](#): A Python package for calculating the repeating burst rate under the Weibull distribution.
- [FRBLFERD](#): A Bayesian code for inferring the event rate density of FRB luminosity function.
- [FRBNORMLF](#): An FRB mock data simulator and a Bayesian code to measure the normalized FRB luminosity function.

- **DMHOST**: A package of Monte Carlo simulations on the dispersion measure of FRB host galaxies in the nearby universe.

## LANGUAGES

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<b>Chinese</b>	Native
<b>English</b>	Fluent
<b>Japanese</b>	Elementary

## REFERENCES

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### **George Hobbs**

*Research Scientist & Group Leader*

CSIRO Space and Astronomy, Australia National Telescope Facility

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### **Kejia Lee**

*Associate Professor*

Kavli Institute for Astronomy and Astrophysics, Peking University

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### **Duncan Lorimer**

*Professor & Associate Dean for Research*

Department of Physics and Astronomy, West Virginia University

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### **Richard N. Manchester**

*CSIRO Fellow & Fellow of the Australian Academy of Science*

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### **Bing Zhang**

*Distinguished Professor*

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## PUBLICATIONS

Summary: 4 first-author papers, including **one article published in Nature**. 11 leading-author papers, 22 publications in total.

Citations: 538 (191 from first-author papers); H-index: 12 (as of Jun 2022).

### First/Corresponding-author papers:

(Notes: \* – corresponding author)

4. **Luo, R.\***, Hobbs, G.\*, Yong, S. Y., Zic, A., Tommey, L., Dai, S., Dunning, A., Li, D., Marshman, T., Wang, C., Wang, P., Wang, S. Q., & Zhang, S. B., *Simulating high-time resolution radio-telescope observations*, 2022, [MNRAS](#), **513**, 5881
3. **Luo, R.**, Wang, B. J., Men, Y. P., Zhang, C. F., Jiang, J. C., Xu, H., Wang, W. Y., Lee, K. J.\*, Han, J. L.\*, Zhang, B.\*, et al., *Diverse polarization angle swings from a repeating fast radio burst source*, 2020, [Nature](#), **586**, 693
2. **Luo, R.\***, Men, Y. P., Lee, K. J.\*, Wang, W. Y., Lorimer, D. R., & Zhang, B., *On the FRB luminosity function - II. Event rate density*, 2020, [MNRAS](#), **494**, 665
1. **Luo, R.\***, Lee, K. J.\*, Lorimer, D. R., & Zhang, B., *On the normalized FRB luminosity function*, 2018, [MNRAS](#), **481**, 2320

### Second/Third-author papers:

7. Niu, C.-H., Li, D., **Luo, R.**, Wang, W.-Y., Yao, J., Zhang, B., Zhu, W.-W., Wang, P., Ye, H., Niu, J.-R., et al., *CRAFTS for Fast Radio Bursts: Extending the dispersion-fluence relation with new FRBs detected by FAST*, 2021, [ApJ](#), **909**, L8
6. Zhu, W., Li, D., **Luo, R.**, Miao, C., Zhang, B., Spitler, L., Lorimer, D., Kramer, M., Champion, D., Yue, Y., Cameron, A., Cruces, M., Duan, R., Feng, Y., Han, J., Hobbs, G., Niu, C., et al., *A Fast Radio Burst discovered in FAST drift scan survey*, 2020, [ApJ](#), **895**, L6
5. Jiang, J. C., Wang, W. Y., **Luo, R.**, Du, S., Chen, X. L., Lee, K. J., & Xu, R. X., *FRB 171019: An event of binary neutron star merger?*, 2020, [RAA](#), **20**, 56
4. Men, Y. P., **Luo, R.**, Chen, M. Z., Hao, L. F., Lee, K. J., Li, J., Li, Z. X., Liu, Z. Y., Pei, X., Wen, Z. G., Wu, J. J., Xu, Y. H., Xu, R. X., Yuan, J. P., & Zhang, C. F., *Piggyback searching for fast radio bursts using Nanshan 26m and Kunming 40m radio telescopes – I. Observing and data analysis systems, discovery of a mysterious peryton*, 2019, [MNRAS](#), **488**, 3957
3. Yi, S.-X., Cheng, K. S., & **Luo, R.**, *Clumpy jets from black hole-massive star binaries as engines of Fast Radio Bursts*, 2019, [MNRAS](#), **483**, 4197
2. Wang, W. Y., **Luo, R.**, Yue, H., Chen, X. L., Lee, K. J., & Xu, R. X., *FRB 121102: A Starquake-induced Repeater?*, 2018, [ApJ](#), **852**, 140
1. Yang, Y.-P., **Luo, R.**, Li, Z., & Zhang, B., *Large Host-galaxy Dispersion Measure of Fast Radio Bursts*, 2017, [ApJ](#), **839**, L25

### Other co-author papers:

11. Yong, S. Y., Hobbs, G., Huynh, M. T., Rolland, V., Petersson, L., Norris, R. P., Dai, S., **Luo, R.**, Zic, A., *SPARKESX: Single-dish PARKES data sets for finding the unexpected — A Data Challenge*, 2022, [MNRAS](#), submitted
10. Xu, H., Niu, J. R., Chen, P., Lee, K. J., Zhu, W. W., Dong, S., Zhang, B., Jiang, J. C., Wang, B. J., Xu, J. W., Zhang, C. F., Fu, H., Filippenko, A. V., Peng, E. W., Zhou, D. J., Zhang, Y. K., Wang, P., Feng, Y., Li, Y., Brink, T. G., Li, D. Z., Lu, W., Yang, Y. P., Caballero, R. N., Cai, C., Chen, M. Z., Dai, Z. G., Djorgovski, S. G., Esamdin, A., Gan, H. Q., Guhathakurta, P., Han,

- J. L., Hao, L. F., Huang, Y. X., Jiang, P., Li, C. K., Li, D., Li, H., Li, X. Q., Li, Z. X., Liu, Z. Y., **Luo, R.**, et al., *A fast radio burst source at a complex magnetised site in a barred galaxy*, 2021, [Nature](#), submitted
9. Niu, C.-H., Aggarwal, K., Li, D., Zhang, X., Chatterjee, S., Tsai, C.-W., Yu, W., Law, C. J., Burke-Spolaor, S., Cordes, J. M., Zhang, Y.-K., Ocker, S., Yao, J.-M., Wang, P., Feng, Y., Niino, Y., Bochenek, C., Cruces, M., Connor, L., Jiang, J.-A., Dai, S., **Luo, R.**, et al., *A repeating fast radio burst associated with a persistent radio source*, 2022, [Nature](#), accepted
  8. Bhandari, S., Heintz, K. E., Aggarwal, K., Marnoch, L., Day, C. K., Sydnor, J., Burke-Spolaor, S., Law, C. J., Prochaska, J. X., Tejos, N., Bannister, K. W., Butler, B. J., Deller, A. T., Ekers, R. D., Flynn, C., Fong, W.-F., James, C. W., Lazio, T. J. W., **Luo, R.**, et al., *Characterizing the FRB host galaxy population and its connection to transients in the local and extragalactic Universe*, 2021, [AJ](#), **163**, 69
  7. Yang, X., Zhang, S.-B., Wang, J.-S., Hobbs, G., Sun, T.-R., Manchester, R. N., Geng, J.-J., Russell, C. J., **Luo, R.**, Tang, Z.-F., Wang, C., Wei, J.-J., Staveley-Smith, L., Dai, S., Li, Y., Yang, Y.-Y., & Wu, X.-F., *81 New Candidate Fast Radio Bursts in Parkes Archive*, 2021, [MNRAS](#), **507**, 3238
  6. Goncharov, B., Shannon, R. M., Reardon, D. J., Hobbs, G., Zic, A., Bailes, M., Curylo, M., Dai, S., Kerr, M., Lower, M. E., Manchester, R. N., Mandow, R., Middleton, H., Miles, M. T., Parthasarathy, A., Thrane, E., Thyagarajan, N., Xue, X., Zhu, X.-J., Cameron, A. D., Feng, Y., **Luo, R.**, et al., *On the evidence for a common-spectrum process in the search for the nanohertz gravitational wave background with the Parkes Pulsar Timing Array*, 2021, [ApJ](#), **917**, L19
  5. Zhang, C. F., Xu, J. W., Men, Y. P., Deng, X. H., Xu, H., Jiang, J. C., Wang, B. J., Lee, K. J., Li, J., Yuan, J. P., Liu, Z. Y., Huang, Y. X., Xu, Y. H., Li, Z. X., Hao, L. F., Luo, J. T., Dai, S., **Luo, R.**, Zakie, H., & Ma, Z. Y., *Fast radio burst detection in the presence of coloured noise*, 2021, [MNRAS](#), **503**, 5223
  4. Dai, S., Lu, J. G., Wang, C., Wang, W. Y., Xu, R. X., Yang, Y.-P., Zhang, S.-B., Hobbs, G., Li, D., **Luo, R.**, Filipovic, M., & Jiang, J. C., *On the Circular Polarization of Repeating Fast Radio Bursts*, 2021, [ApJ](#), **920**, 46
  3. Zhang, S.-B., Hobbs, G., Russell, C. J., Toomey, L., Dai, S., Dempsey, J., Manchester, R. N., Johnston, S., Staveley-Smith, L., Wu, X.-F., Li, D., Yang, Y.-Y., Wang, S.-Q., Qiu, H., **Luo, R.**, Wang, C., Zhang, C., Zhang, L., & Mandow, R., *Parkes transient events: I. Database of single pulses, initial results and missing FRBs*, 2020, [ApJS](#), **249**, 14
  2. Men, Y. P., Aggarwal, K., Li, Y., Palaniswamy, D., Burke-Spolaor, S., Lee, K. J., **Luo, R.**, Demorest, P., Tendulkar, S., Agarwal, D., Young, O., & Zhang, B., *Non-detection of fast radio bursts from six gamma-ray burst remnants with a possible magnetar engine*, 2019, [MNRAS](#), **489**, 3643
  1. Wang, W. Y., Lu, J. G., Zhang, S. B., Chen, X. L., **Luo, R.**, & Xu, R. X., *Pulsar giant pulse: coherent instability near light cylinder*, 2019, [SCPMA](#), **62**, 979511