

# 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: *Monitoring a short gamma-ray burst with possible radio transient*, 9 hours 2022

PI: *Observing the candidate repeating sources from the CHIME/FRB Catalog*, 6 hours 2022

PI: *Searching for fast radio transients from short gamma-ray bursts*, 9 hours 2021

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: *Observing a candidate repeating FRB source with the Parkes UWL*, 16 hours 2022OCTS

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, 120+ 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 FOR COLLOQUIA AND SEMINARS

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

Colloquium\*, Department of Astronomy, Guangzhou University, China Jul 2022

[CSIRO S&A Co-learnium\\*](#), Marsfield, NSW, Australia May 2022

Seminar\*, Yukawa Institute for Theoretical Physics, Kyoto University, Japan Apr 2022

[AUS-NZ-PSR Australasia \(Orange\) Pulsar Meeting\\*](#), Australia and New Zealand Apr 2022

Colloquium\*, Department of Astronomy, Xiamen University, 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, Germany Feb 2021

Colloquium\*, Curtin Institute of Radio Astronomy, Australia Jan 2021

Colloquium\*, Department of Astrophysics, University of Radboud, Netherlands Dec 2020

Lunch Talk\*, Kavli IPMU, University of Tokyo, Japan Dec 2020

[CSIRO S&A Co-learnium\\*](#), Marsfield, NSW, Australia Dec 2020

[CHIME/FRB Journal Club\\*](#), Canada Dec 2020

[AUS-NZ-PSR Australasia \(Orange\) Pulsar Meeting\\*](#), Australia and New Zealand Nov 2020

[CSIRO S&A Co-learnium](#), Marsfield, NSW, Australia Dec 2019

CSIRO ATNF Colloquium, Marsfield, NSW, Australia Sep 2019

KIAA Graduate-Student Dinner Talk, Peking University, Beijing, China Dec 2018

NAOC Graduate Student Seminar, NAOC, Beijing, China Apr 2018

## CONTRIBUTED TALKS AT CONFERENCES AND WORKSHOPS

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

[The 2022 ASA's Annual Scientific Meeting†](#), Hobart, Australia Jun 2022

[ACAMAR 7\\*](#): Australia-China Workshop on Astrophysics Nov 2021

ACAMAR Fast Radio Bursts Virtual Workshop\* Oct 2021

FRB 2021 International Meeting\*: [\[Plenary 3A\]](#) and [\[Plenary 3B\]](#) Jul – Aug 2021

C3DIS 2021 Conference\*, Australia Jul 2021

[FRB 2020 International Meeting\\*](#) 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 <i>Research projects: Search for Fast Radio Bursts in the Parkes Baades' Window Survey</i>	2021 – present
<b>Lunhua Shang:</b> Co-advised. PhD at NJUST, now a lecturer at GZNU <i>Research projects: Observing on pulsed variable stars with radio telescopes</i>	2020 – 2021
<b>Jinchen Jiang:</b> Co-advised. PhD at PKU, now a postdoc at NAOC <i>Research projects: Fast Radio Bursts modelling and polarization</i>	2019 – 2020
<b>Weiyang Wang:</b> Co-advised. PhD at UCAS, now a postdoc at PKU <i>Research projects: Theoretical studies on Fast Radio Bursts</i>	2017 – 2020

## TEACHING AND OUTREACH

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<b>Seek Out Nature Mysteries:</b> A public Chinese science documentary series Narrative in Episode 4 Season 2: <i>Fast Radio Bursts</i>	2022
<b>Mr Science · Astronomy:</b> A Chinese special column for public sciences Article: <a href="#">Hunting for fast radio bursts with the FAST telescope (Chinese)</a>	Nov 2020
<b>PULSE@Parkes:</b> An educational program for high-school students to use the CSIRO Parkes radio telescope to observe pulsars	2019 – present
<b>Special session on the National Youth Science Forum</b>	Jan 2022
<b>TA: GENERAL PHYSICS,</b> School of Earth and Space Sciences, Peking University	2017
<b>TA: ATOMIC PHYSICS,</b> School of Physics, Peking University	2015

## PROFESSIONAL SERVICE

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<b>Journal Referee</b> <i>Monthly Notices of the Royal Astronomical Society</i> <i>The Astrophysical Journal</i>	2021 – present 2021 – present
<b>Proposal Reviewer</b> <i>Call for FAST Science Observing Proposals</i> <i>Call for FAST Science Observing Proposals</i>	2022 2021

## DUTIES AND SUPPORT

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<b>ACAMAR Fast Radio Bursts Virtual Workshop:</b> Served as SOC member	Oct 2021
Commissioning the Parkes Cryogenic PAF Receiver: Data benchmark	2021 – present
Updates on the <a href="#">ATNF-PSRCAT</a>	2020 – present
<b>The CSIRO-ATNF Co-learnia:</b> Main chair	2019 – 2021
The ATCA <b>Duty Astronomer:</b> 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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<b>Programming</b>	PYTHON (Proficient), C, C++, UNIX
<b>Softwares</b>	MATLAB, MATHEMATICA, PRESTO, TEMPO2, PSRCHIVE, MULTINEST
<b>Tools</b>	GIT, LATEX, WIKI, HTML

## CODES DEVELOPMENT

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- [SIMULATESEARCH](#): A software for simulating high-time resolution radio data.
- [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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### **Ronald Ekers**

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

CSIRO Space and Astronomy, Australia National Telescope Facility

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### **George Hobbs**

*Research Scientist & Group Leader*

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### **Kejia Lee**

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### **Duncan Lorimer**

*Professor & Associate Dean for Research*

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### **Richard N. Manchester**

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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, 26 publications in total.

Citations: 632 (354 from leading-author papers); H-index: 12 (as of Sep 2022).

(Notes: \* – corresponding author, † – student co-advised)

### First/Corresponding-author papers:

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:

15. Niu, J.-R., Zhu, W.-W., Zhang, B., Yuan, M., Zhou, D.-J., Zhang, Y.-K., Jiang, J.-C., Han, J. L., Li, D., Lee, K.-J., Wang, P., Feng, Y., Li, D.-Z., **Luo, R.**, Wang, F.-Y., Dai, Z.-G., Miao, C.-C., Niu, C.-H., et al., *FAST observations of an extremely active episode of FRB 20211124A: IV. Spin Period Search*, 2022, [RAA](#), **accepted**
14. Jiang, J.-C., Wang, W.-Y., Xu, H., Xu, J.-W., Zhang, C.-F., Wang, B.-J., Zhou, D.-J., Zhang, Y.-K., Niu, J.-R., Lee, K.-J., Zhang, B., Han, J.-L., Li, D., Zhu, W.-W., Dai, Z.-D., Feng, Y.,

- Jing, W.-C., Li, D.-Z., **Luo, R.**, et al., *FAST observations of an extremely active episode of FRB 20211124A: III. Polarimetry*, 2022, [RAA, accepted](#)
13. Zhang, Y.-K., Wang, P., Feng, Y., Zhang, B., Li, D., Tsai, C.-W., Niu, C.-H., **Luo, R.**, Yao, J.-M., Zhu, W.-W., Han, J. L., Lee, K.-J., Zhou, D.-J., Niu, J.-R., Jiang, J.-C., Wang, W.-Y., Zhang, C.-F., Xu, H., Wang, B.-J., Xu, J.-W., *FAST observations of an extremely active episode of FRB 20211124A: II. Energy Distribution*, 2022, [RAA, accepted](#)
  12. Zhou, D. J., Han, J. L., Zhang, B., Lee, K. J., Zhu, W. W., Li, D., Jing, W. C., Wang, W.-Y., Zhang, Y. K., Jiang, J. C., Niu, J. R., **Luo, R.**, Xu, H., Zhang, C. F., Wang, B. J., Xu, J. W., Wang, P., Yang, Z. L., Feng, Y., *FAST observations of an extremely active episode of FRB 20211124A: I. Burst Morphology*, 2022, [RAA, accepted](#)
  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, in press](#)
  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](#), **609**, 685
  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](#), **606**, 873
  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](#)