

# 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. K.J. 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 (FRBs), Pulsars, Radio Frequency Interference (RFI), the unknown unknowns

**Statistics:** Bayesian inference, Markov Chain Monte Carlo (MCMC)

**Machine Learning:** Convolutional Neural Network (CNN), Out-of-Distribution (OOD) 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

Co-I: *Searching for Fast Radio Bursts from pulsing ULXs*, 10 hours 2021 – 2022

Co-I: *Observing the low-luminosity Fast Radio Bursts in the FAST sky*, 8 hours 2020 – 2021

Co-I: *Observing the radio transients from superluminous supernovae*, 5 hours 2020 – 2021

Co-I: *FAST observations of CU Virginis*, 13.5 hours 2020 – 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

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

Co-I: *Searching for Fast Radio Bursts from pulsing ULXs*, 12 hours 2021OCTS

Co-I: *Establishing the broadband properties in a sample of repeating FRBs*, 43.5 hours 2021OCTS

Co-I: <i>Monitoring the repeating FRB 180301</i> , 32.5 hours	2021APRS
Co-I: <i>A wide-band study of CU Virginis</i> , 7 hours	2021APRS
PI: <i>Observing the repeating FRB 180301 with the Parkes UWL</i> , 32.5 hours	2020OCTS
PI: <i>Monitoring the repeating FRB candidates in the Southern Sky</i> , 16 hours	2020APRS
Contributions: Parkes Pulsar Timing Array, 80+ hours	2020 – present

#### Australia Telescope Compact Array

Co-I: Brown Dwarfs: Studying A New Class of Stellar Lighthouse, 14 hours	2021APRS
PI: <i>Observing CU Virginis at 16cm wavelength using the Green Time</i> , 9 hours	2019OCTS

#### Kunming 40-m radio telescope

Instrumentation: <i>Installing the FRB backend and configuring its searching software</i>	Aug 2017
Instrumentation: <i>Calibration for two polarization channels from the feed</i>	Oct 2014

#### Miyun 50-m radio telescope

Instrumentation: <i>Testing ROACH2 and observing pulsars</i>	Aug 2015
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### INVITED TALKS IN COLLOQUIA AND SEMINARS

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<b>MQ AA</b> Astroseminar, Macquarie University, Sydney, Australia	May 2021
In-person talk: <i>Diverse polarization angle swings from a repeating fast radio burst source</i>	
<b>ASKAP-CRAFT Group Meeting</b> , ATNF-Swinburne-Curtin, Australia	Mar 2021
Remote talk: <i>Current FRB Science Outcomes with FAST</i>	
<b>Pulsar Group Meeting</b> , MPIfR, Bonn, Germany	Feb 2021
Remote talk: <i>Diverse polarization angle swings from a repeating fast radio burst source</i>	
<b>Colloquium</b> , Curtin Institute of Radio Astronomy, Perth, Australia	Jan 2021
Remote talk: <i>Diverse polarization angle swings from a repeating fast radio burst source</i>	
<b>Colloquium</b> , Department of Astrophysics, University of Radboud, Netherlands	Dec 2020
Remote talk: <i>Diverse polarization angle swings from a repeating fast radio burst source</i>	
<b>Lunch Talk</b> , Kavli IPMU, University of Tokyo, Japan	Dec 2020
Remote talk: <i>Diverse polarization angle swings from a repeating fast radio burst source</i>	
<b>CSIRO-ATNF Co-learnium</b> , Marsfield, NSW, Australia	Dec 2020
Remote talk: <i>Life changes of the local residents around the FAST site</i>	
Video recording: <a href="#">[Co-learnium link]</a>	
<b>CHIME/FRB Journal Club</b> , Canada	Dec 2020
Remote talk: <i>Diverse polarization angle swings from a repeating fast radio burst source</i>	
Video recording: <a href="#">[YouTube link]</a>	
<b>AUS-NZ-PSR Group Meeting</b> , Australasia	Nov 2020
Remote talk: <i>Diverse polarization angle swings from a repeating fast radio burst source</i>	
<b>CSIRO-ATNF Co-learnium</b> , Marsfield, NSW, Australia	Dec 2019
In-person talk: <i>A beginner's guide to Bayesian inference</i>	
Video recording: <a href="#">[Co-learnium link]</a>	
<b>CSIRO-ATNF Colloquium</b> , Marsfield, NSW, Australia	Sep 2019
In-person talk: <i>Measurement of the luminosity function of Fast Radio Bursts</i>	
<b>Cosmology Group Meeting</b> , NAOC, Beijing, China	Mar 2019
In-person talk: <i>Measurements on the FRB luminosity function</i>	
<b>KIAA Graduate Dinner Talk</b> , Peking University, Beijing, China	Dec 2018
In-person talk: <i>An Overview on Fast Radio Bursts and FRB luminosity function</i>	
<b>NAOC Graduate Student Seminar</b> , NAOC, Beijing, China	Apr 2018
In-person talk: <i>A Review of Fast Radio Bursts and FRB luminosity function</i>	

### CONTRIBUTED TALKS IN CONFERENCES AND WORKSHOPS

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<b>ACAMAR 7: Australia-China Workshop on Astrophysics</b> , Zoom	Nov 2021
Plenary talk: <i>simulateSearch</i> – A software package for simulating high time-resolution radio data	
<b>ACAMAR Fast Radio Bursts Virtual Workshop</b> , Zoom	Oct 2021
Plenary talk: <i>Diverse polarization angle swings from a repeating fast radio burst source</i>	
<b>FRB 2021 International Meeting</b> , Zoom Webinar	Jul – Aug 2021
Plenary talk: <i>Diverse polarization angle swings from a repeating fast radio burst source</i>	
Video recordings: <a href="#">[Plenary 3A]</a> and <a href="#">[Plenary 3B]</a>	
<b>C3DIS 2021 Conference</b> , Virtual, Australia	Jul 2021
Session talk: <i>simulateSearch</i> – A package for simulating high time-resolution data in radio astronomy	
<b>FRB 2020 International Meeting</b> , Zoom Webinar	Jul 2020
Plenary talk: <i>Measurement of the luminosity function of Fast Radio Bursts</i>	
Video recording: <a href="#">[Session 5]</a>	
<b>ATNF Bolton Symposium</b> , Kensington, Perth, Australia	Mar 2020
Plenary talk: <i>A new repeating FRB discovered by the FAST telescope</i>	
<b>FAST/Future Pulsar Symposium 8</b> , Xi'an, China	Jun 2019
Plenary talk: <i>Measurement of the luminosity function of Fast Radio Bursts</i>	
<b>Radio Astronomy Forum 2017</b> , Pingtang, China	Sep 2017
Poster talk: <i>Simulating DM of host galaxies to derive FRB luminosity function</i>	
<b>Chinese Astronomical Society Annual Meeting 2016</b> , Wuhan, China	Nov 2016
Session talk: <i>Simulating the Dispersion Measure of FRB host galaxies</i>	
<b>Jing-Guang-Xia Astrophysics Meeting</b> , Xiamen, China	Jul 2016
Plenary talk: <i>Simulating the Dispersion Measure of FRB host galaxies</i>	
<b>QTT Colloquium Series 2016</b> , Zunyi, China	Jul 2016
Plenary talk: <i>Simulating the Dispersion Measure of FRB host galaxies</i>	
<b>PKU-XAO Bilateral Meeting</b> , Urumqi, China	Jun 2016
Plenary talk: <i>Simulating the Dispersion Measure of FRB host galaxies</i>	
<b>Chinese Astronomical Society Annual Meeting 2015</b> , Beijing, China	Oct 2015
Session talk: <i>Consideration of Research on FRBs</i>	
<b>QTT Colloquium Series 2015</b> , Ming'antu, China	Jul 2015
Plenary talk: <i>Consideration of Research on FRBs</i>	
<b>KIAA-SHAO Bilateral Workshop</b> , Beijing, China	May 2015
Plenary talk: <i>Consideration of FRB searching</i>	

## STUDENT MENTORING

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<b>Tommy Marshman</b> : Co-advised, PhD student at Macquarie University	2021 – present
Research projects: <i>Searching for Fast Radio Bursts in the Parkes Baades' Window Survey</i>	
<b>Lunhua Shang</b> : Co-advised, Joint-PhD student at NJUST and CSIRO	2020 – present
Research projects: <i>Studies on the pulsed variable stars with radio observations</i>	
<b>Weiyang Wang</b> : Co-advised, PhD at UCAS-NAOC, graduated in the end of 2020	2017 – 2020
Research projects: <i>Theoretical studies on Fast Radio Bursts</i>	

## TEACHING AND OUTREACH

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<b>Seeking the secret of nature</b> : A public Chinese science documentary series	2022
Narrative in Episode 4 Season 2: <i>What are Fast Radio Bursts?</i>	
<b>Mr. Science · Astronomy</b> : A Chinese special column for public sciences	Nov 2020
Article: <a href="#">Hunting for fast radio bursts with the FAST telescope</a>	
<b>PULSE@Parkes</b> : An educational program for high-school students to use the CSIRO Parkes ra-	

radio telescope to observe pulsars

2019 – present

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

2017

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

2015

## PROFESSIONAL SERVICES

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Reviewer for Monthly Notices of the Royal Astronomical Society (**MNRAS**)

Reviewer for [FAST Open Call 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 1st 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](#) (in developing): A software for simulating the 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 for Monte Carlo simulations on the dispersion measure of FRB host galaxies in the nearby universe.

## LANGUAGES

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**Chinese** Native

**English** Fluent

**Japanese** 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**

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### **Duncan Lorimer**

*Professor & Associate Dean for Research*

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### **Richard N. Manchester**

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### **Bing Zhang**

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## PUBLICATIONS

Summary: 19 publications in total, including **one 1st-author paper in Nature**. Citations: 322 (145 for 1st-author papers); H-index: 9 (by Nov 2021).

### First-author papers:

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., Caballero, R. N., Chen, M. Z., Chen, X. L., Gan, H. Q., Guo, Y. J., Hao, L. F., Huang, Y. X., Jiang, P., Li, H., Li, J., Li, Z. X., Luo, J. T., Pan, J., Pei, X., Qian, L., Sun, J. H., Wang, M., Wang, N., Wen, Z. G., Xu, R. X., Xu, Y. H., Yan, J., Yan, W. M., Yu, D. J., Yuan, J. P., Zhang, S. B., & Zhu, Y., *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., et al. *CRAFTS for Fast Radio Bursts – II. 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**, 4, 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:

9. 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.**, Mahony, E. K., Ryder, S. D., Sadler, E. M., Shannon, R. M., Han, J. L., Lee, K. J., & Zhang, B., *Characterizing the FRB host galaxy population and its connection to transients in the local and extragalactic Universe*, 2021, [ApJ](#), submitted
8. 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.**, Li, G.-D., Miao, C.-C., Niu, J.-R., Anna-Thomas, R., Stern, D., Wang, W.-Y., Yuan, M., Yue, Y.-L., Zhou, D.-J.,

- Yan, Z., Zhu, W.-W., & Zhang, B., *A highly active repeating fast radio burst in a complex local environment*, 2021, [Nature](#), *submitted*
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.**, Russell, C. J., Sarkissian, J., Spiewak, R., Wang, S., Wang, J. B., Zhang, L., & Zhang, S., *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(7)**, 979511