

# 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), Bayesian Optimization

## AWARDS AND PRIZES

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

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

Second Academic Scholarship, Peking University 2013 – 2018

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

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 Jul – Oct 2019

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

### Parkes 64-m radio telescope

Co-I: *Monitoring the repeating FRB 180301*, 32.5 hours 2021APRS

Co-I: *A wide-band study of CU Virginis*, 7 hours 2021APRS

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, 70+ hours

Nov 2020 – present

### Australia Telescope Compact Array

Co-I: Brown Dwarfs: Studying A New Class of Stellar Lighthouse, 14 hours

2021APRS

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 OR SEMINARS

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**MQ AA**Astroseminar, Macquarie University, Sydney, Australia

May 2021

In-person talk: *Diverse polarization angle swings from a repeating fast radio burst source*

**ASKAP-CRAFT Group Meeting**, ATNF-Swinburne-Curtin, Australia

Mar 2021

Remote talk: *Current FRB Science Outcomes with FAST*

**Pulsar Group Meeting**, MPIfR, Bonn, Germany

Feb 2021

Remote talk: *Diverse polarization angle swings from a repeating fast radio burst source*

**Colloquium, Curtin Institute of Radio Astronomy**, Perth, Australia

Jan 2021

Remote talk: *Diverse polarization angle swings from a repeating fast radio burst source*

**Colloquium, Department of Astrophysics, University of Radboud**, Netherlands

Dec 2020

Remote talk: *Diverse polarization angle swings from a repeating fast radio burst source*

**Lunch Talk, Kavli IPMU, University of Tokyo**, Japan

Dec 2020

Remote talk: *Diverse polarization angle swings from a repeating fast radio burst source*

**CSIRO-ATNF Co-learnium**, Marsfield, NSW, Australia

Dec 2020

Remote talk: *Life changes of the local residents around the FAST site*

Video recording: [\[Co-learnium link\]](#)

**CHIME/FRB Journal Club**, Canada

Dec 2020

Remote talk: *Diverse polarization angle swings from a repeating fast radio burst source*

Video recording: [\[YouTube link\]](#)

**AUS-NZ-PSR Group Meeting**, Australasia

Nov 2020

Remote talk: *Diverse polarization angle swings from a repeating fast radio burst source*

**CSIRO-ATNF Co-learnium**, Marsfield, NSW, Australia

Dec 2019

In-person talk: *A beginner's guide to Bayesian inference*

Video recording: [\[Co-learnium link\]](#)

**CSIRO-ATNF Colloquium**, Marsfield, NSW, Australia

Sep 2019

In-person talk: *Measurement of the luminosity function of Fast Radio Bursts*

**Cosmology Group Meeting, NAOC**, Beijing, China

Mar 2019

In-person talk: *Measurements on the FRB luminosity function*

**KIAA Graduate Dinner Talk**, Peking University, Beijing, China

Dec 2018

In-person talk: *An Overview on Fast Radio Bursts and FRB luminosity function*

**NAOC Graduate Student Seminar**, NAOC, Beijing, China

Apr 2018

In-person talk: *A Review of Fast Radio Bursts and FRB luminosity function*

## CONTRIBUTED TALKS IN CONFERENCES OR WORKSHOPS

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**FRB 2021 International Meeting**, Zoom Webinar

Jul – Aug 2021

Plenary talk: *Diverse polarization angle swings from a repeating fast radio burst source*

Video recordings: [\[Plenary 3A\]](#) and [\[Plenary 3B\]](#)

**C3DIS 2021 Conference**, 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 MENTORSHIP

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|--|----------------|
| <b>Lunhua Shang</b> : Co-advised, Joint-PhD student at NJUST and CSIRO                 | 2020 – present |
| <i>Research projects: 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    |
| <i>Research projects: Theoretical studies on Fast Radio Bursts</i>                     |                |

## TEACHING AND OUTREACH

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|---|----------------|
| <b>PULSE@Parkes</b> : An outreach on Parkes pulsar observing for high-school students | 2019 – present |
| TA: GENERAL PHYSICS, School of Earth and Space Sciences, Peking University            | 2017           |
| TA: ATOMIC PHYSICS, School of Physics, Peking University                              | 2015           |

## SUPPORTS AND SERVICES

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|--|----------------|
| SOC member for <a href="#">ACAMAR Fast Radio Bursts Virtual Workshop</a> | Oct 2021       |
| Reviewer for <a href="#">FAST Open Call 2021</a>                         | Jun – Jul 2021 |
| Updates on the <a href="#">ATNF-PSRCAT</a>                               | 2020 – present |
| <a href="#">The CSIRO-ATNF Co-learnia</a> : One of main organisers       | 2019 – present |
| The ATCA <a href="#">Duty Astronomer</a> : 4 weeks                       | 2019 – present |
| LOC member for the first Chinese Pulsar Timing Array Meeting             | May 2017       |

## TECHNICAL SKILLS

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|--------------------|--|
| <b>Programming</b> | PYTHON (Proficient), C, C++, UNIX              |
| <b>Softwares</b>   | MATLAB, MATHEMATICA, PRESTO, TEMPO2, MULTINEST |
| <b>Tools</b>       | GIT, LATEX, WIKI, HTML                         |

## CODES DEVELOPED

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

## REFERENCES

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### **George Hobbs**

*Research Scientist and Team Leader*

CSIRO Astronomy and Space Science, Australia National Telescope Facility

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### **Kejia Lee**

*Associate Professor*

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### **Duncan Lorimer**

*Professor and Associate Dean for Research*

Department of Physics and Astronomy, West Virginia University

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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 first-author paper in Nature. H-index: 8, – Aug 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](#), [accepted](#)
  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, [ApJL](#), [accepted](#)
  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 Non-detection of Circular Polarisation from Repeating Fast Radio Bursts*, 2020, [ApJ](#), [accepted](#)
  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](#)