Fengqiu Adam Dong

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Summary

I am currently a PhD candidate at the University of British Columbia Physics and Astronomy Department. My main area of research are pulsars, magnetars and Fast Radio Bursts where I employ the Canadian Hydrogen Intensity Mapping Experiment (CHIME) telescope. I have experience in radio astronomy, interferometry, proposal writing, machine learning and astronomical data processing.

Education

2020 - 2023/4 (present) PhD in Astronomy at The University of British Columbia
2018 - 2021 Masters of Science in Astronomy at The University of British Columbia
2016 - 2017 Bachelors of Science in Physics (Honours) at The University of Auckaland NZ
2010 - 2015 Bachelors of Engineering (Honours) at The University of Auckaland NZ

Publications

3.1 Collaboration Publications

These are collaboration publications. I was involved in the publication of all of them from data collection to data analysis.

The CHIME/FRB Collaboration (Apr. 2023). "CHIME/FRB Discovery of 25 Repeating Fast Radio Burst Sources". In: *The Astrophysical Journal* 947.2, p. 83. DOI: 10.3847/1538-4357/acc6c1. URL: https://dx.doi.org/10.3847/1538-4357/acc6c1.

– (July 2022). "Sub-second periodicity in a fast radio burst". In: *Nature* 607.7918, pp. 256–259. DOI: 10.1038/s41586-022-04841-8. URL: https://doi.org/10.1038%2Fs41586-022-04841-8.

– (Dec. 2021). "The First CHIME/FRB Catalog". In: *The Astrophysical Journal Supplement Series* 257.2, p. 59. DOI: 10.3847/1538-4365/ac33ab. URL: https://doi.org/10.3847%2F1538-4365%2Fac33ab.

– (2020a). "A bright millisecond-duration radio burst from a Galactic magnetar". In: *Nature* 587.7832, pp. 54–58. ISSN: 14764687. DOI: 10.1038/s41586-020-2863-y. arXiv: 2005.10324.

– (June 2020b). "Periodic activity from a fast radio burst source". In: *Nature* 582.7812, pp. 351–355. ISSN: 14764687. DOI: 10.1038/s41586-020-2398-2. arXiv: 2001.10275.

3.2 First Author or Major Contribution

F.A. Dong, K. Crowter, et al. (2023). "The second set CHIME/FRB/Pulsar pulsar discoveries: 14 Rotating Radio Transients and 7 pulsars". In: *The Monthly Notices of the Royal Society*. DOI: https://doi.org/10.1093/mnras/stad2012.

F.A. Dong, I.H. Stairs, and et al. The CHIME/FRB/Pulsar Collaboration (2023). "The Discovery of an Ultra Long Period Magnetar Candidate by CHIME/FRB/Pulsar". In: - *Submission to The Astrophysical Journal Letters on Nov. 1 2023.*

F.A. Dong, I.H. Stairs, and et al. The CHIME/Pulsar Collaboration (2023). "Characterisation of the single pulse luminosity function and burst rates of radio transients via the correction of selection effects". In: - *Submission to The Astrophysical Journal on Nov. 1 2023.*

F.A. Dong and The CHIME/FRB/Pulsar Collaboration (2022). "CHIME/FRB Detection of a Bright Radio Burst from SGR 1935+2154". In: *Astronomers telegram*. URL: https://www.astronomerstelegram.org/?read=15681.

F.A. Dong, Wen Qi Zhang, et al. (2022). "Nonreciprocity in Optical Fiber Radiation Modes Induced by Spin-Momentum Locking". In: *SSRN Electronic Journal - Submitted to Journal of Optics and Laser Technology*. DOI: 10.2139/ssrn.4159885. URL: https://doi.org/10.2139%2Fssrn.4159885.

Merryfield, Marcus, ... **F.A. Dong**, et al. (2022). "An Injection System for the CHIME/FRB Experiment". In: DOI: 10.48550/ARXIV.2206.14079. URL: https://arxiv.org/abs/2206.14079.

Good, D. C., ...**F. A. Dong**, et al. (Nov. 2021). "First Discovery of New Pulsars and RRATs with CHIME/FRB". In: *The Astrophysical Journal* 922.1, p. 43. DOI: 10.3847/1538-4357/ac1da6. URL: https://doi.org/10.3847%2F1538-4357%2Fac1da6.

Atakaramians, Shaghik, **F.A., Dong**, et al. (2019). "Radiated and guided optical waves of a magnetic dipole-nanofiber system". In: *Scientific Reports* 9.1, pp. 1–10. ISSN: 20452322. DOI: 10.1038/s41598-018-38115-z.

3.3 Other publications

All publications here include **F.A. Dong**.

Chawla, P., V. M. Kaspi, et al. (Mar. 2022). "Modeling Fast Radio Burst Dispersion and Scattering Properties in the First CHIME/FRB Catalog". In: *The Astrophysical Journal* 927.1, p. 35. DOI: 10.3847/1538-4357/ac49e1. URL: https://doi.org/10.3847/1538-4357/ac49e1.

Curtin, Alice P., Shriharsh P. Tendulkar, et al. (2022). *Limits on Fast Radio Burst-like Counterparts to Gamma-ray Bursts using CHIME/FRB*. DOI: 10.48550/ARXIV.2208.00803. URL: https://arxiv.org/abs/2208.00803.

Kader, Zarif, Calvin Leung, et al. (2022). "A High-Time Resolution Search for Compact Objects using Fast Radio Burst Gravitational Lens Interferometry with CHIME/FRB". In: DOI: 10.48550/ARXIV.2204.06014. URL: https://arxiv.org/abs/2204.06014.

Lanman, Adam E., Bridget C. Andersen, et al. (Mar. 2022). "A Sudden Period of High Activity from Repeating Fast Radio Burst 20201124A". In: *The Astrophysical Journal* 927.1, p. 59. DOI: 10.3847/1538-4357/ac4bc7. URL: https://doi.org/10.3847%2F1538-4357%2Fac4bc7.

Leung, Calvin, Zarif Kader, et al. (2022). "Constraining Primordial Black Holes using Fast Radio Burst Gravitational-Lens Interferometry with CHIME/FRB". In: DOI: 10.48550/ARXIV.2204.06001. URL: https://arxiv.org/abs/2204.06001.

Mckinven, R., B. M. Gaensler, et al. (2022). *A Large Scale Magneto-ionic Fluctuation in the Local Environment of Periodic Fast Radio Burst Source, FRB 20180916B*. DOI: 10.48550/ARXIV.2205.09221. URL: https://arxiv.org/abs/2205.09221.

Shin, Kaitlyn, Kiyoshi W. Masui, et al. (2022). *Inferring the Energy and Distance Distributions of Fast Radio Bursts using the First CHIME/FRB Catalog*. DOI: 10.48550/ARXIV.2207.14316. URL: https://arxiv.org/abs/2207.14316.

Fonseca, E., H. T. Cromartie, et al. (July 2021). "Refined Mass and Geometric Measurements of the High-mass PSR J07406620". In: *The Astrophysical Journal Letters* 915.1, p. L12. DOI: 10.3847/2041-8213/ac03b8. URL: https://doi.org/10.38472F2041-82132Fac03b8.

Pleunis, Ziggy, Deborah C. Good, et al. (Dec. 2021). "Fast Radio Burst Morphology in the First CHIME/FRB Catalog". In: *The Astrophysical Journal* 923.1, p. 1. DOI: 10.3847/1538-4357/ac33ac. URL: https://doi.org/10.3847%2F1538-4357%2Fac33ac.

Rafiei-Ravandi, Masoud, Kendrick M. Smith, et al. (Nov. 2021). "CHIME/FRB Catalog 1 Results: Statistical Cross-correlations with Large-scale Structure". In: *The Astrophysical Journal* 922.1, p. 42. DOI: 10.3847/1538-4357/ac1dab. URL: https://doi.org/10.3847%2F1538-4357%2Fac1dab.

Chawla, P., B. C. Andersen, et al. (2020). "Detection of Repeating FRB 180916.J0158+65 Down to Frequencies of 300 MHz". In: *The Astrophysical Journal* 896.2, p. L41. ISSN: 2041-8213. DOI: 10.3847/2041-8213/ab96bf. arXiv: 2004.02862.

Fonseca, E., B. C. Andersen, et al. (Feb. 2020). "Nine New Repeating Fast Radio Burst Sources from CHIME/FRB". In: *The Astrophysical Journal* 891.1, p. L6. ISSN: 2041-8213. DOI: 10.3847/2041-8213/ab7208. URL: https://iopscience.iop.org/article/10.3847/2041-8213/ab7208.

Talks, invited and submitted

Fengqiu Adam Dong - With great telescope power comes great pulsar hunting responsibilities, an overview of the CHIME/FRB/Pulsar galactic transient discoveries - Invited talk at the Herzberg Institute National Research Council of Canada (2023)
Fengqiu Adam Dong - With great telescope power comes great pulsar hunting responsibilities and a look towards the future - TomFest (2023)
Fengqiu Adam Dong - An assortment of galactic science results using CHIME/FRB - Invited talk at West Virginia University (2023)
Fengqiu Adam Dong - With great telescope power comes great pulsar hunting responsibilities - The Canadian Astronomical Society AGM (2023)
Fengqiu Adam Dong - Galactic Pulsar Discoveries using the CHIME/FRB and CHIME/Pulsar instruments. The American Astronomical Society AGM Winter session(2023)
Fengqiu Adam Dong - Identifying FRB repeater candidates with CHIME/FRB using unsupervised machine learning. The International Astronomical Union General Assembly (2022)
Fengqiu Adam Dong - Overview of CHIME/FRB and CHIME/Pulsar instruments and science. Invited talk at Victoria University of Wellington (2022)
Fengqiu Adam Dong, Bradley Meyers, Ingrid Stairs - The first CHIME/FRB catalog. Invited talk at the UBC Astronomy Colloquium (2021)
Fengqiu Adam Dong - Finding new pulsars using CHIME/Pulsar And CHIME/FRB. Invited talk at the UBC Astronomy Colloquium (2020)
Fengqiu Adam Dong - Finding new galactic sources with CHIME/Pulsar And CHIME/FRB. TRU American Physical Society NW Conference (2020)
Fengqiu Adam Dong - Discovery of new Pulsars with CHIME/Pulsar - The Canadian Astronomical Society Anual General Meeting (2020)
V. S. Afshar, S. Atakaramians, **F. Dong** ... - Purcell Effect of Magnetic Dipoles in Nanofibers in 2017 European Conference on Lasers and Electro-Optics and European Quantum Electronics Conference, (Optical Society of America, 2017), paper CK P 6.
S. V. Afshar, **F. Q. Dong** ... - Symmetry breaking in directional coupling to radiation modes of a nanfofiber by dipole emission in Advanced Photonics 2018 (BGPP, IPR, NP, NOMA, Sensors, Networks, SPPCom, SOF), OSA Technical Digest (online) (Optical Society of America, 2018), paper JTu5A.18.

Successful proposals (Telescope and others)

Swift X-ray follow up of a Galactic Transient Detected with CHIME/FRB - Granted 32 hours
GBT Follow-up on a Novel Repeating Galactic Transient Detected with CHIME/FRB - Granted 32/32 hours
uGMRT Localisation of a Novel Repeating Galactic Transient Detected with CHIME/FRB - Granted 12/24 hours
Request for Sockeye Supercomputing Allocation at the University of British Columbia - Success, fair share access to CPU nodes and 5 TB of project storage

Honours and Awards

ALMA Ambassador Fellowship (2023)
The University of British Colunbia Four Year Fellowship (2020-2024)
The University of British Colunbia Faculty of Science International Tuition Award (2018,2019,2020,2021,2022)
The University of British Colunbia Faculty of Science PhD Tuition Award (2018,2019)
The University of British Columbia President's Excellence award (2020,2021,2022,2023)
University of Auckland Research Scholarship (2017)

Sydney University Research Scholarship (2017)
Dodd-Walls masters scholarship - declined due to accepting UBC (2017)
Master of Astronomy and Astrophysics Advanced Scholarshipship ANU - declined due to accepting offer at UBC (2017)
First in Class Physics 754 (Condensed Matter) (2016)
Australian National University Research Scholarship (2015)
President University of Auckland Badminton Club (2013)

Thesis

Masters
Pulsars are compact objects which are remnants of once-massive stars. Most are lighthouses in radio frequencies, and studying them has led to significant discoveries of exoplanets, gravitational waves, and fundamental physics theories. An ongoing research area is the source of pulsar emission and, in turn, the strange way telescopes see some pulsars. These include intermittent pulsars and Rotating Radio Transients (RRATs) i.e. ones that turn on for some time but remain quiet otherwise. While the study of pulsars stretches back to 1967, a more contemporary discovery is that of Fast Radio Bursts (FRBs). The discovery in 2007 led to a burgeoning field in radio astronomy, which has enticed many current-generation telescopes. The Canadian Hydrogen Intensity Mapping Experiment (CHIME) is among the bank of telescopes that have been commissioned to find FRBs. This thesis addresses the development and deployment of a novel pipeline for finding new pulsars from galactic and extragalactic single-pulse events. We employ the vast astronomical database collected by the aptly named the CHIME/FRB collaboration over 29 months. The majority of the work was to sort through the CHIME/FRB database for RFI and known pulsars before implementing an unsupervised machine learning algorithm, DBSCAN. DBSCAN made clusters of transient astronomical events which are checked against known pulsars in extant catalogs before being followed up by a second CHIME backend instrument, CHIME/Pulsar. The process has led to 144 candidates, with 12 confirmed new pulsars. Many of the pulsars discovered are RRATs, objects that are atypical for a pulsar in that the pulsed emission is sporadic and intermittent. The continued study of RRATs have the potential to elucidate their intermittency and, by extension, the emission mechanism for pulsars. Thus adding to the current 120 known RRATs will enable pulsar astronomers to make more substantial claims regarding the estimated $\sim 10^5$ RRATs in the Milky Way Galaxy.
Undergraduate
The aim of this study was to test the Binary Population and Spectral Synthesis (BPASS) stellar evolution models and thus validate their accuracy in modelling eclipsing binaries. We did this by attempting to predict the age and metallicities of eclipsing binaries in hopes of matching pre-known trends. By using eclipsing binaries, data with very low uncertainties are able to be obtained. The galactic dataset used for this study is the Detached Eclipsing Binaries Catalogue (DEBCat), while the Small Magellanic Cloud (SMC) dataset are a subset of a larger catalog observed by OGLE. Overall we showed that current single star BPASS models are sufficient to capture properties in detached eclipsing binaries across a wide range of initial masses and stages in evolution.