Emmanuel Fonseca – Curriculum Vitae

Postdoctoral Researcher
McGill University, Department of Physics
3600 rue University
Montreal, QC H3A 2T8, Canada

efonseca([at]physics[dot]mcgill[dot]ca)
https://emmanuelfonseca.github.io
Office phone: 514–398–1912
Github: emmanuelfonseca

Research Areas

Radio pulsars: high-precision pulsar timing; orbital dynamics in binary/triple systems; neutron-star mass measurements; gravitational radiation and pulsar timing arrays.

Fast radio bursts: algorithm development for detection and characterization; dispersion-measure statistics and associations with host-galaxy redshift; burst morphology.

Education

Ph.D. in Astronomy — 2012 - 2016
School: The University of British Columbia (UBC)
Advisor: Ingrid H. Stairs
Thesis: *Mass and Geometric Measurements of Binary Radio Pulsars*

M. Sc. in Astronomy — 2010 - 2012
School: UBC
Advisor: Ingrid H. Stairs
Thesis: *Experimental Gravity with PSR B1534+12*

B. Sc in Physics, Astronomy (dual degrees) — 2006 - 2010
School: The Pennsylvania State University (PSU)
Minor: Mathematics
Advisors: Stephen Holland, Scott Koch, Erik Hoversten

Employment

Postdoctoral researcher (McGill)	2016 - present
Graduate research assistant (UBC)	2010 - 2016
Research intern (NASA Goddard Space Flight Center)	2009, 2010
Undergraduate research assistant (PSU)	2008 - 2010

Teaching/Outreach Positions

Public outreach assistant (PSU, UBC, McGill)	2009 - present
Laboratory Instructor, Science Creative Literacy Symposium (UBC)	2014 - 2016
Graduate teaching assistant (UBC)	2010 - 2016

Presentations

Selected Colloquia and Conference Talks/Posters

"Invited colloquium for the Kavli Institute for Cosmological Physics at the University of Chicago. 22 November 2019."

"Relativistic Shapiro Delay Measurements of an extremely massive Millisecond Pulsar." Contributed poster at the 2019 annual general meeting for the Canadian Astronomy Society in Montréal, Québec (Canada), 17-20 June 2019.

"A GPU-enabled, Pulsar-Timing Backend for the Canadian Hydrogen Intensity Mapping Experiment." Invited talk at the Dominion Radio Astrophysical Observatory in Kaleden, British Columbia (Canada), 4 June 2019.

"FRB Detection & Characterization at the Dawn of the CHIME Era." Invited talk for the URSI National meeting in Boulder, Colorado (USA), 9-12 January 2019.

"The NANOGrav Nine-Year Data Set: Mass and Geometric Measurements of Binary Millisecond Pulsars." Invited talk for the JINA-CEE international symposium on *Neutron Stars in the Multi-Messenger Era: Prospects and Challenges* in Athens, Ohio (USA), 23-27 May 2016.

"High-precision Pulsar Timing in the Era of Gravitation-Wave Astronomy." Invited talk at ASTRON in Dwingeloo, the Netherlands, 28 January 2016.

"The NANOGrav Nine-Year Data Set: Mass and Geometric Measurements of Binary Millisecond Pulsars." Invited talk for the NANOGrav Fall collaboration meeting in Montreal, QB (Canada), 19-21 October 2015.

"Dynamical Studies of NANOGrav Binary Pulsars using the 9-year Data Release." Contributed talk for the NANOGrav Spring collaboration meeting in Arecibo, Puerto Rico (USA), 4-6 February 2015.

"A Comprehensive Study of Relativistic Gravity with PSR B1534+12." Contributed talk+poster for Testing Gravity Conference in Vancouver, BC (Canada), 14-17 January 2015.

"Long-term Timing of the Pulsar Triple System in M4." Contributed poster for AAS 2015 Conference in Seattle, WA (USA), 4-8 January 2015.

"Dynamical Studies and Strong-field Tests with Radio Pulsars." Colloquium for the Department of Physics at McGill University in Montreal, QB (Canada) on 14 August 2014.

"Long-term Timing of the Pulsar Triple System in M4." Poster for IPTA 2014 Conference in Banff, AB (Canada), 16-27 June 2014.

"A Comprehensive Study of Relativistic Gravity with PSR B1534+12." Talk for IPTA 2013 Conference in Krabi, Thailand, 17-28 June 2013.

"Precession and Geometry with PSR B1534+12." Poster for CASCA 2013 Conference in Vancouver, BC (Canada), 28-30 May 2013.

"Experimental Gravity with PSR B1534+12." Talk for NANOGrav WebEx Science Seminar, 1 April 2013.

"Experimental Gravity with PSR B1534+12." Talk for CASCA 2012 Conference in Calgary, AB (Canada) on 4-7 June 2012.

Public Outreach Talks

"Monsters in the Darkroom: Imaging the Event Horizons of Black Holes." Talk for Astronomy on Tap in Montreal, QC, 27 March 2018.

"The Warped Road of Einstein's General Relativity." Talk for the Public Astro Night at McGill University, 14 December 2017.

"Seeing Gravity and the (Invisible) Universe." Talk for Astronomy on Tap in Montreal, QC, 28 November 2017.

"Seeing Gravity and the (Invisible) Universe." Talk for the Elite Mentors Association, 12 April 2015.

"La Gravedad y el Universo Invisible." Talk at the Visitor Center of the Arecibo Observatory, 5 February 2014.

"Seeing Gravity and the (Invisible) Universe." TEDx talk for Terry Project, UBC, 2 November 2013.

Successful Proposals:

Telescopes

- 300-m Arecibo Observatory: 900+ hours as PI (e.g., P2945, P3183, P3228)
- 100-m Green Bank Telescope: 30+ hours as PI (e.g., 14A-421, 18B-280, 19A-411)

Professional Activities & Service

Membership

- International Pulsar Timing Array (IPTA) 2012 - present
- N. A. Nanohertz Observatory for Gravitational Waves (NANOGrav) 2012 - present
- Canadian Astronomical Society (CASCA) 2011 - present
- Canadian Hydrogen Intensity Mapping Experiment (CHIME) 2017 - present

Conference Organization:

- CASCA 2019: member of local organizing committee; designer of conference website.
- NANOGrav spring 2017 meeting: member of science organizing committee (SOC)
- NANOGrav spring 2015 meeting: member of the science-meeting SOC.
- CASCA 2013: co-organizer of grad-student workshop, general conference assistant.

Committees:

- IPTA Diversity Committee (2016 - 2019)
- hiring committee for staff scientists at the Arecibo Observatory (2018)

Publication Referee:

- the Astrophysical Journal
- the Monthly Notices of the Royal Astronomical Society

Press Coverage

The Conversation:
invitation to write article(s) on CHIME/FRB backends

Scientific American:
article on first CHIME/FRB detection (13 August 2018)

CBC Radio Canada:
recorded telephone interview on first CHIME/FRB detection, in spanish (8 August 2018)

Awards & Honors

Dante Ciccone Memorial Scholarship, 2015 - $2,200 CAD
John C. Mather Nobel Scholar, 2009 - $3,000 USD (academic travel grant)

Publications

Academic, Peer-Reviewed

1. The CHIME/FRB Collaboration: Andersen, B., Bandura, K., Bhardwaj, M., et al. "CHIME /FRB Discovery of Eight Repeating Fast Radio Burst Sources" *Submitted to the Astrophysical Journal Letters*, arχiv:1908.03507 (corresponding author: **Fonseca, E.**)

2. Josephy, A., Chawla, P., **Fonseca, E.**, et al. "CHIME/FRB Detection of the Original Repeating Fast Radio Burst Source FRB 121102." *Accepted by the Astrophysical Journal Letters, June 2019*, arχiv:1906.11305

3. Cromartie, H. T., **Fonseca, E**, Ransom, S. M., et al. "A very massive neutron star: relativistic Shapiro delay measurements of PSR J0740+6620." *Accepted by Nature Astronomy, July 2019*, arχiv:1904.06759

4. The NANOGrav Collaboration: Aggarwal, K., Arzoumanian, Z., Baker, P. T., et al. "The NANOGrav 11 yr Data Set: Limits on Gravitational Waves from Inidividual Supermassive Black Hole Binaries." *The Astrophysical Journal*, 880, 116. July 2019

5. The CHIME/FRB Collaboration: Amiri, M., Bandura, K., Bhardwaj, M., et al. "A Second Source of Repeating Fast Radio Bursts." *Nature*, 566, 235-238. January 2019.

6. The CHIME/FRB Collaboration: Amiri, M., Bandura, K., Bhardwaj, M., et al. "Observations of Fast Radio Bursts at Frequencies down to 400 MHz." *Nature*, 566, 230-234. January 2019.

7. Stovall, K., Freire, P. C. C., Antoniadis, J. et al. "PSR J2234+0611: A New Laboratory for Stellar Evolution." *The Astrophysical Journal*, 870, 74.

8. The CHIME/FRB Collaboration: Amiri, M., Bandura, K., Berger, P., et al. "The CHIME Fast Radio Burst Project: System Overview." *The Astrophysical Journal*, 863, 48.

9. Lam, M. T., Ellis, J. A., Grillo, G., et al. "A Second Chromatic Timing Event of Interstellar Origin toward PSR J1713+0747." *The Astrophysical Journal*, 861, 132.

10. The NANOGrav Collaboration: Arzoumanian, Z., Brazier, A., Burke-Spolaor, S., et al. "The NANOGrav Eleven-Year Data Set: Pulsar-timing Constraints On The Stochastic Gravitational-wave Background." *The Astrophysical Journal*, 859, 47.

11. Lynch, R. S., Swiggum, J. K., Kondratiev, V. I., et al. "The Green Bank North Celestial Cap Survey II: 45 New Pulsar Timing Solutions." *The Astrophysical Journal*, 859, 2.

12. The NANOGrav Collaboration: Arzoumanian, Z., Brazier, A., Burke-Spolaor, S., et al. "The NANOGrav Eleven-Year Data Set: High-precision timing of 45 Millisecond Pulsars." *The Astrophysical Journal (Supplement)*, 235, 37. April 2018.

13. Kawash, A. M., McLaughlin, M. A., Kaplan, D. L., et al. "The Green Bank North Celestial Cap Survey II: The Discovery and Timing of Ten Pulsars." *The Astrophysical Journal*, 857, 131. April 2018.

14. Jones, M. L., McLaughlin, M. A., Lam, M. T., et al. "The NANOGrav Nine-Year Data Set: Measurement and Interpretation of Variations in Dispersion Measures." *The Astrophysical Journal*, 841, 125. June 2017.

15. Lam, M. T., Cordes, J. M., Chatterjee, S., et al. "The NANOGrav Nine-Year Data Set: Excess Noise in Millisecond Pulsar Arrival Times." *The Astrophysical Journal*, 834, 35. January 2017

16. **Fonseca, E.**, Pennucci, T. T., Ellis, J. A., et al. "The NANOGrav Nine-Year Data Set: Mass and Geometric Measurements of Binary Millisecond Pulsars." *The Astrophysical Journal*, 832, 167. December 2016.

17. Kaplan, D. L., Kupfer, T., Nice, D. J., et al. "PSR J1024-0719: A Millisecond Pulsar in an Unusual Long-Period Orbit." *The Astrophysical Journal*, 826, 86. July 2016.

18. Lentati, L., Shannon, R. M., Coles, W. A., et al. "From spin noise to systematics: stochastic processes in the first International Pulsar Timing Array data release." *Monthly Notices of the Royal Astronomical Society*, 458, 2161. May 2016.

19. Verbiest, J. P. W., Lentati, L., Hobbs, G., et al. "The International Pulsar Timing Array: First data release." *Monthly Notices of the Royal Astronomical Society*, 458, 1267. May 2016.

20. The NANOGrav Collaboration: Arzoumanian, Z., Brazier, A., Burke-Spolaor, S., et al. "The NANOGrav Nine-Year Data Set: Limits on the Isotropic Stochastic Gravitational Wave Background." *The Astrophysical Journal*, 821, 13. April 2016.

21. Lam, M. T., Cordes, J. M., Chatterjee, S., et al. "The NANOGrav Nine-Year Data Set: Noise Budget for Pulse Arrival Times on Intraday Timescales." *The Astrophysical Journal*, 819, 155. March 2016.

22. Matthews, A. M., Nice, D. J., **Fonseca, E.**, et al. "The NANOGrav Nine-Year Data Set: Astrometric Measurements of 37 Millisecond Pulsars." *The Astrophysical Journal*, 818, 92. February 2016.

23. Levin, L., McLaughlin, M. A., Jones, G., et al. "The NANOGrav Nine-Year Data Set: Monitoring Interstellar Scattering Delays." *The Astrophysical Journal*, 818, 166. February 2016.

24. The NANOGrav Collaboration: Arzoumanian, Z., Brazier, A., Burke-Spolaor, S., et al. "The NANOGrav Nine-Year Data Set: Observations, Arrival Time Measurements and Analysis of 37 Millisecond Pulsars." *The Astrophysical Journal*, 813, 65. November 2015.

25. Zhu, W. W, Stairs, I. H., Demorest, P. B., et al. " 21-Year Timing of Millisecond pulsar PSR J1713+0747 with Arecibo and GBT." *The Astrophysical Journal*, 809, 41-56. 10 August 2015.

26. Arzoumanian, Z., Brazier, A., Burke-Spolaor, S., et al. "NANOGrav Constraints on Gravitational Wave Bursts with Memory." *The Astrophysical Journal*, 810, 150-163. 10 September 2015.

27. **Fonseca, E.**, Stairs, I. H., and Thorsett, S. E. "A Comprehensive Study of Relativistic Gravity using PSR B1534+12." *The Astrophysical Journal*, 787: 82-91. May 2014.

28. Holland, S. T., Sbarufatti, B., Shen, R., et al. "GRB 090417B and its host galaxy: a step towards an understanding of optically-dark gamma-ray bursts." *The Astrophysical Journal*, 717: 223-234. July 2010.

Academic, White Papers

29. **Fonseca, E.**, Demorest, P B., Ransom, S. M., Stairs, I. H. "Fundamental Physics with Radio Millisecond Pulsars." *Bulletin of the American Astronomical Society*, 51, 425. May 2019. (Contribution to the Astro2020 U. S. Decadal Survey on Astronomy & Astrophysics.)

Public Outreach

30. "Fly Me to the (Super) Moon", blog post for Science Borealis on 24 September 2015.