Emmanuel Fonseca – Curriculum Vitae

Assistant professor (starting Fall 2021)
West Virginia University
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Research Areas

Radio pulsars: high-precision pulsar timing; orbital dynamics; neutron-star mass measurements; gravitational radiation and pulsar timing arrays; pulsar instruments for next-generation telescopes.

Fast radio bursts: algorithm and hardware development for detection, characterization and localization; modeling of burst morphology.

Education

Ph.D. in Astronomy — 2012 - 2016
School: 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; minor in Math) — 2006 - 2010
School: Pennsylvania State University (PSU)
Advisors: Stephen Holland, Scott Koch, Erik Hoversten

Employment

Assistant professor (West Virginia University; WVU)	starting Fall 2021
Postdoctoral researcher (McGill)	2016 - 2021
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

"High-Cadence Timing of Radio Pulsars with CHIME." Invited talk for the April 2020 Meeting of the American Physical Society. Remote presentation. 17-20 April 2021.

"FRB Astrophysics in the Era of CHIME." Invited colloquium for the Kavli Institute for Cosmological Physics at the University of Chicago. 6 December 2019.

"Pulsar & FRB Astrophysics in the Era of CHIME." Invited astronomy colloquium at Northwestern University. 3 December 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.

"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.

"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.

"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: 1000+ 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)
- Karl G. Jansky Very Large Array: 3.5 hours as PI (20A-474)

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) 2016 - 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)

Publication List for E. Fonseca

Academic, Peer Reviewed

70. **Fonseca, E.**, Cromartie, H. T., Pennucci, T. T., et al. "Refined Mass and Geometric Measurements of the High-Mass PSR J0740+6620." *The Astrophysical Journal Letters, in press.* April 2021. arχiv:2104.00880

69. Riley, T. E., Watts, A. L., Ray, P. S., et al. "A NICER View of the Massive Pulsar PSR J0740+6620 Informed by Radio Timing and XMM-Newton Spectroscopy." *Submitted to the Astrophysical Journal Letters.* April 2021. arχiv:2105.06980.

68. Miller, M. C., Lamb, F. K., Dittmann, A. J., et al. "The Radius of PSR J0740+6620 from NICER and XMM-Newton Data." *Submitted to the Astrophysical Journal Letters.* April 2021. arχiv:2105.06979

67. The NANOGrav Collaboration: Arzoumanian, Z., Baker, P. T., Blumer, H., et al. "Searching For Gravitational Waves From Cosmological Phase Transitions With The NANOGrav 12.5-year dataset." *Submitted to the Physical Review Letters.* April 2021. arχiv:2104.13930.

66. Wahl, H. M., McLaughlin, M. A., Gentile, P. A., et al., "The NANOGrav 12.5-Year Data Set: Polarimetry, Rotation Measures, and Galactic Magnetic Field Strengths from NANOGrav Observations with the Green Bank Telescope." *Submitted to the Astrophysical Journal.* April 2021. arχiv:2104.05723.

65. Pol, N. S., Taylor, S. R., Kelley, L. Z., et al. "Astrophysics Milestones For Pulsar Timing Array Gravitational Wave Detection." *The Astrophysical Journal Letters*, 911, L34. April 2021.

64. Pleunis, Z., Michilli, D., Bassa, C. G., et al. "LOFAR Detection of 110-188 MHz Emission and Frequency-dependent Activity from FRB 20180916B." *The Astrophysical Journal Letters*, 911, L3. April 2021.

63. Bhardwaj, M., Gaensler, B. M., Kaspi, V. M., et al. "A Nearby Repeating Fast Radio Burst in the Direction of M81." *The Astrophysical Journal Letters*, 910, L18. April 2021.

62. Pleunis, Z., Good, D. C., Kaspi, V. M., et al. "Fast radio burst morphology in the first CHIME/FRB catalog." *Submitted to the Astrophysical Journal.* March 2021.

61. Tendulkar, S. P., Gil de Paz, A., Kirichenko, A. Yu., et al. "The 60-pc Environment of FRB 20180916B." *The Astrophysical Journal Letters*, 908, L12. February 2021.

60. Agazie, G., Mingyar, M., McLaughlin, M. A., et al. "The Green Bank Northern Celestial Cap Pulsar Survey. VI. Timing and Discovery of PSR J1759+5036: A Double Neutron Star Binary Pulsar." *Submitted to the Astrophysical Journal.* February 2021. arχiv:2102.10214.

59. The CHIME/FRB Collaboration: Amiri, M., Andersen, B. C., Bandura, K., et al. "The First CHIME/FRB Fast Radio Burst Catalog." *Submitted to theAstrophysical Journal Supplements.* January 2021.

58. The NANOGrav Collaboration: Alam, M. F., Arzoumanian, Z., Baker, P. T., et al. "The NANOGrav 12.5-year Data Set: Wideband Timing of 47 Millisecond Pulsars." *The Astrophysical Journal Supplements*, 252, 5. January 2021.

57. The NANOGrav Collaboration: Alam, M. F., Arzoumanian, Z., Baker, P. T., et al. "The NANOGrav 12.5-year Data Set: Observations and Narrowband Timing of 47 Millisecond Pulsars." *The Astrophysical Journal Supplements*, 252, 4. January 2021.

56. Arzoumanian, Z., Baker, P. T., Blumer, H., et al. "The NANOGrav 12.5 yr Data Set: Search for an Isotropic Stochastic Gravitational-wave Background." *The Astrophysical Journal Letters*, 905, L34. December 2020.

55. Good, D. C., Andersen, B. C., Chawla, P., et al. "First discovery of new pulsars and RRATs with CHIME/FRB." *Submitted to the Astrophysical Journal.* December 2020. arχiv:2012.02320.

54. Parent, É., Chawla, P., Kaspi, V. M., et al. "First Discovery of a Fast Radio Burst at 350 MHz by the GBNCC Survey." *The Astrophysical Journal*, 904, 92. December 2020.

53. Ng, C., Wu, B., Ma, M. et al. "The Discovery of Nulling and Mode Switching Pulsars with CHIME/Pulsar." *The Astrophysical Journal*, 903, 81 November 2020.

52. The CHIME/FRB Collaboration: Andersen, B. C. Bandura, K. M., Bhardwaj, M., et al. "A bright millisecond-duration radio burst from a Galactic magnetar." *Nature*, 587, 54-58. November 2020.

51. The NANOGrav Collaboration: Arzoumanian, Z., Baker, P. T., Brazier, A., et al. "Multi-Messenger Gravitational Wave Searches with Pulsar Timing Arrays: Application to 3C66B Using the NANOGrav 11-year Data Set." *The Astrophysical Journal*, 900, 102. September 2020.

50. The CHIME/Pulsar Collaboration: Amiri, M., Bandura, K., Boyle, P. J., et al. "The CHIME Pulsar Project: System Overview." *Submitted to the Astrophysical Journal Supplements.* August 2020. arχiv:2008.05681.

49. The CHIME/FRB Collaboration: Amiri, M., Andersen, B. C., Bandura, K., et al. "Periodic Activity from a Fast Radio Burst Source." *Nature*, 582, 351-354. June 2020.

48. Ng, C., Pandhi, A., Naidu, A., et al. "Faraday rotation measures of northern-hemisphere pulsars using CHIME/Pulsar." *Monthly Notices of the Royal Astronomical Society*, 496, 2836. June 2020.

47. Chawla, P., Andersen, B. C., Bhardwaj, M., et al. "Detection of Repeating FRB 180916.J0158+65 Down to Frequencies of 300 MHz." *The Astrophysical Journal Letters*, 896, L41. June 2020.

46. Behrens, E. A., Ransom, S. M., Madison, D. R., et al. "The NANOGrav 11 yr Data Set: Constraints on Planetary Masses Around 45 Millisecond Pulsars." *The Astrophysical Journal Letters*, 893, L8. April 2020.

45. Vallisneri, M., Taylor, S. R., Simon, J., et al. "Modeling the Uncertainties of Solar System Ephemerides for Robust Gravitational-wave Searches with Pulsar-timing Arrays." *The Astrophysical Journal*, 893, 112. April 2020.

44. **Fonseca, E.**, Andersen, B. C., Bhardwaj, M., et al. "Nine New Repeating Fast Radio Burst Sources from CHIME/FRB." *The Astrophysical Journal Letters*, 891, L6. February 2020.

43. Kirichenko, A. Yu., Karpova, A. V., Zyuzin, D. A., et al. "Searching for optical companions to four binary millisecond pulsars with the Gran Telescopio Canarias." *Monthly Notices of the Royal Astronomical Society*, 492, 3032. February 2020.

42. Hazboun, J. S., Simon, J., Taylor, S. R., et al. "The NANOGrav 11 yr Data Set: Evolution of Gravitational-wave Background Statistics." *The Astrophysical Journal*, 890, 108. February 2020.

41. Marcote, B., Nimmo, K., Hessels, J. W. T., et al. "A repeating fast radio burst source localised to a nearby spiral galaxy." *Nature*, 577, 190. January 2020.

40. Cromartie, H. T., **Fonseca, E**, Ransom, S. M., et al. "A very massive neutron star: relativistic Shapiro delay measurements of PSR J0740+6620." *Nature Astronomy*, 4, 72. January 2020.

39. The NANOGrav Collaboration: Aggarwal, K., Arzoumanian, Z., Baker, P. T., et al., "The NANOGrav 11 yr Data Set: Limits on Gravitational Wave Memory." *The Astrophysical Journal*, 889, 38. January 2020.

38. Perera, B. B. P., DeCesar, M. E., Demorest, P. B., et al. "The International Pulsar Timing Array: second data release." *Monthly Notices of the Royal Astronomical Society*, 490, 4666. December 2019.

37. The CHIME/FRB Collaboration: Andersen, B., Bandura, K., Bhardwaj, M., et al. "CHIME /FRB Discovery of Eight Repeating Fast Radio Burst Sources" *Astrophysical Journal Letters*, 855, L24. September 2019. (Corresponding author: **Fonseca, E**.)

36. Josephy, A., Chawla, P., **Fonseca, E.**, et al. "CHIME/FRB Detection of the Original Repeating Fast Radio Burst Source FRB 121102." *The Astrophysical Journal Letters*, 882, L18. September 2019.

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

34. Aloisi, R. J., Cruz, A., Daniels, L., et al. "The Green Bank North Celestial Cap Pulsar Survey. IV. Four New Timing Solutions." *The Astrophysical Journal*, 875, 19. April 2019.

33. Deneva, J. S., Ray, P. S., Lommen, A., et al. "High-precision X-Ray Timing of Three Millisecond Pulsars with NICER: Stability Estimates and Comparison with Radio." *The Astrophysical Journal*, 874, 160. April 2019.

32. Lam, M. T., McLaughlin, M. A., Arzoumanian, Z., et al. "The NANOGrav 12.5 yr Data Set: The Frequency Dependence of Pulse Jitter in Precision Millisecond Pulsars." *The Astrophysical Journal*, 872, 193. February 2019.

31. Madison, D. R., Cordes, J. M., Arzoumanian, Z., et al. "The NANOGrav 11 yr Data Set: Solar Wind Sounding through Pulsar Timing." *The Astrophysical Journal*, 872, 150. February 2019.

30. 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.

29. 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.

28. Zhu, W. W., Desvignes, G., Wex, N., et al. "Tests of gravitational symmetries with pulsar binary J1713+0747." *Monthly Notices of the Royal Astronomical Society*, 482, 3249. January 2019.

27. Stovall, K., Freire, P. C. C., Antoniadis, J. et al. "PSR J2234+0611: A New Laboratory for Stellar Evolution." *The Astrophysical Journal*, 870, 74. January 2019.

26. Caballero, R. N., Guo, Y. J., Lee, K. J., et al. "Studying the Solar system with the International Pulsar Timing Array." *Monthly Notices of the Royal Astronomical Society*, 481, 5501. December 2018.

25. Brook, P. R., Karastergiou, A., McLaughlin, M. A., et al. "The NANOGrav 11-year Data Set: Pulse Profile Variability." *The Astrophysical Journal*, 868, 122. December 2018.

24. 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. August 2018.

23. Gentile, P. A., McLaughlin, M. A., Demorest, P. B., et al. "The NANOGrav 11 yr Data Set: Arecibo Observatory Polarimetry and Pulse Microcomponents." *The Astrophysical Journal*, 862, 47. July 2018.

22. 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. July 2018.

21. 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. June 2018.

20. 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. May 2018.

19. 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.

18. 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.

17. 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.

16. 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

15. **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.

14. 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.

13. 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.

12. 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.

11. 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.

10. 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.

9. 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.

8. 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.

7. 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.

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

5. 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. August 2015.

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

3. 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. July 2010.

Academic, White Papers

2. **Fonseca, E.**, et al. "Fundamental Physics with Pulsars." October 2019. (Contribution to the 2020-2030 Long Range Plan for the Canadian Astronomical Society.)

1. **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.)