Bence Bécsy

Curriculum Vitae

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Education

2018–2022 **PhD in Physics**, *Montana State University*, Bozeman, Montana, USA
Thesis: "Exploring the low-frequency gravitational-wave universe with pulsar timing arrays"
Advisor: Neil Cornish, Regents Professor at Montana State University

2016–2018 **MSc in Physics**, *Eötvös Loránd University*, Budapest, Hungary
Thesis: "Parameter estimation for gravitational-wave transients using minimal assumptions" (in Hungarian)
Advisor: Péter Raffai, Assistant professor at Eötvös Loránd University

2013–2016 **BSc in Physics**, *Eötvös Loránd University*, Budapest, Hungary
Degree classification: outstanding
Thesis: "Extracting astrophysical information from detections of gravitational-wave bursts" (in Hungarian)
Advisor: Péter Raffai, Assistant professor at Eötvös Loránd University

Professional employment and research experience

2024– **Assistant Professor**, *University of Birmingham*, Edgbaston, UK

2022–2024 **Postdoctoral Researcher**, *Oregon State University*, Corvallis, OR, USA

2019–2022 **Graduate Research Assistant**, *Montana State University*, Bozeman, MT, USA

Fall 2018 **Graduate Teaching Assistant**, *Montana State University*, Bozeman, MT, USA

July–August 2017 **Summer student**, *Massachusetts Institute of Technology*, Cambridge, MA, USA

Professional activities

2025– EPTA member

2020– NANOGrav full member

2016– LIGO Scientific Collaboration long-term member

2019–2020 NANOGrav associate member

2017 LVC Electromagnetic Follow-up advocate shifts

2014–2016 LIGO Scientific Collaboration undergraduate member

Scholarships and awards

December 2017 1st prize, Science Workshop of the Eötvös University in Physics, Particle- and Astrophysics Section

2017, 2016, 2015 Student-Scholar of the Hungarian Republic Award

2017–2018 New National Excellence Program of the Ministry of Human Capacities (research grant)

May 2017 1st prize, NyIFFF National Team Competition of Experimental Physics

September 2016 2nd prize, NyIFFF National Team Competition of Experimental Physics

2016–2017	New National Excellence Program of the Ministry of Human Capacities (research grant)
2016	Junior Templeton Fellow
September 2015	3rd prize, NyIFFF National Team Competition of Experimental Physics
April 2015	Honorable Mention, National College Science Workshop
2015	Excellence in Undergradual Studies Award, Eötvös University, Faculty of Sciences
December 2014	3rd prize, Science Workshop of the Eötvös University in Physics, Theoretical Physics Section
November 2014	Honorable mention, Ortvay International College Competition in Physics
2014, 2013	Scholarship of the Prime Minister of Hungary
2013, 2012	Student excellence of Érd award
August 2013	Silver medal, 7th International Olympiad on Astronomy and Astrophysics, Greece
August 2012	Bronze medal, 6th International Olympiad on Astronomy and Astrophysics, Brazil

Languages

Hungarian	Mothertongue
English	Fluent (TOEFL iBT 113/120; ECL level C1 certificate)
French	Basic

Computer skills

Operating systems	Linux
Programming	Python, Jupyter, Matlab, C, shell script
Word processing	LaTeX, LibreOffice
Other	Stellarium, InkScape, Gimp, Darktable, Orange Data Mining, git

Advising

2022–	Jacob Taylor, graduate student at Oregon State University
2022–	Rand Burnette, graduate student at Oregon State University
2023–	Emiko Gardiner, graduate student at UC Berkeley

Invited Talks

March 2024	Overview talk and update about NANOGrav at EPTA Meeting (online)
December 2023	Talk at Astro Pizza Lunch, Eötvös Loránd University, Budapest, Hungary
September 2023	Talk at University of Mississippi Gravity Seminar (virtual)
March 2023	Tutorial on Astrophysics with Pulsar Timing Arrays at the NANOGrav Student Workshop, Oregon State University, Corvallis, OR, USA
December 2022	Talk at Ghent Gravity Group Seminar, Department of Physics and Astronomy, Ghent University
November 2022	Talk at Physics Seminar, Department of Physics, Oregon State University
July 2022	Tutorial on numerical Bayesian techniques at the 2022 VIPER Summer School on PTA GW Astrophysics at Vanderbilt University, Nashville, TN, USA (remote)
May 2022	Talk at CGCA seminar, Center for Gravitation, Cosmology & Astrophysics, University of Wisconsin-Milwaukee
April 2022	Talk at NANOGrav group seminar, Department of Physics, Oregon State University
November 2021	Talk at Idaho State University Physics Colloquium (virtual)

September 2021 Talk at virtual seminar, Center for Gravitation, Cosmology & Astrophysics, University of Wisconsin-Milwaukee

June 2021 Tutorial on NANOGrav data analysis at Virtual Gravitational Wave Astronomy Northwest Student Workshop

Conference Participation

June 2024 Poster at the 2024 IPTA Meeting, Sexten, Italy, "Efficient Bayesian Inference and Model Selection for Continuous Waves in PTA Data"

July 2023 Talk at the 2023 Amaldi Meeting, Virtual, "Search for supermassive black hole binaries in the NANOGrav 15-year dataset"

June 2023 Remote talk at the 2023 IPTA Meeting, Port Douglas, Australia, "Search for supermassive black hole binaries in the NANOGrav 15-year dataset"

April 2023 Poster at the 2023 APS April Meeting, Minneapolis, MN, USA, "Exploring individual binaries and a stochastic background in population-based simulated pulsar timing array datasets"

March 2023 Talk at the 2023 NANOGrav Spring Meeting, Oregon State University, USA, "Search for individual supermassive black hole binaries in the NANOGrav 15-year dataset"

October 2022 Talk at the 2022 NANOGrav Fall Meeting, University of Wisconsin-Milwaukee, USA, "Search for individual supermassive black hole binaries in the NANOGrav 15-year dataset"

June 2022 Poster at the 240th American Astronomical Society Meeting, Pasadena, USA, "Searching for individual supermassive black hole binaries and a stochastic background in population-based simulated pulsar timing array datasets"

March 2022 Talk at the 2022 NANOGrav Spring Meeting, Center for Computational Astrophysics, USA, "Fast Bayesian Analysis of Individual Binaries in Pulsar Timing Array Data"

December 2021 Talk at the 2021 Gravitational Wave Physics and Astronomy Workshop, Hannover, Germany, "Search for generic gravitational wave bursts in PTA data"

October 2021 Talk at the 2021 NANOGrav Fall Meeting, Vanderbilt University, USA, "Searching for individual SMBHBs and a stochastic background in population-based simulated PTA datasets"

May 2021 Talk at the 2021 NANOGrav Spring Virtual Meeting, "BayesHopperBurst - Search for generic GW bursts in PTA data"

January 2021 Poster at the 237th American Astronomical Society Meeting (Virtual), "Search for generic gravitational wave bursts in PTA data"

January 2021 Poster at the 237th American Astronomical Society Meeting (Virtual), "Bayesian reconstruction of gravitational waves from eccentric binary black holes with minimal assumptions"

October 2020 Talk at the 2020 NANOGrav Fall Virtual Meeting, "BayesHopperBurst - Search for generic GW bursts in PTA data"

September 2020 Poster at the Virtual International Pulsar Timing Array Meeting, "Joint search for bright binaries and a stochastic background in PTA Data"

June 2020 Talk at the Virtual Gravitational Wave Astronomy Northwest Meeting, "Joint Search for Isolated Sources and a Stochastic Background in PTA Data"

April 2020 Talk at the 2020 Virtual APS April Meeting, "BayesHopper: Joint Search for Isolated Sources and a Stochastic Background in PTA Data"

March 2020 Talk at the 2020 NANOGrav Spring Meeting, University of Central Florida, USA, "BayesHopper: Joint Search for Isolated Sources and a Stochastic Background in PTA Data"

January 2020 Poster presented by Neil Cornish at the 235th American Astronomical Society Meeting, Honolulu, USA, "Joint search for isolated sources and an unresolved confusion background in PTA data"

June 2019 Talk at the Gravitational Wave Astronomy Northwest Meeting, LIGO Hanford detector, USA, "Simultaneously searching for individual sources and stochastic background in PTA data"

March 2019 Poster at the 2019 March LVC Meeting, Lake Geneva, USA, "Eccentricity distribution of eccentric binary black holes in galactic nuclei"

May 2018 Talk at the Új Nemzeti Kiválóság Program Konferencia 2018, Budapest, Hungary, "Gravitációshullám-kitörések észlelése és értelmezése" (in Hungarian)

April 2018 Talk at the VII. Eötvözet Konferencia, an interdisciplinary conference for graduate and undergraduate students, Szeged, Hungary, "Ismeretlen forrásból érkező gravitációshullám-kitörések paraméterbecslése" (in Hungarian)

January 2018 Talk at the Gravity at Malta 2018 Conference, Valletta, Malta, "Model-independent constraints on astrophysical parameters of gravitational-waves sources"

May 2017 Talk at the Új Nemzeti Kiválóság Program Konferencia 2017, Budapest, Hungary, "Gravitációshullám-kitörésekkel asztrofizikai kérdések nyomában" (in Hungarian)

April 2017 Talk at the XVIII. Eötvös Konferencia, Budapest, Hungary, "Gravitációshullám-kitörések tulajdonságainak meghatározása" (in Hungarian)

March 2017 Talk at the 2017 March LVC Meeting, Pasadena, USA, "BayesWave Parameter Estimation and Model-Independent Constraints on the Source"

September 2016 Participation in the 2016 September LVC Meeting, Glasgow, Scotland

March 2016 Talk at the 2016 March LVC Meeting, Pasadena, USA, "BayesWave parameter estimation performance study"

September 2015 Poster at the 2015 September LVC Meeting, Budapest, Hungary, "Testing globular cluster models with future detections of gravitational waves from eccentric black hole binaries"

August 2014 Talk at the International Conference of Physics Students, Heidelberg, Germany, "Why do pulsars glitch?"

Summer school and workshop participation

April 2024 LISA Sprint, Caltech, Pasadena, USA

April 2024 LISA Analysis Tools Workshop (online)

March 2020 NANOGrav Student Workshop, University of Central Florida, USA

February 2020 NANOGrav Detection Working Group Hack Week, Pasadena, USA

September 2017 IMPRS Summer School 2017: Compact Objects & Gravitational Waves, Heidelberg, Germany

October 2016 Workshop on researcher's competences, Benczúr Hotel, Budapest

September 2016 IMPRS Summer School 2016: Astrostatistics & Data Mining, Heidelberg, Germany

August 2016 Data Science workshop, Eötvös Loránd University, Budapest, Hungary

Public outreach talks

December 2023 Outreach talk about recent NANOGrav results in the "From atoms to stars" series (*Az atomoktól a csillagokig*), Eötvös Loránd University, Budapest, Hungary

September 2023	Outreach talk about supermassive black hole binaries and gravitational waves at NANOSTARS Telecon
June 2018	Outreach talk about black holes at Piarista High School, Budapest
April 2018	Outreach talk about special and general relativity at The Hungarian University of Fine Arts, Budapest
March 2018	Outreach talk about neutron stars at Városmajori High School, Budapest
November 2017	Outreach talk at the Budapest University of Technology's Szent-Györgyi Albert Szakkollégium, Budapest
April 2017	Outreach talk about LIGO at the Astronomical Club of Érd, Érd
February 2017	Outreach talk at the Dürer Verseny (science competition for high school students), Miskolc
November 2016	Outreach talk at the Alumni Meeting of Vörösmarty Mihály High School, Érd
September 2016	Outreach talk at the Night of Researchers about the LIGO discovery, Eötös Loránd University, Budapest
August 2016	Outreach talk about the LIGO discovery at the XVI. Kiskun-Neptunusz Observing Astronomy Camp, Jászszentlászló
April 2016	Outreach talk about the LIGO discovery at the Eötvös College Scientific Evening, Eötvös József College, Budapest
March 2016	Outreach talk about the LIGO discovery at Városmajori High School, Budapest
March 2016	Outreach talk about the LIGO discovery at Polaris Observatory, Budapest
February 2016	Outreach talk for high school students about the LIGO discovery at Vörösmarty Mihály High School, Érd
January 2016	Outreach talk and workshop about gravitational waves for high school students at Eötvös József College, Budapest
November 2015	Outreach talk at Polaris Observatory, Budapest, "Gravitational Waves: a new window to the Universe"
December 2014	Outreach talk for 5th grade students at Vörösmarty Mihály High School, Érd

Education and outreach activities

April 2022	Event co-captain at Montana Science Olympiad (Solar System)
April 2021	Event captain at Montana Science Olympiad (Reach for the stars)
November 2019	Event captain at Montana Science Olympiad (Reach for the stars)
2014–2019	Preparing the Hungarian team for the International Olympiad on Astronomy and Astrophysics
2014–2018	Co-leading an astrophysical and astronomical study group for high school students in Budapest
2015–2017	Organizing a conference for high school students on continuing education each year in December, Vörösmarty Mihály High School Alumni Conference, Érd
July 2017	Organizing a weekend workshop for astronomy Olympians, Eötvös József College, Budapest
December 2016	Participation at the 10th International Olympiad on Astronomy and Astrophysics as an observer, India
June 2016	Organizing a weekend workshop for astronomy Olympians, Eötvös József College, Budapest
June 2015	Co-leading the Hungarian team on the 1th Regional Mini-Olympiade on Astronomy

Publications

I currently have 157 publications with more than 55 thousand citations. I am a member of large international collaborations, and many of my publications are a result of my membership in and contributions to these collaborations. Due to the large number of these collaboration publications I only list those that I co-led, in addition to short author list papers. My full publication list can be found here: ADS

Short author-list and (co-)led collaboration publications
(Total: 19; First-author: 9; Collaboration paper lead: 2; Co-author: 8)

Nima Laal, Stephen R. Taylor, Luke Zoltan Kelley, Joseph Simon, Kayhan Gültekin, David Wright, **Bence Bécsy**, J. Andrew Casey-Clyde, Siyuan Chen, Alexander Cingoranelli, Daniel J. D'Orazio, Emiko C. Gardiner, William G. Lamb, Cayenne Matt, Magdalena S. Siwek, and Jeremy M. Wachter. Deep Neural Emulation of the Supermassive Black Hole Binary Population. *ApJ*, 982(1):55, Mar. 2025, 2411.10519. doi:10.3847/1538-4357/adb4ef.

Bence Bécsy, Neil J. Cornish, Polina Petrov, Xavier Siemens, Stephen R. Taylor, Sarah J. Vigeland, and Caitlin A. Witt. Towards robust gravitational wave detections from individual supermassive black hole binaries. *arXiv e-prints*, page arXiv:2502.18114, Feb. 2025, 2502.18114. doi:10.48550/arXiv.2502.18114.

Emiko C. Gardiner, **Bence Bécsy**, Luke Zoltan Kelley, and Neil J. Cornish. Characterizing Continuous Gravitational Waves from Supermassive Black Hole Binaries in Realistic Pulsar Timing Array Data. *arXiv e-prints*, page arXiv:2502.16016, Feb. 2025, 2502.16016. doi:10.48550/arXiv.2502.16016.

Jacob A. Taylor, Rand Burnette, **Bence Bécsy**, and Neil J. Cornish. Fast wavelet basis search for generic gravitational wave bursts in pulsar timing array data. *Phys. Rev. D*, 111(2):022006, Jan. 2025, 2408.07864. doi:10.1103/PhysRevD.111.022006.

Bence Bécsy. Efficient Bayesian inference and model selection for continuous gravitational waves in pulsar timing array data. *Classical and Quantum Gravity*, 41(22):225017, Nov. 2024, 2406.16331. doi:10.1088/1361-6382/ad84b0.

Bence Bécsy, Neil J. Cornish, Patrick M. Meyers, ..., and NANOGrav Collaboration. How to Detect an Astrophysical Nanohertz Gravitational Wave Background. *ApJ*, 959(1):9, Dec. 2023, 2309.04443. doi:10.3847/1538-4357/ad09e4.

Heling Deng, **Bence Bécsy**, Xavier Siemens, Neil J. Cornish, and Dustin R. Madison. Searching for gravitational wave burst in pulsar-timing-array data with piecewise linear functions. *Phys. Rev. D*, 108(10):102007, Nov. 2023, 2306.17130. doi:10.1103/PhysRevD.108.102007.

Gabriella Agazie, ..., **Bence Bécsy**, ..., and NANOGrav Collaboration. The NANOGrav 15 yr Data Set: Bayesian Limits on Gravitational Waves from Individual Supermassive Black Hole Binaries. *ApJL*, 951(2):L50, July 2023, 2306.16222. doi:10.3847/2041-8213/ace18a.

Gergely Dálya, Sibe Bleuzé, **Bence Bécsy**, Rafael S. de Souza, and Tamás Szalai. Constraining Supernova Physics through Gravitational-Wave Observations. *arXiv e-prints*, page arXiv:2302.11480, Feb. 2023, 2302.11480. doi:10.48550/arXiv.2302.11480.

Bence Bécsy, Neil J. Cornish, and Luke Zoltan Kelley. Exploring Realistic Nanohertz Gravitational-wave Backgrounds. *ApJ*, 941(2):119, Dec. 2022, 2207.01607. doi:10.3847/1538-4357/aca1b2.

Bence Bécsy, Neil J. Cornish, and Matthew C. Digman. Fast Bayesian analysis of individual binaries in pulsar timing array data. *Phys. Rev. D*, 105(12):122003, June 2022, 2204.07160. doi:10.1103/PhysRevD.105.122003.

R. Abbott, ..., **B. Bécsy**, ..., Ligo Scientific Collaboration, VIRGO Collaboration, and Kagra Collaboration. All-sky search for short gravitational-wave bursts in the third Advanced LIGO and Advanced Virgo run. *Phys. Rev. D*, 104(12):122004, Dec. 2021, 2107.03701. doi:10.1103/PhysRevD.104.122004.

B. Bécsy and N. J. Cornish. Bayesian search for gravitational wave bursts in pulsar timing array data. *Classical and Quantum Gravity*, 38(9):095012, May 2021, 2011.01942. doi:10.1088/1361-6382/abf1c6.

Gergely Dálya, Peter Raffai, and **Bence Bécsy**. Bayesian reconstruction of gravitational-wave signals from binary black holes with nonzero eccentricities. *Classical and Quantum Gravity*, 38(6):065002, Mar. 2021, 2006.06256. doi:10.1088/1361-6382/abd7bf.

Neil J. Cornish, Tyson B. Littenberg, **Bence Bécsy**, Katerina Chatziioannou, James A. Clark, Sudarshan Ghonge, and Margaret Millhouse. BayesWave analysis pipeline in the era of gravitational wave observations. *Phys. Rev. D*, 103(4):044006, Feb. 2021, 2011.09494. doi:10.1103/PhysRevD.103.044006.

B. Bécsy and N. J. Cornish. Joint search for isolated sources and an unresolved confusion background in pulsar timing array data. *Classical and Quantum Gravity*, 37(13):135011, July 2020, 1912.08807. doi:10.1088/1361-6382/ab8bbd.

B. Bécsy, P. Raffai, K. Gill, T. B. Littenberg, M. Millhouse, and M. J. Szczepańczyk. Interpreting gravitational-wave burst detections: constraining source properties without astrophysical models. *Classical and Quantum Gravity*, 37(10):105011, May 2020, 2004.13729. doi:10.1088/1361-6382/ab7ee2.

J. Takátsy, **B. Bécsy**, and P. Raffai. Eccentricity distributions of eccentric binary black holes in galactic nuclei. *MNRAS*, 486(1):570–581, Jun 2019, 1812.04012. doi:10.1093/mnras/stz820.

B. Bécsy, P. Raffai, N. J. Cornish, R. Essick, J. Kanner, E. Katsavounidis, T. B. Littenberg, M. Millhouse, and S. Vitale. Parameter Estimation for Gravitational-wave Bursts with the BayesWave Pipeline. *ApJ*, 839:15, Apr. 2017, 1612.02003. doi:10.3847/1538-4357/aa63ef.

Conference proceedings

P. Raffai, **B. Bécsy**, Z. Haiman, and Z. Frei. A Statistical Method for Detecting Gravitational Recoils of Supermassive Black Holes in Active Galactic Nuclei. In *IAU Symposium*, volume 324 of *IAU Symposium*, pages 227–230, 2017. doi:10.1017/S1743921317000734.

Scientific outreach papers

B. Bécsy. Gravitációs hullámok észlelése pulzárok segítségével ("Observing gravitational waves with pulsars" in Hungarian). *Természet Világa*, 154. évfolyam, 12. szám, 2023.

B. Bécsy. Pulzárokkal a gravitációs hullámok nyomában ("Chasing gravitational waves with pulsars" in Hungarian). *Élet és tudomány*, LXXVI. évfolyam, 23. szám, 2021.

B. Bécsy. Using Gaia as a gravitational-wave detector, Astrobites.org, 2020.

B. Bécsy, G. Dálya, and P. Raffai. Összeütköző neutroncsillagok – a többcsatornás csillagászat forradalma ("Colliding neutron stars - the revolution of multi-messenger astronomy" in Hungarian). *Meteor*, XLVII. évfolyam 12. szám, 2017.

B. Bécsy, G. Dálya, and P. Raffai. Interferométerekkel a gravitációs hullámok nyomában ("Chasing gravitational waves with interferometers" in Hungarian). *Természet Világa*, 147. évfolyam, 3. szám, 2016.

G. Dálya, **B. Bécsy**, and P. Raffai. GW150914: először hallottuk az univerzum zenéjét ("GW150914: the first time we heard the music of the Universe" in Hungarian). *Meteor*, XLVI. évfolyam 3. szám, 2016.

Book chapters published

G. Dálya and **B. Bécsy**. A gravitációs asztrofizika megszületése ("The start of gravitational-wave astrophysics" in Hungarian). *Meteor Csillagászati Évkönyv 2018 (astronomical almanac of the Hungarian Astronomical Association)*, pages 261–276, 2018.